Modelling Earthquake Hazard Preparedness During Recovery in Nepal

A thesis presented in partial fulfilment of the requirements for the degree of

Doctor of Philosophy in Emergency Management
At Massey University, School of Psychology
Wellington, New Zealand

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2018

Abstract

Preparedness is a vital component of disaster risk reduction (DRR), but more often communities fail to prepare for disasters adequately. Theory-based approaches have found prominence for helping to identify the factors that drive preparedness behaviour of the population. However, there has been a limited empirical validation of these theories of preparedness in post-disaster recovery contexts. Further, their application has been mostly limited to culturally individualistic and developed countries, and there is a great need for their application in the setting of developing countries where disaster impacts are often most severe. This study, therefore, aimed to investigate the preparedness of a population in a post-disaster recovery scenario in a developing country.

A mixed method research design with a household questionnaire survey (n=306) followed by a follow-up qualitative study driven by semi-structured interviews (n=11) was adopted to conduct this study. The outcomes of the study include 1) development of a conceptual model predicting earthquake hazard preparedness after reviewing the existing theories and models applied in the setting of natural hazards 2) empirical validation of the proposed conceptual model predictions by analysing quantitative data collected through household survey conducted in two villages in Dhading district, of central Nepal. 3) identification of factors and processes underlying people's decisions related to recovery efforts and preparedness to future events in a post-disaster context derived by developing a hierarchical value map from the qualitative interview data.

The quantitative findings from the survey data justify the capability of the proposed model to assess the interaction of individual, community and institutional factors to predict household's intentions to prepare in a post-disaster recovery scenario. Furthermore, the qualitative findings support the quantitative findings and provide evidence for the influence of socio-cultural values of Nepalese society on household preparedness decision-making during post-disaster recovery. The qualitative findings also provide evidence of additional predictors those need to be considered in future modelling of preparedness. Further, the qualitative findings show that people's preparedness decisions and recovery efforts are influenced by

personal beliefs, community efforts, and community and institutional collaborations during the post-disaster recovery period.

Understanding of population preparedness in a post-disaster recovery is limited in both developed and developing countries. Thus this research makes a significant contribution to the body of knowledge on population preparedness in the post-disaster context in a developing country. The findings further contribute to any future study on developing theoretical foundations for the preparedness of populations in both developed and developing countries. The application of the outcomes of this study is evident as it is already cited for its theoretical, and methodological rigour.

Acknowledgement

This thesis would not have been possible without the participation of communities in Dhading. I extend my thanks to those participants who volunteered to participate in the research process despite facing the challenges and demands imposed by the Gorkha earthquake in 2015.

I am greatly indebted to my supervision panel: Professor David Johnston, Professor Douglas Paton, Doctor Raj Prasanna and Doctor Sam McColl for their excellent mentoring, support and patience.

I extend my gratitude to the Department of Disaster Management Section, Ministry of Home Affairs for their support in the research process. I am grateful to NZAID scholarship without which this project would not have been possible. My thanks extend to FOCUS Nepal and survey assistants who contributed to facilitate the process of data collection.

I am grateful to the Joint Centre for Disaster Research for providing me with a conducive environment for conducting this research. I want to extend my thanks to expert colleagues of JCDR and University IT services and library facilities and staffs.

I dedicate this thesis to my family for their unconditional support and encouragement throughout the research process.

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Chapter 1: Introduction

Preparing citizens is critical to ensuring self-reliance when coping with the effects of disasters in populations exposed to disaster risk (Ganapati, 2014; Han & Waugh, 2017; Mulligan, Ahmed, Shaw, Mercer & Nadarajah, 2012; Phillips, 2015). Disasters continue to be a significant cause of death, injury and disruption globally (Guha-Sapir & Vos, 2011; Spence, So & Scawthorn, 2011). In developing countries, the high intensity of hazards, fragile infrastructure, socio-economic status of the population and the poor quality of response and emergency services contribute to death, injury and disruption (Ejeta, Ardalan & Paton, 2015; Guha-Sapir & Vos, 2011; Nibanupudi & Shaw, 2016). In these countries, which are socio-economically vulnerable, the state may have limited capacity to respond and recover from a disaster (Han & Waugh, 2017; Jones & Boyd, 2011; Jones, Oven & Wisner, 2016). Moreover, during a significant disaster, the government capacity to adequately respond is strained (Manandhar, Varughese, Howitt & Kelly, 2017; Phillips, 2015; Shaw, 2014). Consequently, communities have to rely on their response and recovery capacity when they encounter a disaster (Mulligan et al., 2012; Nakagawa & Shaw, 2004; Radianti, Hiltz & Labaka, 2016; Shaw & Sinha, 2003; von Vacano, 2014). Therefore, increasing the capability of the communities to cope with and adapt to the impact disasters is vital.

The community capacity building agenda received global attention in the Hyogo Framework for Action 2005-2015; and continues to be the top priority in the Sendai Framework for Disaster Risk Reduction 2015-2030 (United Nations International Strategy for Disaster Risk Reduction, 2015). Many preparedness strategies and outreach programmes have been developed and implemented for community capacity building (Ronan, Johnston, Daly & Fairley, 2001; Shaw, Shiwaku Hirohide Kobayashi & Kobayashi, 2004; Shiwaku, Shaw, Kandel, Shrestha & Dixit, 2007). For example, some

of the programmes implemented are: information dissemination via leaflets, films, notices, radio and television broadcasting, installing early warning systems, drills and training, family and community learning, and school curricula for children (Lindell & Perry, 2000; Paton & McClure, 2013; Preston, 2012; Shaw, Takeuchi, Ru Gwee & Shiwaku, 2011; Shiwaku et al., 2007; Tuladhar, Yatabe, Dahal & Bhandary, 2015). However, such information-based approaches are ineffective as risk communication strategies are often one-way and treat the public as a passive receiver of information (Johnston et al., 2013; Karanci, Aksit & Dirik, 2005; Kohn et al., 2012; Solberg, Rossetto & Joffe, 2010).

Pursuing preparedness interventions pre-event is vital but challenging for infrequent and periodic hazards (Slovic, Fischhoff & Lichtenstein, 1979). People do not accept the information from disaster risk management (DRM) agencies at face value (Oven et al., 2016; Paton, McClure & Bürgelt, 2006; Slovic, Fischhoff & Lichtenstein, 1982). People evaluate and interpret the risk information relative to their own experience and knowledge (Slovic et al., 1979, 1982). However, most of the disaster risk reduction interventions occur when people have limited or no experience of disasters (Paton & McClure, 2013). Even if people accept the risk information, in the absence of their relevant experience, they may develop rudimentary knowledge that may not motivate them to change their beliefs and attitudes (Paton & McClure, 2013; Slovic et al., 1982). Experience influences people's risk judgement and biases (McClure, Johnston, Henrich, Milfont & Becker, 2015; Slovic et al., 1982). Lack of experience might inhibit people forming and sustaining risk beliefs that are essential to promoting protective behaviour (Becker, Paton, Johnston & Ronan, 2013; McClure et al., 2015; McIvor & Paton, 2007).

To adopt preparedness behaviours, people must adopt a proactive attitude towards preparing and accept the inevitability of the hazard (Becker et al., 2013; McIvor & Paton, 2007; Slovic et al., 1982; Slovic & Weber, 2002). Unlike everyday experiences, infrequent events, such as earthquakes, mean people rarely have the

chance to experience an event, either directly or indirectly, and develop relevant beliefs as a result (Paton & McClure, 2013; Slovic & Weber, 2002). Consequently, people perceive rare hazards as less critical when compared to the everyday issues of life (Ajzen, 1991; McIvor & Paton, 2007; Paton & McClure, 2013). Furthermore, the realisation of risk may not facilitate preparedness, unless people know what to prepare for and how to prepare (Paton & McClure, 2013). In this way, despite acknowledging the hazard risk, people do not prepare (Lindell & Perry, 2000; Paton & McClure, 2013; Solberg et al., 2010). These complexities of natural hazard preparedness necessitate theory-based or quasi-experimental approaches to understand preparedness for natural hazards better.

1.1. Problem Statement

Theory-based approaches to disaster risk reduction (DRR) interventions are becoming essential to address the issue of population preparedness (Lindell & Perry, 2000; Solberg et al., 2010). Many psychological theories and models have been applied to measure factors of preparedness in natural hazards (Ejeta et al., 2015; Solberg et al., 2010). These theories and models provide valuable insights into the preparedness behaviour at the personal, community, and institutional level. However, all of these theories and models address a different aspect of the preparedness puzzle; and, as such, no theory or model alone provides a comprehensive set of variables for predicting preparedness (Ejeta et al., 2015; Lindell & Perry, 2000; Paton & McClure, 2013; Solberg et al., 2010).

To date, most of the theory-based research has occurred in a pre-disaster context (Ejeta et al., 2015; Solberg et al., 2010). It is imperative then to research preparedness before a disaster, as this is when people need to prepare. However, theories developed in a pre-event context may not represent essential factors of post-event recovery (Paton, Johnston, Mamula-Seadon & Kenney, 2014). Therefore, these theories may not incorporate all the relevant information when designing appropriate

DRR interventions (Solberg et al., 2010). The authors did not intend to capture the post-event context when conceptualising preparedness theories and models. The empirical validity of these theories using the in-situ information from post-disaster is yet to be done, with the exceptions of the Protection Motivation Theory (Martin, Bender & Raish, 2007; McLennan, Cowlishaw, Paton, Beatson & Elliott, 2014; Paton et al., 2014). Even PMT, which considered post-event data, did not capture all the relevant variables representing the post-disaster scenario. Therefore, it is imperative to develop integrated and comprehensive theories progressively.

When researching preparedness in a post-disaster scenario, critical variables such as risk perception may not be captured in a research process for infrequent hazards (Paton et al., 2014). Consequently, it could be beneficial to conduct developmental preparedness research during a disaster response and recovery, when people are more likely to acknowledge the issues that they struggle with, what they did to combat the issue, and what supported or restricted their abilities (Paton & Jang, 2016; Paton et al., 2014). Paton et al. (2014), in their qualitative analysis of the recovery experience, identified the influence of several variables that were not obvious in pre-event research. For example, actual disaster experience can elevate the importance of some issues and thus contribute to identifying what helps or hinders a response to a given disaster.

An investigation of preparedness in a post-disaster context must explore developing theories, establish the empirical validity of the theories in post-disaster context, and develop the required evidence base to inform theory-driven DRR interventions. Modelling preparedness during a post-disaster recovery scenario, such as people recovering from the impact of an earthquake, helps to achieve these objectives.

1.2. The Rationale of the Study

Preparation for the next cycle of a disaster begins in the recovery period of the most recent event. Reconstruction and community capacity building that begin during the recovery period promote future preparedness (Fan, 2013). For example, recovery efforts such as reconstructing earthquake resilient infrastructure prevent potential loss and damage from the collapse of houses in future events (Coppola, 2015c; Shaw & Sinha, 2003). The plans and programmes developed and implemented during the recovery period are expected to contribute toward ongoing recovery; and thus achieve the goal of restoration in synchronisation with long-term development goals (Han & Waugh, 2017; Paton, Jang & Irons, 2015; Phillips, 2015; Rubin, 2009). So, planning offers people a chance to learn from their experience, rectify their vulnerabilities, and conceive appropriate strategies for coping with future events and thus build back better (Fan, 2013; Kennedy, Ashmore, Babister & Kelman, 2008; Khasalamwa, 2009). Therefore, exploring the prospect of facilitating preparedness in recovery settings informs the systematic development of building back better (BBB) strategies. Building back better relates to future preparedness capability developments in populations who continually face potential hazardous events (Fan, 2013; Fordham, 2007; Kennedy et al., 2008; Thomalla et al., 2017).

Researching during post-disaster periods would enable collection of in-situ (real time) information about the direct experience of the threat, its impact, and consequent adaptive behaviour. People's prior direct and indirect experience informs their decisions and actions (Becker et al., 2013; Becker, Paton, Johnston, Ronan & McClure, 2017; Siegrist & Gutscher, 2008). The usefulness of the decisions and actions applied while responding and recovering informs future preparedness. It is critical examining how people's experience of earthquake recovery supports the use of variables in the model, and preparedness behaviour provides evidence for the validity of the model. Establishing the validity of preparedness models builds a solid foundation for establishing the validity of theory-driven DRR interventions.

This research focuses on a developing country context in order to assess the population preparedness in post-disaster recovery. In developing countries with fragile governance and socio-economically vulnerable populations, the exposure to natural hazards reveals a limited capacity to respond and recover: building population capacity to independently respond and recover, with minimal or no external support, is critical (Han & Waugh, 2017; Jones et al., 2016; Mulligan & Nadarajah, 2011; Mustafa, 2003; Sanderson, Sharma, Kennedy & Burnell, 2014). There is limited empirical evidence related to population preparedness, as well as theoretical research-driven strategy development and outreach interventions (Ejeta et al., 2015). However, for assessing population preparedness in recovery settings, a site or country recently exposed to disaster is required. Nepal was therefore selected as a case as the 2015 Nepal earthquake provided an opportunity to assess population preparedness in a recovery context. Furthermore, the primary researcher being a native Nepali added the value to research for understanding the socio-cultural context, facilitating communication between researchers and participants to collect data.

1.3. Research Purpose and Research Goals

The purpose of this research is to investigate the influence of social contexts on earthquake preparedness among households recovering from the impact of the devastating 2015 earthquake in Nepal. The specific goals of the research are i) to identify individual, community, and institutional factors contributing to earthquake hazard preparedness at the household level during the recovery period; and ii) to explore the influence of people's lived experience of a devastating earthquake, and their recovery context on the preparedness process (Table 1.1).

1.4. Research Questions

The contribution to the first (i) goal of the study is the review of existing literature on theories and models applied to natural hazards, which will help to develop

a quantitative model of earthquake hazard preparedness. The model is then tested, using empirical data collected during the post-disaster recovery period in Nepal. This part of the study constitutes an overarching hypothesis, which underpins the conceptual model (covered in Chapter Three). The research questions one and two guides the literature review for developing the conceptual model and the hypothesis for achieving the first goal (Table 1.1). The second (ii) goal of the research explores the nature of preparedness during recovery, represented as the third and fourth research questions listed below (Table 1.1).

1) What factors influence the individual/household's decision to prepare for an earthquake hazard?
2) To what extent do community and societal processes influence household decisions during recovery?
3) How does the experience of a hazard influence a household's / an individual's estimations of their risk and coping capability in a recovery context?
4) How does the social context influence the individual/household's decision to prepare for an earthquake hazard during the recovery period?

Table 1.1. The research purpose, goals, research questions and objectives.

Research purpose	Goals	Research questions	Objectives
Investigate the influence of social context on earthquake hazard preparedness among households recovering from the devastating impacts of the 2015 earthquake in Nepal	i) Identify individual, community and institutional factors contributing to earthquake hazard preparedness at household level during the recovery period	1) What factors influence the individual/household's decision to prepare for an earthquake hazard? 2) To what extent do community and societal processes influence household decisions during recovery?	1) Conduct a review of cognitive models applied to assess natural hazard preparedness decision making. 2) Assess the capabilities of these models to measure the earthquake hazard decision making in post-disaster context and improve the model as required 3) Empirically test the validity of the model
	ii) Explore the influence of people's lived experience of a devastating earthquake hazard and their social context on the preparedness process	3) How does the experience of a hazard influence household/an individual's estimation of their risk and coping capability in a recovery set? 4) How does the social context influence the individual/household's decision to prepare for an earthquake hazard during the recovery period?	4) Identify the factors and process of earthquake hazard preparedness decision-making at the household level in a recovery setting. 5) Identify the influence of post-disaster recovery context on household preparedness decisions

1.5. Thesis Structure

The thesis is produced in a traditional doctoral thesis format, according to the Massey University thesis guidelines, and is composed of eight chapters (Figure 1.1) As with a traditional thesis; the methodology chapter contains the methods of data collection and analysis. However, in this study, the methodology chapter provides an

overview of the research philosophy, research design, and methods of data collection. The subsequent sections address the methodology adopted for this study. The methodology of this research comprises a description of the research philosophy, research design and methods and procedures of data collection. The findings chapter include the methods of data analysis of the study. Each findings chapter constitutes a different method of data analysis. The presentation of data analysis and outcomes in the same chapter provides a clear logic of the relationship between the methods of analysis and the outcomes of the analysis.

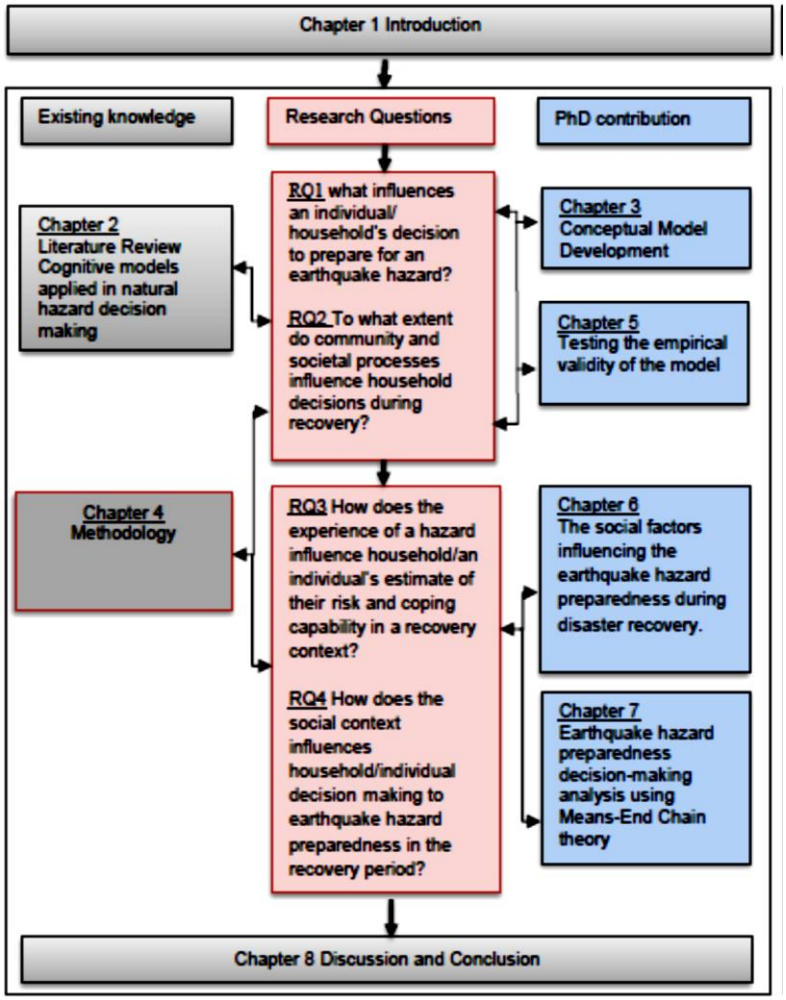

Figure 1.1. Chapter plan.

Chapter One (Introduction) provides the background of the study, the rationale of the study, and identifies the research hypothesis, questions, and objectives of the study. It also covers an overview of the structure.

Chapter Two commences by introducing the earthquake risk and the general introduction to DRR strategies. The literature review includes functional categories of preparedness, review of models and theories applied in natural hazards, and their relevance and applicability in post-disaster context, comprehensive preparedness modelling and developing countries.

Chapter Three provides a detailed discussion of the model, model variables, and related hypotheses. It also covers the discussion of post-disaster recovery efforts and processes to identify the model variables.

Chapter Four presents the research philosophy, research design, and methods of data collection. The methods of data analysis are discussed in the respective findings chapters.

Chapter Five presents a method of data analysis and quantitative findings obtained from the analysis of the empirical data, collected in Nepal. It provides a detailed discussion of the results obtained from an analysis of the empirical data and provides evidence of the empirical validity of the model. It also includes the results of mediation and multi-group analysis.

Chapters Six and Seven provide an account of the process of qualitative data analysis and the findings from the qualitative data. Chapter Six provides a detailed process of coding and analysis, generating themes based on grounded theory tools (open and axial coding). Chapter Seven elaborates the process of looping the codes and themes obtained in Chapter Six into a hierarchical value map (HVM). It also provides a discussion of the qualitative findings.

Chapter Eight provides a synthesis of the quantitative and quantitative findings and provides theoretical and practical implications, relations of the findings to the qualitative model of social resilience, limitations, and conclusion.

Chapter 2: Literature Review

2.1. Introduction

Preparing citizens for enhancing their capabilities to respond and recover from the effects of a disaster is one of the primary components of disaster risk reduction (DRR) (United Nations International Strategy for Disaster Risk Reduction, 2015). Several programmes (e.g. school curricula, training and drills) are underway, which aim to achieve the goal of population preparedness (Shaw et al., 2004; Shaw et al., 2011). However, research has shown modest population preparedness regardless of several efforts to encourage people to prepare (Lindell, Arlikatti & Prater, 2009; Russell, Goltz & Bourque, 1995; Solberg et al., 2010). An attempt to understand why people do not prepare despite acknowledging the threat of a hazard has prompted the development of theories to provide a systematic framework to facilitate preparedness (Ejeta et al., 2015; Lindell & Perry, 2000; Solberg et al., 2010). Several theories have been developed and applied to understand population preparedness in natural hazards (Ajzen, 1991; Lindell & Perry, 2012; Paton, 2008; Rogers, 1983; Solberg et al., 2010). However, it is critical to evaluate the capabilities of the theories and models to measure preparedness in a post-disaster context.

This chapter reviews the models and theories of preparedness, applied in natural hazards, by assessing their capability to predict preparedness in a post-disaster setting. The literature review begins with an overview of earthquake hazard risk and disaster risk management strategies. The review of model and theories of preparedness precedes discussion of the combined-model approach and its application in developing a country context in a post-disaster scenario.

There are seven subsections in this chapter: section 2.1 is an introduction to the literature review; section 2.2 provides an overview of the earthquake hazard risk, the contribution of the population, and the built environment to the risk; and section 2.3

covers an overview of disaster risk management (DRM) strategies. Gaining an understanding of activities conducted both pre-event and post-event gives an idea of how and why pre-event preparation helps post-event response and recovery. Section 2.4 provides a review of the definitions for preparedness, as well as functional typologies: this research focuses on assessing preparedness while people are recovering from the impact of hazards, where developing a comprehensive understanding of preparedness is essential. Section 2.5 reviews cognitive theories and models to understand the preparedness for natural hazards. The subsequent section includes a discussion of gaps in research: preparedness in a post-disaster recovery context, comprehensive theoretical model development, and preparedness research in developing country context. Finally, the chapter summary highlights how these research gaps, uncovered in the literature review, suggest the future direction of this research project.

2.2. Earthquake Hazard Risk

Before embarking on the topic of population preparedness to earthquake risk, it is useful to examine how the coupled human-environment relationship contributes to this risk. Historically, communities and societies have co-existed with their natural environment (Berkes, Colding & Folke, 2008; Buergelt & Paton, 2014). People continually interpret environmental (physical and social) signals and integrate these into their pre-existing mental schemas, thereby modifying their ability to anticipate and respond to the changing environment (Blumer, 1986). In this interaction process, people develop a sound memory of knowledge and experiences, referred to as ‘‘adaptive capacities’’ (Berkes et al., 2008; Norris, Stevens, Pfefferbaum, Wyche & Pfefferbaum, 2008). These adaptive capacities facilitate the ability of a population to mitigate the risks encountered in everyday life (Buergelt & Paton, 2014; Norris et al., 2008).

Despite this, it may be challenging to cope with and adapt to the consequences of extreme natural hazards, such as earthquakes (Guha-Sapir & Vos, 2011). When an extreme earthquake hazard (e.g. ground shaking) interacts with a population and their environment, it often exceeds their ability to respond and recover, causing enduring impacts to the population and their assets (Alexander, 2002; Guha-Sapir & Vos, 2011; United Nations International Strategy for Disaster Risk Reduction, 2009). An analysis of the Emergency Events Database (EM-DAT), from 1901 to 2017, reveals a total of around 2.6 million deaths globally, and an average of 1906 fatalities per event (Centre for Research on the Epidemiology of Disasters, 2009).

It is significant to note that the impact distribution from earthquakes is uneven throughout the world (Eshghi & Larson, 2008; Spence et al., 2011). For example, Asia experiences very high losses, comprising an estimated 71% of total global deaths, damage, and disruption (Figure 2.1). Geographical differences in risk partially result from hazard variability, but also other factors such as building design, socioeconomic status, population health, and the quality of response and emergency services (Doocy, Daniels, Packer, Dick & Kirsch, 2013; Eshghi & Larson, 2008; Guha-Sapir & Vos, 2011). Thus, there is a strong social and economic influence on hazard risk, affecting the ability of a population to live within their environment and its associated hazards.

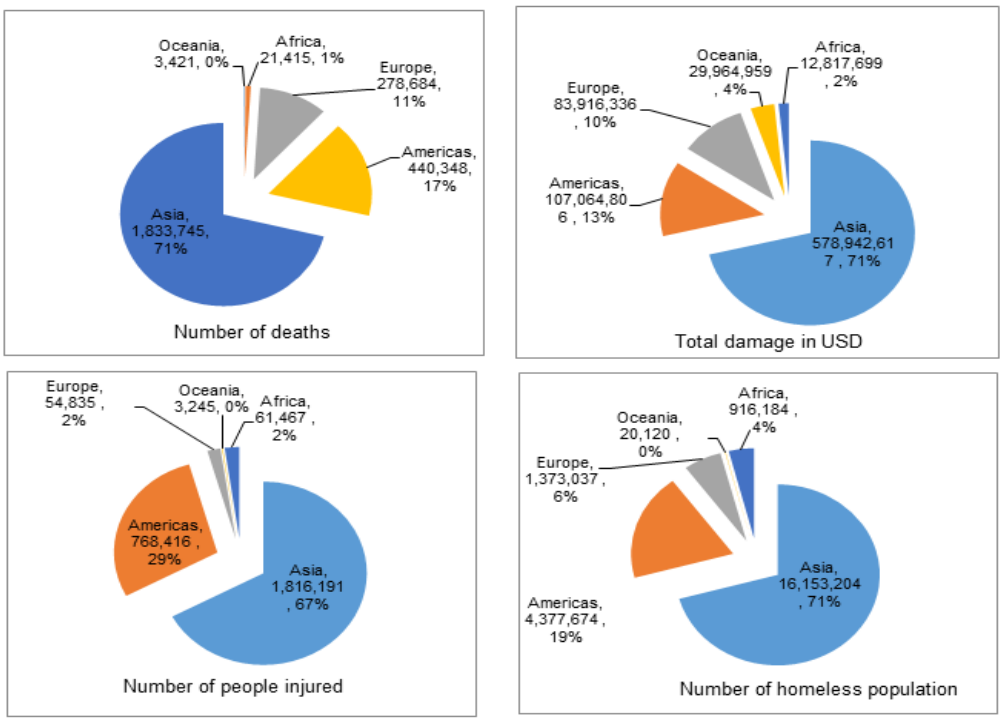

Figure 2.1. Deaths, total damage in USD, population injured, and homeless population resulting from earthquakes from 1901–2017 (Centre for Research on the Epidemiology of Disasters, 2009).

Populations in developing countries with unusually high exposure to earthquake hazards often have limited resources to respond and recover, due to poverty and weak governance, and therefore experience even more challenges when preparing for earthquake risk (Han & Waugh, 2017).

Regardless, people and communities exposed to earthquake hazards can adopt strategies and activities to reduce their risk (Norris et al., 2008; Paton & McClure, 2013). These might include: securing extra food, household emergency planning, retrofitting private houses, land-use planning, policy formulation, public education and awareness, or drills and training (Coppola, 2015b). All these activities fall under the broad topic of disaster risk management (DRM) (Alexander, 2002).

2.3. Disaster Risk Management

Disaster risk management (DRM) is the systematic process of building policies, strategies, and coping capacities of households, communities, and societies to ensure their safety, as well as reducing the loss of life, injury, and damage to valuable resources during a disaster (Alexander, 2002; United Nations International Strategy for Disaster Risk Reduction, 2009).

Alexander (2002) provides a framework of DRM, which he calls the 'disaster cycle': disasters are recurring events and thus represent a cyclical form. The framework constitutes four phases with distinct activities contributing to DRR (Figure 2.2).

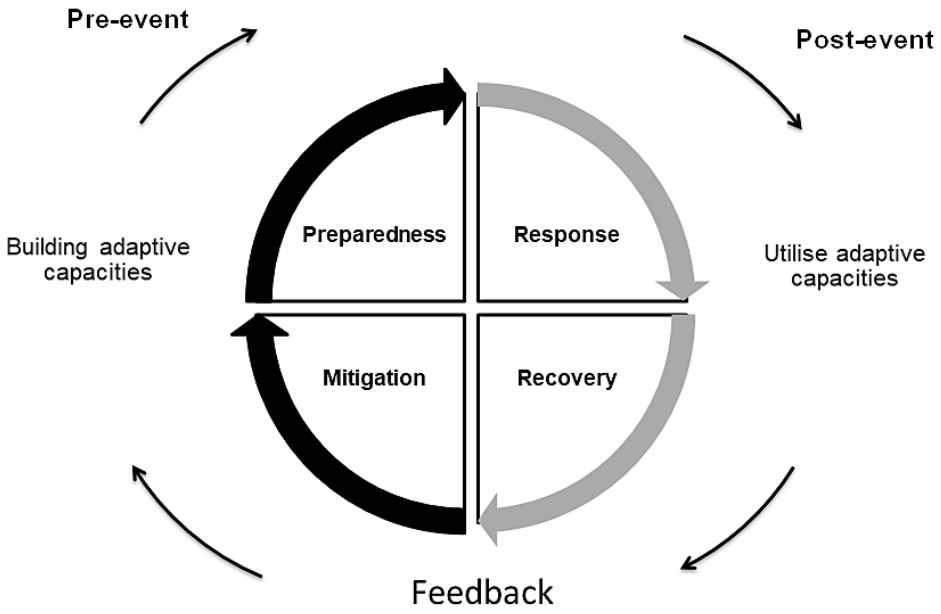

Figure 2.2. Disaster cycle (Adapted from Alexander, 2002)

The first two phases; mitigation and preparedness occur in a pre-disaster setting, while response and recovery occur in a post-disaster context (Figure 2.2). Each phase includes different activities and processes to address the varied needs of the people and society at risk.

2.3.1. Mitigation

Mitigation is one of the phases of the disaster cycle (Figure 2.2). Mitigation is a risk reduction strategy for strengthening physical infrastructure such as retrofitting buildings, formulating and enforcing regulatory measures (e.g. building codes), and land-use planning (Alexander, 2002; Coppola, 2015a). Mitigative measures require comprehensive development strategies, financial and human resources, and lengthy timeframes for implementation and maintenance (Alexander, 2002; Coppola, 2015a). Furthermore, political and public support is vital to effectively implement mitigation policies and strategies (Han & Waugh, 2017; Phillips, 2015; Shaw, 2014).

Mitigation measures provide long-term solutions to DRR (Alexander, 2002). These should remain a strategic goal for DRR in developing countries, such as Nepal. However, mitigation activities, such as the construction of barriers, retention systems, and resistant buildings, are costly, time-consuming, and require technical experts; such measures are designed for a particular magnitude earthquake (Coppola, 2015a). However, despite adopting mitigative measures, there remains a risk for people for which they need to develop their capacity to respond (Coppola, 2015a). Preparedness is a cost-effective strategy, complementary to mitigation, and is achievable in the short-term for comprehensive risk reduction (Coppola, 2015b; Phillips, 2015).

2.3.2. Preparedness

Preparedness is another crucial phase of the disaster cycle (Figure 2.2). United Nations International Strategy for Disaster Reduction (UNISDR) terminology for Disaster Risk Reduction defines preparedness as ‘‘the knowledge and capabilities of individuals, household, communities, organisations and societies to anticipate, respond and recover from the impacts of likely, imminent or current disaster (United Nations International Strategy for Disaster Risk Reduction, 2016, p. 21).’’

Preparedness activities at household level include: securing food, water, extra batteries, extra fuel for cooking, developing a household emergency plan, and securing

houses (Lindell et al., 2009; Russell et al., 1995). Preparing households to respond and recover from a disaster encourages self-reliance (Lindell et al., 2009; Paton & McClure, 2013; Russell et al., 1995). Furthermore, preparedness reduces the loss and damage from a disaster, reducing reliance on national and external resources for relief (Paton & McClure, 2013; Shaw, 2014). Various programmes underway to enhance the knowledge and capabilities of households and communities include: information sharing via leaflets, pamphlets, brochures, films, notices; radio and television broadcasting; early warning systems, such as drills and training; family and community learning initiatives; and school curriculum for children (Lindell & Perry, 2000; Paton & McClure, 2013; Preston, 2012; Shaw et al., 2011; Shiwaku et al., 2007; Tuladhar et al., 2015).

Global research shows that public preparedness has remained modest, despite the efforts mentioned above (Lindell et al., 2009; Paton & McClure, 2013; Paul & Bhuiyan, 2010; Solberg et al., 2010). People do not accept hazard risk information, and instead interpret the available material based on their previous experience (Becker, Paton, Johnston & Ronan, 2012; Slovic, 1987). Similarly, people may have limited or no experience of rare and extreme hazards; as such, it may be difficult for them to consider the relevance of the information (McIvor & Paton, 2007; Paton & McClure, 2013; Slovic & Weber, 2002). Consequently, people turn towards their family, friends, neighbours, and community members to formulate the meaning of uncertainty, and the risk associated with disasters (Paton & McClure, 2013). Several cognitive theories have been developed to understand the reasons for not preparing, as discussed later in this chapter. Empirical evidence shows that the extent of preparedness activities conducted in the pre-event contribute to the post-disaster response and recovery process (YingyingSun, 2017). It is therefore critical to discuss the range of activities people conduct during response and recovery.

2.3.3. Response

Response represents the post-event phase of the disaster cycle (Figure 2.2). Response to earthquake disasters occurs at both the household and societal level (Mulligan et al., 2012; Paton et al., 2014). Response at the household level includes personal evacuation for survival, the rescue and recovery of family, and the use of essential supplies, such as stored water and food, to cope with the disaster (Kohn et al., 2012; Paton & McClure, 2013). The response begins immediately after the earthquake, and the affected household may need to rely on their coping abilities to respond to the impact of hazards and survive through the crisis (Schwarz, 2014a; Shaw & Sinha, 2003; von Vacano, 2014). There might be limited assistance from the government, as was the case in the 2001 Gujarat earthquake (Schwarz, 2014a; Shaw & Sinha, 2003), and the 2015 Nepal earthquake (Government of Nepal, 2015). As a member of the community, households have to engage in community response during a disaster, while also tending to personal coping methods (Shaw & Sinha, 2003; Zaumseil, 2014).

The societal response is the effort taken immediately after the disaster to limit the causalities and damage to people, property, and the environment (Coppola, 2015d). Response activities involve saving a life, rescue, and provision of food, shelter and necessary supplies for the survivors (Coppola, 2015d). The transitional activities during the response period lead slowly to recovery (Phillips, 2015).

In many instances, members of the affected communities carry out search and rescue activities before government and external assistance arrive in the disaster zone (Shaw, 2006; Shaw & Sinha, 2003). In the 2001 Gujarat earthquake, local communities conducted the first search and rescue operation as the government response was delayed (Shaw & Sinha, 2003). Similarly, during the 1995 Kobe earthquake, families and community members initially evacuated trapped community members (Shaw & Goda, 2004; YingyingSun, 2017).

People's capacity to cope with and adapt to a disaster is partly contingent on the number of preparatory activities that individuals and households pursue (Coppola, 2015b; Paton & McClure, 2013). Preparing survival items, such as food, water, and medicines, as well as implementing plans and tools to evacuate during the earthquake, facilitate individual and household response (Lindell & Perry, 2000; Russell et al., 1995). Self-reliance of individuals and households to respond makes more people available to help others, reducing the burden of rescue and relief operations on the government (Coppola, 2015d; Phillips, 2015). Proactive responses permit a smooth transition for communities to the recovery phase (Paton & McClure, 2013; Phillips, 2015).

2.3.4. Recovery

Recovery is ''the process of restoring, rebuilding and reshaping physical, social, economic and natural environment through pre-event planning and post-event actions'' (Smith & Wenger, 2007, p. 237). It is important to note that reconstruction, restoration, rehabilitation, restitution, and recovery are used synonymously (Han & Waugh Jr, 2017; Phillips, 2015).

The recovery phase begins once the rescue and relief operation subsides; and transitional activities begin during the latter part of the response period (Phillips, 2015). The early recovery activities include assessment of damage, securing temporary housing, restoring lifelines, and clearing debris to restore lifelines to minimum operating standards (Coppola, 2015c; Phillips, 2015). Households collectively support external agencies by carrying out early recovery activities (Nakagawa & Shaw, 2004; von Vacano, 2014). Following the 2004 Indian Ocean tsunami, local survivors carried out not only search and rescue operations, but made arrangements for essential supplies and shelters, and jointly managed the deceased with external assistance (von Vacano, 2014).

Furthermore, early recovery leads to long-term recovery (Han & Waugh, 2017; Phillips, 2015). Long-term recovery includes debris management; reconstruction of housing, business, and critical infrastructures, such as roads and bridges; restoration of lifelines (power, sewer); and the recovery of the public sector (Han & Waugh, 2017; Phillips, 2015; Rubin, 2009). In this phase, formal interventions assess the disaster impact and identify community needs (Phillips, 2015). During the recovery period, planning for reconstruction begins; government and communities are often under pressure to address the emerging needs and challenges, beyond dealing with the physical impact of a disaster (Phillips, 2015; Shaw, 2014).

Several stakeholders such as government, international aid agencies, and local NGOs, CBOs, networks, communities work collaboratively toward community and societal recovery (Aldrich, 2012; Mulligan et al., 2012; Nakagawa & Shaw, 2004; Phillips, 2015; Shaw & Sinha, 2003). For example, in Indonesia, after the 2006 Yogyakarta earthquake, communities lost around 350,000 residential buildings, microenterprises, and businesses, which increased the unemployment rate by 4% (Joakim & Wismer, 2015). The home-based microenterprise was a significant contributor to the household economy. Collaboration with the Indonesian central government, humanitarian organisations in the UN cluster, and the multilateral Java Reconstruction Fund (European Commission) resulted in a livelihood recovery programme (Joakim & Wismer, 2015). Similarly, in the 2001 Gujarat earthquake effective coordination and collaboration between local government, NGOs, private companies, and communities (households) resulted in good quality housing reconstruction (Shaw & Sinha, 2003). In the same way, effective coordination and collaboration between government, local non-governmental organisations, and communities facilitated recovery after the 2010-2011 earthquakes in Christchurch, New Zealand (Paton et al., 2014).

The cases discussed above reflect the involvement of government, international aid agencies, private companies, local NGOs, and communities for planning and

implementing strategies and programmes for post-disaster recovery (Shaw & Goda, 2004; Shaw & Sinha, 2003). However, the effectiveness of these activities depends on the capacity of government and concerned stakeholders to coordinate and collaborate for planning, resource sharing, and executing the plan (Fan, 2013; Fordham, 2007; Gaillard et al., 2008; Ganapati, 2014; Thomalla et al., 2017).

2.3.5. Preparedness-recovery Relationships

The primary goal of DRR is to encourage households to prepare for self-reliance (Coppola, 2015b). Mitigation activities provide solutions to a certain threshold of earthquake risk (Coppola, 2015a). People need to prepare themselves to reduce risk beyond this threshold (Coppola, 2015a; Paton & McClure, 2013).

Household preparedness has remained low despite the plethora of information dissemination and outreach interventions (Johnston et al., 2013; Karanci et al., 2005; Tuladhar et al., 2015). People interpret the information received from DRM agencies based on their own experience and prior knowledge of the hazard, instead of accepting it as it is (Slovic, Finucane, Peters & MacGregor, 2004). They may not find the information relevant due to a lack of previous experience with rare and complex hazardous events (Slovic & Weber, 2002). Despite this, people attempt to cope with and adapt to extreme hazards when they encounter natural disasters, such as an earthquake (Norris et al., 2008).

Households use different strategies and abilities to cope with and adapt to a disaster (Shaw & Goda, 2004; von Vacano, 2014). As discussed above in sections 2.3.3 and 2.3.4, individuals and households arrange survival supplies, medical treatment, and evacuate family members during the response period (Shaw & Goda, 2004; von Vacano, 2014). As members of the community, households coordinate and collectively organise search and rescue operations; make arrangements of temporary shelters; execute debris clearance; and manage the injured and deceased (Shaw & Goda, 2004; von Vacano, 2014). Furthermore, as a collective, households coordinate

and negotiate with government and other concerned agencies over access to resources for response and recovery efforts (Mulligan et al., 2012; Paton et al., 2014; Shaw & Sinha, 2003). This supports the need to facilitate preparedness at community and societal levels, enabling households to respond and recover from a disaster (Mulligan et al., 2012; Paton, Jang, et al., 2015; Paton et al., 2014).

Furthermore, planning and reconstruction begin during the recovery period (Phillips, 2015). The plans and programmes developed and implemented are expected to contribute toward ongoing recovery; and thus achieve the goal of restoration in harmonisation with long-term development goals (Han & Waugh, 2017; Paton, Jang, et al., 2015; Phillips, 2015; Rubin, 2009). Reconstruction and restrengthening promote future preparedness (Fan, 2013). For example, recovery efforts such as constructing earthquake resilient infrastructure prevent potential loss and damage from the collapse of houses in future events (Coppola, 2015c; Shaw & Sinha, 2003). Preparation for the next cycle of a disaster begins in the recovery period of the most recent event.

The review of disaster risk reduction strategies highlights the relationship between preparedness and recovery. However, it also indicates the need to explore population preparedness in post-disaster recovery further. Additionally, advancing preparedness research in post-disaster recovery necessitates developing a better understanding of what preparedness entails. For this, it is necessary to examine the empirical research defining preparedness and its influencing factors.

2.4. The Preparedness and Functional Typologies

The definitions of preparedness are broad (Table 2.1). A common denominator in these definitions is ‘actions taken’ for an imminent or potential disaster. Coppola (2015b) and Alexander (2002) point out that activities conducted before a disaster constitute preparedness. However, they do not explicitly detail the action and responsibility of stakeholders for performing these activities. Paton and McClure (2013) identify anticipatory, responding, recovering, and learning abilities of people as

preparedness. They use the term readiness instead of preparedness. United Nations International Strategy for Disaster Risk Reduction (2016) terminology in DRR explicitly specifies stakeholders (government, DRM organisations, communities, and individuals) whose knowledge contributes to the personal, community and societal capacity for growth. Despite this, knowledge and capacity are broad terms and may include a range of activities and programmes. These definitions provide an umbrella concept of disaster preparedness. Therefore, further investigation of empirical research is required to identify the functional definitions and categories of preparedness.

Table 2.1. Definitions of Preparedness

Definitions of preparedness	Authors
Preparedness is the actions taken in advance of a disaster to ensure adequate response to its impacts and the relief and recovery from its consequences.	(Coppola, 2015b, p. 275)
Preparedness is the ability of people to a) anticipate what they have to contend with (hazard consequences); b) cope with and adapts to, recover from the hazard consequences, and particularly in areas that can expect to experience hazard events repeatedly; c) learn from these experiences.	(Paton & McClure, 2013, p. 46)
Preparedness is the knowledge and capacities of governments, professional response and recovery organisations, communities and individuals to effectively anticipate, respond to and recover from, the impacts of likely, imminent or current hazard events.	(United Nations International Strategy for Disaster Risk Reduction, 2009, p. 21)
Preparedness is the actions taken to reduce the impact of disasters when they are forecast and imminent.	(Alexander, 2002, p. 5)

There is much empirical research on disaster preparedness (Lindell et al., 2009; Mulilis, Duval & Lippa, 1990; Onuma, Shin & Managi, 2017; Russell et al., 1995). However, different research uses different dimensions, typologies, and measures to assess preparedness (Kohn et al., 2012; Levac, Toal-Sullivan & OSullivan, 2012; Lindell & Perry, 2000; Paton & McClure, 2013; Solberg et al., 2010). A systematic review of the literature concerning earthquake hazards preparedness, conducted here, identifies functional categories of preparedness; and develops a clearer comprehension of the term. In total, 17 research articles were selected following a review protocol.

4.1.1. Article Review Protocol

A review protocol criteria for inclusion or exclusion is required to conduct a systematic review of research articles. The inclusion and exclusion criteria for this systematic review was: original articles published in peer-reviewed journals; articles measuring personal and household earthquake hazard preparedness; articles that develop a scale to measure household or personal preparedness, and empirically validate the scale; and articles that apply tested scales to assess preparedness.

The literature for the systematic review was identified using SCOPUS and ISI Web of Science. Additionally, previous reviews were also used to identify relevant articles. The initial search records resulted in 2336 documents (Table 2.2).

The documents and articles obtained from the general search were transferred to Microsoft Excel from SCOPUS and to Endnote from ISI Web of Science. First sorting of articles based on the titles resulted in 382 articles. In the second step, the 82 articles were sorted from 382 by evaluating their abstracts. Further screening, using the inclusion criteria of the preparedness scale, resulted in 29 articles. Out of these 29 articles, only 17 reported the results for each measure of preparedness (Table 2.3). The results of the systematic review are presented in the next section.

Table 2.2. Database and information search results

Database	Keywords	Number of articles obtained
SCOPUS	TITLE-ABS-KEY (earthqauke* AND preparedness* or readiness*) (preparedness scale* AND earthquake*)	1076 (November 2017)
ISI Web of Science	‘‘earthquake’’ AND preparedness ‘earthquake’ AND preparedness scale	1256 (November 2017)

2.4.6. Classification of Preparedness Dimensions and Measures

The preparedness dimension and measures in each article were manually analysed and recorded in a sheet (Table 2.3). The five classifications of dimensions were derived from the review, based on the classifications by Russell et al. (1995) and Lindell et al. (2009). Russell et al. (1995) conducted a factor analysis of the preparedness measures, classifying them into survival preparedness, planning, and hazard mitigation. Furthermore, Lindell et al. (2009) classified preparedness measures into direct action items and capacity building. However, in the classification by Lindell et al., survival, planning, and hazard mitigation dimensions were included as one factor. Even so, both these classifications did not include the knowledge and skills required to survive, such as the use of a first aid kit. Therefore, a summary of preparedness measures into five dimensions is presented in Table 2.3.

Table 2.3. Readiness dimensions, scale items and authors

Readiness dimension	Authors
Survival preparedness	

Storing food and water	(Mulilis et al., 1990), (Kirschenbaum, Rapaport & Canetti, 2017), (Mileti & Darlington, 1997), (Onuma et al., 2017), (Russell et al., 1995), (Basolo et al., 2009), (Heller, Alexander, Gatz, Knight & Rose, 2005), (Johnson & Nakayachi, 2017), (Karanci et al., 2005), (Lindell et al., 2009), (Lindell & Whitney, 2000), (Wood et al., 2012), (Spittal, McClure, Siegert & Walkey, 2008; Spittal, Walkey, McClure, Siegert & Ballantyne, 2006)
Having a working radio, torch, extra batteries	(Mulilis et al., 1990), (Kirschenbaum et al., 2017), (Mileti & Darlington, 1997), (Onuma et al., 2017), (Russell et al., 1995), (Basolo et al., 2009), (Heller et al., 2005), (Johnson & Nakayachi, 2017), (Karanci et al., 2005), (Lindell et al., 2009), (Lindell & Whitney, 2000), (Wood et al., 2012), (Paul & Bhuiyan, 2010), (Spittal et al., 2008; Spittal et al., 2006)
First aid kit	(Mulilis et al., 1990), (Kirschenbaum et al., 2017), (Mileti & Darlington, 1997), (Onuma et al., 2017), (Russell et al., 1995), (Basolo et al., 2009), (Heller et al., 2005), (Karanci et al., 2005), (Lindell et al., 2009), (Lindell & Whitney, 2000), (Wood et al., 2012), (Paul & Bhuiyan, 2010), (Spittal et al., 2008; Spittal et al., 2006)
Having a working fire extinguisher, tools, e.g. wrench to shut off utilities	(Heller et al., 2005), (Lindell et al., 2009), (Lindell & Whitney, 2000), (Spittal et al., 2008; Spittal et al., 2006)
Extra fuel and heating equipment	(Onuma et al., 2017), (Spittal et al., 2008; Spittal et al., 2006)
Disaster helmet and hood	(Onuma et al., 2017), (Paul & Bhuiyan, 2010)
Purchasing items for personal safety (gas mask, duct tape)	(Wood et al., 2012)

Planning preparedness	
Household emergency plan	(Mulilis et al., 1990), (Kirschenbaum et al., 2017), (Mileti & O'Brien, 1992), (Russell et al., 1995), (Basolo et al., 2009), (Johnson & Nakayachi, 2017), (Karanci et al., 2005), (Lindell & Whitney, 2000),
Insurance (House insurance)	(Mulilis et al., 1990), (Palm & Hodgson, 1992), (Russell et al., 1995), (Heller et al., 2005), (Karanci et al., 2005), (Lindell et al., 2009), (Lindell & Whitney, 2000),
Neighbourhood plan	(Russell et al., 1995)
Protective physical shelters or sealed rooms	(Kirschenbaum et al., 2017)
Have considered earthquake risk when deciding to live in this house	(Spittal et al., 2008; Spittal et al., 2006)
Have preparedness at work	(Spittal et al., 2008; Spittal et al., 2006)
Knowledge and skills for survival and first aid	
Emergency broadcasting channel on a radio	(Mulilis et al., 1990)
Learn to shut off utilities, e.g. electricity shut off valve, water shut off valve	(Kirschenbaum et al., 2017), (Mulilis et al., 1990), (Russell et al., 1995), (Basolo et al., 2009), (Heller et al., 2005), (Lindell et al., 2009), (Lindell & Whitney, 2000),
Learn first aid skills	(Mileti & Darlington, 1997), (Russell et al., 1995)

Learn firefighting	(Mileti & Darlington, 1997),
Identify location of the emergency medical centre	(Mulilis et al., 1990), (Russell et al., 1995), (Lindell et al., 2009), (Lindell & Whitney, 2000),
Emergency contact person	(Mileti & Darlington, 1997), (Heller et al., 2005), (Lindell et al., 2009),
Rescue to assist elderly/immobile, trapped people	(Mileti & Darlington, 1997),
Housing structural integrity	
Securing items: television, cupboards, tall furniture, water heaters to the walls Fixed chimney	(Mulilis et al., 1990), (Mileti & Darlington, 1997), (Mileti & O'Brien, 1992), (Russell et al., 1995) (Heller et al., 2005), (Johnson & Nakayachi, 2017), (Karanci et al., 2005), (Lindell et al., 2009), (Lindell & Whitney, 2000), (Spittal et al., 2008; Spittal et al., 2006)
Store breakable items safely	(Mileti & Darlington, 1997), (Russell et al., 1995), (Heller et al., 2005), (Lindell & Whitney, 2000), (Spittal et al., 2008; Spittal et al., 2006)
Bolt house to the foundation	(Mileti & Darlington, 1997),(Mileti & O'Brien, 1992), (Russell et al., 1995), (Heller et al., 2005), (Johnson & Nakayachi, 2017), (Karanci et al., 2005), (Spittal et al., 2008; Spittal et al., 2006)
Capacity building	
Contacting Red Cross or government agencies, attending meetings	(Lindell et al., 2009),
Seeking information: reading materials about earthquakes, listening to the radio	(Mulilis et al., 1990), (Mileti & O'Brien, 1992)
Voting for the bill	(Mulilis et al., 1990)

related to EQ structural integrity	
Participating in community events: e.g. schools for EQ preparedness	(Mulilis et al., 1990), (Lindell et al., 2009), (Lindell & Whitney, 2000),
Have written a letter about earthquake hazards	(Lindell et al., 2009)
Joined an earthquake-related organisation	(Lindell et al., 2009)

The five dimensions and their measures are discussed in the following sections.

2.4.6.1 Survival Preparedness

Survival preparedness items included having extra food, water, medicine, radio, torch, batteries, first aid kit, helmets, and hoods (Table 2.3). As discussed above (Section 2.3.4) during the disaster, communities might have to cope without governmental and external assistance. In such a situation, survival preparedness facilitates communities transition through to the response phase. The survival preparedness, such as storing food and water, enables communities and households to be self-reliant for a period while they are isolated from societal support (Levac et al., 2012; Lindell et al., 2009). Beyond identifying the measures necessary for preparing for survival, the review highlighted preparedness planning.

2.4.6.2 Preparedness Planning

Preparedness planning refers to developing emergency evacuation plans, meeting places, escape routes, and emergency items (Russell et al., 1995). The articles considered for the review included a household emergency plan, insurance of the house, neighbourhood plans, sealed rooms or physical protection shelters, and preparedness at work (Table 2.3). Household emergency plan and insurance were the

most common type of activities. Household emergency planning allows families to use identified exit routes, safety shelters, and resources for survival.

Additionally, home insurance enables the rebuilding of housing facilities efficiently; the insurance company partially covers the financial cost required to reconstruct the house (Palm & Hodgson, 1992). Russell et al. (1995) included a neighbourhood plan as an item in the planning dimension. The neighbourhood plan is a valuable item, but it represents collective activity and thus demands community efforts or community members to collectively develop such a plan. However, collective efforts are critical to coping with the impact of a disaster (Section 2.3.3). The next category identified from the review was the knowledge and skills for first aid and survival.

2.4.6.3 Knowledge and Skills for Survival and First Aid

Survival and first aid knowledge included skills to shut off utilities; use of firefighting equipment and a first aid kit; identification of emergency radio channel, medical centre and contact person; and the ability to rescue the elderly and vulnerable (Table 2.3). These types of knowledge and skills are beneficial for survival; and those community members that have this knowledge and skill-sets can support other community members during a disaster (Kirschenbaum, 2006; Mileti & Darlington, 1997; Mulilis et al., 1990). Another dimension of preparedness identified in the review was housing structural integrity.

2.4.6.4 Housing Structural Integrity

Housing structural integrity included strengthening the house; stabilising the chimney; and fastening heavy objects to ensure housing structural integrity and physical protection (Table 2.3). A house provides a sense of physical protection from the impact of earthquake hazards (Mulilis et al., 1990; Russell et al., 1995). However, the fragility of housing infrastructure can result in loss of life and damage to property during an earthquake (Lindell & Perry, 2000; Russell et al., 1995). Ensuring structural integrity is an essential component of comprehensive preparedness for earthquake

hazards (Johnson & Nakayachi, 2017; Karanci et al., 2005). Secured housing enhances the survival capacity of the people by preventing them from the need to live in shelters (Lindell & Perry, 2000; Paton & McClure, 2013). Besides structural integrity, capacity building was another component identified in the literature.

2.4.6.5 Capacity Building

The capacity building included seeking information from different sources; participating in community meetings; contacting the Red Cross and DRM agency, and attending meetings and voting for bills about earthquake resistant housing facilities (Table 2.1). The analysis reveals that the capacity building items reflected activities that required coordination and collaboration between individuals and households, communities and DRM agencies for preparedness. Capacity building preparedness has implications for household response and recovery in a post-disaster context. Households, as a member of the community, have to collaborate with other members and concerned stakeholders to respond and recover from earthquake hazards (Mulligan et al., 2012).

2.4.7. Gaps in the Understanding of Preparedness

In summary, the review of literature confirms that earthquake hazard preparedness is a multidimensional and complex factor in disaster recovery, which carries multiple meanings and measures (Lindell et al., 2009; Russell et al., 1995). The preparedness dimensions fall into five categories: a) survival, b) planning, c) survival and first aid knowledge and skills, d) housing structural integrity and e) capacity building. None of the studies used a standard definition of preparedness, although common elements of preparedness are consistently used in recent publications; this finding supports the previous reviews by Lindell and Perry (2000), Kohn et al. (2012), Levac et al. (2012), and Solberg et al. (2010).

In all the studies reviewed, some sample populations did not prepare, while some did selective preparedness. People prefered to prepare with survival items,

rather than engage with planning and mitigation. These findings corroborate earlier research (Kohn et al., 2012; Levac et al., 2012; Lindell & Perry, 2000; Solberg et al., 2010). Multiple studies demonstrated that the factors predicting preparedness contributed to the discrepancy in the level of preparedness (Karanci et al., 2005; Kirschenbaum et al., 2017; Lindell et al., 2009; Lindell & Whitney, 2000; Mileti & Darlington, 1997; Mileti & O'Brien, 1992; Mulilis et al., 1990; Onuma et al., 2017; Russell et al., 1995; Rüstemli & Karanci, 1999).

Several personal and social factors contributed to the varying degree of preparedness, and the selective measures adopted. Some of the personal factors identified in the review are: risk perception (Lindell et al., 2009; Mileti & O'Brien, 1992; Palm & Hodgson, 1992); prior experience ; hazard knowledge (Dooley, Catalano, Mishra & Serxner, 1992; Lindell & Whitney, 2000; Onuma et al., 2017; Russell et al., 1995; Uprety & Poudel, 2012); preparedness knowledge (Mileti & Darlington, 1997); responsibility of protection (Lindell & Whitney, 2000); salience of hazard (Mileti & O'Brien, 1992); and exposure to information sources (Basolo et al., 2009). Some of the social factors are: seeing others prepare (Mileti & Darlington, 1997); social networking (Kirschenbaum, 2006); contact with DRM agencies (Russell et al., 1995); and trust in government (Basolo et al., 2009; Kirschenbaum et al., 2017).

There is a lack of clarity regarding how different factors interact to promote preparedness (Kohn et al., 2012; Lindell & Perry, 2000). Studies have been conducted over different periods, among various populations, and using diverse methodologies (Lindell & Perry, 2000). These studies consider a range of preparedness dimensions and different measures for predicting preparedness.

This empirical review confirms a modest preparedness in the public sphere despite continuous efforts over a prolonged period. The information-based approach to risk communication has proven ineffective; it regards the public as a passive information receiver, and therefore neglects the interpretive process that people undergo when exposed to sources of information (Johnston et al., 2013; Karanci et al.,

2005; Lindell et al., 2009; Paton & McClure, 2013). In the literature, cognitive theories for predicting population preparedness were introduced to explain the gaps mentioned above.

2.5. Cognitive Theories and Natural Hazards Preparedness

Several cognitive theories have been applied to understand why people are not motivated to adopt recommended behaviours despite being aware of the importance of preparing and the associated risk of natural hazards (Lindell & Perry, 2000; Solberg et al., 2010). Some of the early contributions are the work of Dooley et al. (1992) and Russell et al. (1995). In these models, quantitative data was used to identify the predictor of preparedness: a regression was conducted between the outcome variable and independent variables (IVs) to assess the causal influence of IVs on the dependent variable (DV).

Application of cognitive-based theories and models succeeded in the regression-based models. Cognitive theories were applied to identify variables contributing to individual behaviour change, and the influence of the social environment on natural hazards. These theories included: the Protection Motivation Theory (PMT) (Rogers, 1983); Person Relative to Event theory, represented as PrE (Duval & Mulilis, 1999; Mulilis, 1996; Mulilis & Duval, 1995, 1997); PMT-TTM (Trans Theoretical model) (Martin et al., 2007); Theory of Planned Behaviour (TPB) (Ajzen, 1991; McIvor & Paton, 2007); and Community Engagement Theory (CET) (Paton, 2008; Paton & McClure, 2013).

A review of these theories and models contributing to predicting individual behaviour are presented in the following section.

2.5.1. Protection Motivation Theory

Rogers (1975) initially proposed the Protection Motivation Theory (PMT) to assess the changes in health behaviour. PMT was developed to promote preventive health behaviour in people by communicating the possible risk of disease, and its consequences, should they abandon the recommended precautions (Floyd, Prentice-Dunn & Rogers, 2000; Milne, Orbell & Sheeran, 2002). Maddux and Rogers (1983) integrated self-efficacy as a fourth variable in the PMT model, testing it with empirical data on cigarette smoking behaviour. Rogers (1983), in his revised version of PMT, added the variables 'rewards' and 'response costs': smoking for self-satisfaction and social approval, despite the risk of lung cancer, or quitting smoking, respectively. PMT was further extended to measure the change in attitude (Munro, Lewin, Swart & Volmink, 2007; Norman, Boer & Seydel, 2005).

Protection Motivation Theory assumes that people are motivated to adopt protective behaviour by evaluating the perceived risk and coping strategies available (Rogers, 1983). As proposed by Rogers, PMT has two perceptual processes: threat/risk appraisal and coping appraisal. Risk appraisal is the primary process that promotes coping and protective behaviour and is, therefore, a composite of three variables: the perceived probability of a hazard, perceived severity, and rewards. Rewards are the actions or behaviour resulting from maladaptation or ill-preparedness. The second process following risk appraisal is coping appraisal. A coping appraisal is also a composite of self-efficacy, response efficacy, and response costs: if people recognise the risk of a hazard, they likely to assess their coping abilities to counteract that risk. A relative balance between risk appraisal and coping appraisal results in motivation to prepare (Norman et al., 2005; Rogers, 1983).

Protection Motivation Theory variables were designed to predict the volitional behaviour in people facing a known and immediate health issue such as smoking (Norman et al., 2005; Rogers, 1983). Three meta-analyses provided evidence of the use of this theory in health science (Floyd et al., 2000; Milne et al., 2002; Munro et al.,

2007). However, in terms of the frequency of occurrence and response urgency, health hazards are more imminent than natural hazards (Paton & McClure, 2013). People focus on health issues rather than natural hazards, even though natural hazards, such as earthquakes, could be catastrophic (Paton & McClure, 2013). People are inherently concerned with the immediate future, rather than a longer-term perspective (Paton & McClure, 2013). They tend to prepare for high-frequency events compared to low-frequency events, even if the low-frequency event could be catastrophic (Slovic et al., 1982).

Regardless, PMT has been used to examine natural hazard preparedness. Martin et al. (2007) integrated PMT with the Transtheoretical Model (TTM) to expand on the interaction of risk appraisal and coping variables between different stages of readiness. The integrated model of PMT-TTM is discussed in section 2.5.2. Furthermore, McLennan et al. (2014) applied PMT to measure the behavioural intentions of populations exposed to Australian bushfires. Self-efficacy and response efficacy (equivalent to outcome expectancy) were significant predictors for those who intended to evacuate early, while susceptibility of threat and self-efficacy were significant predictors of intention to 'stay and defend' (McLennan et al., 2014). Unlike bushfires, earthquakes occur without warning; people have a limited chance of evacuating potential impact areas (Eshghi & Larson, 2008; Jordan et al., 2011). People need to stay in the earthquake impact zone and protect themselves, for which self-efficacy is vital. When a population has experienced a hazard and therefore has some knowledge of the risk, the assessment of the recurrent event, such as bushfires, provides evidence of the suitability of PMT variables for tracking behavioural intentions.

2.5.2. Protection Motivation Theory and Transtheoretical Model

Originally, Prochaska and DiClemente (1986) developed the Transtheoretical Model (TTM) to measure the stages an individual undergoes when ceasing unwanted behaviour (health hazard), such as smoking behaviour. The TTM assumes a change in

behaviour over time, and people, therefore, progress through a series of stages (Block & Keller, 1998; Prochaska & DiClemente, 1986). These stages are: pre-contemplation (not ready), contemplation (getting ready), preparation (ready), action, maintenance, and termination (Prochaska & DiClemente, 1986). Block and Keller (1998) integrated PMT and TTM to assess how the readiness stages interact with vulnerability, severity, self-efficacy, and response variables of PMT, which predicts the motivation to adopt precautionary behaviour related to health hazards.

In natural hazards, Martin et al. (2007) adopted the integrated PMT-TTM to measure the protective behaviour of people for bushfire hazards. The PMT-TTM identified the interaction between risk perception, coping dimensions, and stage of readiness in a progression (Martin et al., 2007). Martin et al. (2007) asserted that in the pre-contemplative and contemplative stages, people with higher personal knowledge, vulnerability, severity, response efficacy, and self-efficacy were good predictors of risk perception. In the action stage, the severity of the threat was a predictor for people with high subjective knowledge. Martin et al. (2007) further highlighted that subjective knowledge played a critical role in adopting protective behaviours. People with high subjective knowledge realised the severity of the risk; and their self-efficacy to reduce risk, as well and responsive actions were higher compared to those people with low subjective knowledge (Martin et al., 2007). This study reinforces the importance of PMT variables in predicting protection motivation behaviour, particularly for those who are unprepared, or yet to engage in preparedness. Duval and Mulilis (1999) derived a model of a person to the event (PrE), based on PMT, to assess earthquake hazard preparedness.

2.5.3. Person Relative to Event Theory

Mulilis and Duval (1995) postulated a model of a person relative to event theory (PrE). They derived this model from the work of (Lazarus, 1991; Lazarus & Folkman, 1984) and (Rogers, 1975). The PrE model assumes that people decide

whether to prepare by judging their risk and available resources (Mulilis & Duval, 1995). In their PrE model, Mulilis and Duval (1995) hypothesised that people are motivated to adopt problem-focused coping (PFC) if they accept the risk of a hazard. However, the decision to adopt PFC depends on the availability of resources for coping; people adopt PFC if they have enough resources to address the risk.

Mulilis and Duval (1995) further asserted that people avoid PFC if the resources necessary to cope are at a deficit. For any hazard, a direct relationship exists between the resources available and the coping behaviour people are likely to adopt. The utility of this theory extends to earthquakes (Duval & Mulilis, 1999; Mulilis & Duval, 1995), tornados (Mulilis & Duval, 1997; Mulilis, Duval & Bovalino, 2000), and disaster-resistant technology (Mulilis, 1996).

The PMT, and variant models of PMT and TTM, discussed so far identify the factors predicting individual behaviour. The studies provide valuable information about individual attitudes and behavioural influences on disaster preparedness. However, these studies exclude the likely influence of the social environment within which people interact.

It is imperative to consider the influence of the social environment in natural hazard preparedness modelling (Becker et al., 2012). Socio-cultural factors may force individual behaviour to vary at different times (Becker et al., 2012; Shinn & Toohey, 2003). People's risk beliefs and coping behaviours are socially constructed (Blumer, 1986; Denzin, 1992). People regularly interact with their social and physical environment (Blumer, 1986). In this process, they receive signals or information from their environment, referred to as 'stimuli'.

They interpret the stimuli from their environment; reflect on it and integrate it into their already existing mental schemas (Blumer, 1986). They attribute meaning to their interactions with their environment, based on the reflections of their experiences (Blumer, 1986). These socially constructed meanings guide the behaviour of people (Bagozzi, Bergami & Leone, 2003a). This process applies to hazard risk interpretation

as much as it relates to routine transactions between people (Paton, Burgelt & Prior, 2008; Paton & McClure, 2013). Therefore, a review of theories and models that identify the role of social variables in predicting preparedness is necessary.

2.5.4. Critical Awareness Model

Paton (2003) proposed a Critical Awareness Model (CAM). Paton and Johnston (2001) applied CAM to assess people's perceptions of volcanic hazard preparedness. The model is named after the 'critical awareness' variable. Critical awareness is the degree to which people self-reflect and interacts with family, friends, and neighbours about a hazardous issue (Dalton, Elias & Wandersman, 2001). The extent to which people interact with and consider hazards helps people realise the importance of hazard risk: this further encourages them to take necessary actions (Dalton et al., 2001; Paton, 2003; Paton, Smith & Johnston, 2005). In terms of predicting the intention to prepare and actual preparedness, the model identifies factors such as critical awareness and risk perception; anxiety mediated through outcome expectancy; and self-efficacy and action coping (Dalton et al., 2001; Paton, 2003; Paton et al., 2005). Paton et al. (2005) tested the utility of CAM for earthquake hazard preparedness in New Zealand and bushfires in Australia (Paton, Kelly, Burgelt & Doherty, 2006). The CAM considers the influence of social factors through critical awareness and a sense of community. The CAM variable 'critical awareness' similarly demonstrates the positive influence of significant others: a prediction of the Theory of Planned Behaviour (TPB), which motivates people to adopt preparedness (Paton & McClure, 2013).

2.5.5. Theory of Planned Behaviour

Ajzen (1991) proposed the theory of planned behaviour (TPB). TPB assumed that attitude, subjective norms, and perceived behavioural control each influence the decision to adopt protective behaviours (Ajzen, 1991). TPB argues that beliefs in the efficacy of behaviour that is outcome beliefs and outcome evaluations beliefs promote

protective actions (Ajzen, 1991). Ajzen (1991) described attitudes as people's beliefs towards a particular behaviour accrued from the perceived likely outcomes of the behaviour. Outcome beliefs are the likelihood of achieving a desired result of the action, while the outcome evaluations are the response efficacy for a given action (Ajzen, 1991; Doll & Ajzen, 1992). Ajzen and colleagues asserted that people hold certain attitudes at a given time, and they are ordered in a hierarchy of importance. The higher the importance of an attitude, the higher the chance to influence people's behavioural intentions (Doll & Ajzen, 1992).

Subjective norms also influence the decision of protective action (Ajzen, 1991). Subjective norms represent the perceived social pressure from family, friends, and relatives about the outcome of behaviour (Doll & Ajzen, 1992). Perceived behavioural control is the perceived ease or difficulty required to perform a given action (Doll & Ajzen, 1992). TPB has been applied to earthquakes (McIvor & Paton, 2007) and bushfires (McLennan et al., 2014).

To predict behavioural intentions, McIvor and Paton (2007) tested a variant of the TPB model considering the positive attitude, positive subjective norm, action coping, and outcome expectancy. McIvor and Paton (2007) found that a positive attitude, directly and indirectly, predicted behavioural intentions, while outcome expectancy mediated positive attitudes and positive subjective norms to behavioural intentions. They highlighted that the positive subjective norms or social expectations from significant others, such as family and friends, influenced the outcome expectancy belief of an individual's likely preparedness. Therefore, the variable subjective norms affect the individual's likelihood to be influenced by their social context (McIvor & Paton, 2007). The role of significant others became essential when interpreting the risk and shared the meaning of the situation in an uncertain and complex hazard (Paton & McClure, 2013). Furthermore, Mileti and Darlington (1997) attempted to assess the information-seeking behaviour of people in earthquake hazard preparedness.

2.5.6. An Actionable Risk Communication Model

Wood and colleagues modelled preparedness action outcome variable with information variables information content, density, and information observed and preparedness mediating variables (knowledge, perceived effectiveness, and milling). They defined milling as information-seeking behaviour, which includes discussing that information with others in society. They found that information observed, such as seeing preparedness actions others have taken, and information received about what actions to take in preparation were relevant variables for predicting preparedness. The variable milling mediates the information observed; and information content, density, and knowledge reflect the role of the significant other, or society, in influencing preparedness behaviour of people (Wood et al., 2012). This model is a general model for all hazards, including terrorism. However, the model has not been explored further in natural hazards.

2.5.7. Impact of Information on the Preparedness Model

Recently, Kirschenbaum et al. (2017) developed and tested a working model of the impact of information on earthquake hazard preparedness. The model assumes that the level of trust in information sources interacts with exposure, experience, and personal characteristics of people to predict preparedness (Kirschenbaum et al., 2017). They found that people rely on both formal and informal sources DRM agencies, media, family, and friends to look for information. Among these samples, they also determined that those populations who received information reported higher actual and perceived preparedness, in comparison to those who did not acquire information.

Furthermore, they identified that experience resulted in trust in formal information sources (Kirschenbaum et al., 2017). This model was developed to solve the issue of compliance among DRM agencies persuading the public, and the attitude of the public accepting the information recommended by DRM agencies. Generating models and hypothesis from practice-based research is imperative. However, it would

have been useful if the model was related to prior theoretical frameworks that provide ample evidence of trust in information.

Incorporating most of the model variables discussed above, Lindell and Perry (2012) developed the Protective Action Decision Model (PADM).

2.5.8. Protective Action Decision Model

Lindell and Perry (2012) proposed a Protective Action Decision Model (PADM). The PADM consists of multiple stages: environmental and social context, psychological process, situational facilitators and impediments, and feedback (Lindell & Perry, 2012). Furthermore, the environmental and social context is composed of environmental cues; social cues and information sources; channel access and preference; warning messages and receiver characteristics; and psychological processes, including pre-decisional process (exposure, attention, and comprehension), perceptual process (threat perception, protective action perception, and stakeholder perception), and protective action decision-making (Lindell & Perry, 2012).

Lindell and Perry (2012) hypothesised that the protective action decision-making process begins with the environmental and social signals, and risk communication information that stimulates the pre-decisional process. The pre-decisional process could prompt people to move towards protective action decision-making if people receive hazard information, in addition to understanding the information that they have received (Lindell & Perry, 2012). An awareness of the environmental threat to people is not enough to stimulate protective action decision-making; they must realise a threat is imminent; personalise the impact of that threat; and evaluate the coping options available (Lindell & Perry, 2012). Therefore, stakeholders further influence the individual risk perception process; the protective action-decision interacts with situational facilitators or impediments that may lead to actual response behaviour, or prevent any action taken (Lindell & Perry, 2012).

The PADM considers the uncertainty associated with the sources of information, information search process, and transmitting agencies (Lindell & Perry, 2012). Lindell and Perry (2012) consider that ambiguity in information might force people to spend more time searching for further information, thus prolonging proactive action decision-making. In their model, they introduce the social context at three points: first, at the information search process, identified by the social cues people form by seeing others. Secondly, at the stakeholders' perception; Lindell and Perry refer to the relationships of the expert and media, but do not explicitly discuss how that relationship influences an individual's decision. Finally, they introduce personal circumstances (situational facilitators or impediments), which may hinder or promote the actual response. They do not explicitly discuss the nature of influence that the social environment, such as community engagement and the relationship with DRM agencies, could have on people's decision-making processes.

During the course of model development, Paton and colleagues (Paton, Bajek, Okada & McIvor, 2010; Paton, Burgelt, et al., 2008; Paton, Kelly, et al., 2006; Paton, Okada & Sagala, 2013; Paton, Sagala, et al., 2010) identified the social contextual variables that influence hazard decision-making.

2.5.9. Community Engagement Theory

Community Engagement Theory views disaster readiness as a function of the risk interpretation process at the individual, communal, and societal level (Paton, 2006, 2008; Paton, Burgelt, et al., 2008). The variable outcome expectancy represents the individual level, while community participation, collective efficacy, empowerment, and trust denote collective efforts at community and society levels, thus predicting behavioural intentions to prepare (Paton, 2008; Paton & McClure, 2013).

Community Engagement Theory suggests that people hold outcome expectancies regarding hazard preparedness (Paton, 2008; Paton, Burgelt, et al., 2008). An outcome expectancy is a belief as to whether the action would result in a

desirable outcome (Paton, 2008; Paton & McClure, 2013). The decision to prepare occurs only if an individual holds a positive outcome expectancy (Paton, 2008). Furthermore, people interact with their significant others that is family, friends, and neighbours (Paton, 2008). The individual-community interaction occurs due to normative influence and a search for accurate information, thereby mitigating the hazard issue in the community (Paton & McClure, 2013; Paton, Sagala, et al., 2010). Community participation and collective efficacy each represent this phase. However, communities may not have all the required information and resources to mitigate the hazard issue by a collective effort. Therefore, communities turn to DRM agencies (Paton, 2008; Paton, Burgelt, et al., 2008; Paton & McClure, 2013). An empowering and trustworthy environment could ensure reliable information and resources, and responsibility-sharing between the community and DRM agencies (Paton, Sagala, et al., 2010). Two factors of trust and empowerment are considered necessary for measuring the community-agency relationship.

Community Engagement Theory (CET) captures the hazard-related social context as model variables. However, this theory was formulated and applied in pre-disaster settings, where people may not have previous direct experiences of hazards (Paton, 2008; Paton, Burgelt, et al., 2008). Therefore, the CET social contextual variables represent the everyday experiences of people. These variables are essential to a comprehensive understanding of readiness behaviour in people (Becker et al., 2012; Becker et al., 2017; Paton & McClure, 2013).

CET includes the social contextual variables among the models discussed above. However, it does not explicitly illustrate how the interaction between individuals and the social environment occurs. In an attempt to bridge this gap, Becker et al. (2012) explored the process of individual interaction within the social environment.

2.5.10. Model of Household Preparedness for Earthquakes

Becker et al. (2012) conducted exploratory research for assessing how people make decisions regarding earthquake hazards, and how their social context influences their decision-making process. They used symbolic interactionism and grounded theory to explore the nature of preparedness in a pre-disaster setting. Becker and colleagues illustrated the process of how people interact with risk information and precautionary options available to them; they also explored how people make meaning from the information, and what enables or hinders them from making decisions regarding earthquake hazards. They found that cognitive, emotional, and social factors influence people's decision-making over earthquake hazards. However, this model was developed to identify future research questions related to the earthquake hazard decision-making process, and the influence of the social environment.

2.6. Discussion

As discussed above, Protection Motivation Theory (PMT), Theory of Planned Behaviour (TPB), and Community Engagement Theory (CET) are the prominent theories applied in the field of natural hazards (Ejeta et al., 2015). While these theories are useful, the review suggests that: these theories have been applied in mostly pre-disaster scenarios (Ejeta et al., 2015); a single theory alone is insufficient to accurately model preparedness in post-disaster recovery; most of these theories and models originated in culturally individualistic developed countries. A detailed discussion of these issues is presented in the following subsections.

2.6.1. Preparedness Research in a Post-disaster Context

There is limited empirical evidence of theoretical research on population preparedness in post-disaster recovery, across developed and developing countries (Ejeta et al., 2015; Paton & Jang, 2016; Paton et al., 2014). Most of the theories and models explored above have been applied to natural hazard cognition in a pre-disaster

context, except PMT (bushfires) and MRM (earthquakes). Preparedness research in a pre-event context is imperative as people tend to engage with preparedness in this stage (Paton & McClure, 2013). However, people facing the severe impact of hazard risks deal with several demands and challenges during a disaster (Guha-Sapir & Vos, 2011). The theories and models developed and tested in hazard inactivity do not capture the elements of the post-disaster context (Paton et al., 2014). Therefore, there is a scope to explore theories and models for examining preparedness in a post-disaster context.

Protection Motivation Theory (PMT) identifies variables such as risk appraisal and coping appraisal but instead assesses the causal influence of individual behaviour on preparedness (Norman et al., 2005). PMT has been successfully applied to bushfire hazards, which are recurring events, thereby making it easier for the affected population to develop essential beliefs and practices for protective behaviour. The Multilevel Resilience Model (MRM), recently applied to identify the variables of readiness, indicates the essential variables and processes of recovery (Paton et al., 2014). However, the MRM does not capture some of the critical variables determining hazard cognition in people, like risk perception. Consequently, conducting developmental preparedness research during the response and recovery phase can be beneficial: people are more likely to acknowledge the issues they must contend with, what they need to do, and what helps or hinders their ability to be prepared. During this phase, the issues may be more accessible to people and, consequently, the research process.

Paton et al. (2014) identified the influence of several variables that were not obvious in pre-event research while studying readiness in post-disaster recovery: actual disaster experience can elevate the salience of associated risks, which could further assist people in identifying factors and processes promoting or hindering their response to a given disaster. In rare and complex hazards, such as earthquakes, this is never possible in the pre-event phase. Therefore, people rarely develop and sustain

risk beliefs in hazard inactivity. Lack of experience prevents people from developing and sustaining risk beliefs necessary for forming motivation for preparedness (Doll & Ajzen, 1992; Slovic et al., 1979; Slovic & Weber, 2002). Therefore, conducting preparedness research in recovery settings is vital.

Recovery settings present a range of challenges and demands for survivors, which raises the need to explore preparedness in this setting (Paton, Jang, et al., 2015; Paton et al., 2014). Finally, facilitating preparedness in recovery settings influences the systematic development of building back better (BBB) strategies, thereby developing future preparedness capabilities in populations who face future hazard events (Fan, 2013; Kennedy et al., 2008; Khasalamwa, 2009).

2.6.2. Comprehensive Theoretical Model Development

In general, two types of theories and models were identified in the literature review: those that concentrated on measuring individual behaviour, and those that focused on identifying the influence of social contextual variables.

The PMT (and it's variant models) and TTM each identify several factors predicting the behaviour of an individual (Martin et al., 2007; Mulilis & Duval, 1995; Rogers, 1983). PMT identifies risk appraisal and coping appraisal, while it's variant PrE adds problem-focused coping unique to PMT (Mulilis & Duval, 1995). An integrated PMT-TTM provides the relationship of risk appraisal and coping appraisal to preparedness stages (Martin et al., 2007). These studies provide valuable information about individual attitudes and behavioural influences on preparedness. However, these studies exclude the likely influence of the social environment on individuals.

Many models attempted to assess the influence of the social environment on individual behaviour, though each contributed to different aspects of the preparedness puzzle. The Critical Awareness Model (CAM) used the variable ‘critical awareness’ to identify the influence of interaction with significant others on natural hazard decision-making (Paton & Johnston, 2001). The CAM variable ‘critical awareness’ demonstrates

the influence of significant others, which relates to the normative influence that the Theory of Planned Behaviour (TPB) predicts along with the personal efficacy motivating people to adopt preparedness (Ajzen, 1991). The variables 'critical awareness' and 'subjective norms' are essential contributions to preparedness models. The role of significant others is critical when interpreting risk, creating a shared meaning of unfamiliar situations during uncertain and complex hazards (Paton & McClure, 2013).

Similarly, Wood et al. (2012) identified 'milling' which means observing others preparing. Milling mediated the information observed, information content and density, and knowledge, reflecting the role of significant others in influencing preparedness behaviour of people. Furthermore, Kirschenbaum et al. (2017) developed and tested a working model of the impact of information on earthquake hazard preparedness, which identified trust in information sources, exposure and experience, and personal characteristics of people to predict preparedness. However, normative influence, critical awareness, milling, and trust are only the tip of the social influence iceberg.

Furthermore, PADM attempts to include social influence at multiple stages (Lindell & Perry, 2012). The PADM consists of multiple stages: environmental and social context, psychological process, situational facilitators and impediments, and feedback (Lindell & Perry, 2012). The PADM covers most of the social variables discussed above. However, they did not explicitly address the level of influence that a social environment, including community process and relationships with DRM agencies, could have on people's decision-making.

In an attempt to understand the nature and process of social influence, Becker et al. (2012) used the Symbolic Interaction Theory to explore the process of interaction between individuals within their social environment. They found that cognitive, emotional, and social factors influence people's decision-making regarding earthquake hazards. However, this model was developed to identify future research questions

related to the earthquake hazard decision-making process, and the influence of the social environment.

The CET identified the influence of the social environment on earthquake hazard decision-making at communal and societal levels through such factors as community participation, collective efficacy, empowerment, and trust (Paton, 2008; Paton, Burgelt, et al., 2008). However, the CET was developed and tested in pre-event, and this model also informed the multilevel resilience model (MRM). Recently, Paton and colleagues applied the MRM to measure the community readiness and recovery among earthquake-affected populations in Taiwan and New Zealand (Paton & Jang, 2016; Paton, Jang, et al., 2015; Paton et al., 2014). They identified the following factors: self-efficacy, sense of community, social support, community participation, collective efficacy, empowerment, and trust. The application of the MRM provides qualitative validity to the CET variables, illuminating post-disaster aspects of the social environment.

All of the theories and models discussed above provide valuable insights into variables that predict disaster preparedness. However, each of these theories and models was developed with different assumptions, and consequently, constitute some independent variables (IVs). Therefore, they represent the diverse features of disaster preparedness and, in doing so, address different aspects of the preparedness puzzle. None of these theories and models can individually cover all the possible combinations to predict preparedness. Therefore, there exists a significant gap in the literature to explore further how these theories could be integrated or developed to identify further a comprehensive set of variables for predicting preparedness.

From the above discussion, it can be argued that combining the PMT and CET could provide a more comprehensive model to predict preparedness during post-disaster recovery. Protection Motivation Theory (PMT) measures the risk appraisal and coping behaviour of people to predict preparedness (Rogers, 1983). The application of PMT variables for measuring intentions to prepare for recurring bushfire hazards

suggests the effectiveness of PMT to asses volitional behaviour of a population, particularly when they have experienced the hazard, and therefore hold previous knowledge of its associated risks (Martin et al., 2007; McLennan et al., 2014). However, PMT focuses on the beliefs and behaviour of only an individual. Therefore, another theory capable of measuring social contextual factors is essential to develop a robust model for disaster preparedness comprehensively.

It can be argued that CET is capable of fulfilling the gaps of PMT as it is capable of capturing social contextual model variables. CET variables were derived from the everyday experiences of people to develop an understanding of the risks they encounter, and the resultant behaviour they display to manage their risk (Paton, Burgelt, et al., 2008; Paton & McClure, 2013). The CET informs the Multilevel Resilience Model (MRM): variables, such as community participation, collective efficacy, empowerment, and trust, represent the social environment in a multilevel model of resilience and are therefore similar to CET variables (Paton et al., 2014).

2.6.3. Preparedness research in developing country context

Most of the theoretical works on preparedness have originated and been applied in culturally individualistic and developed countries, such as Australia, New Zealand, and the United States of America (Ejeta et al., 2015; Martin et al., 2007; McLennan et al., 2014; Paton, Kelly, et al., 2006). However, many of these theories and models have proved successful in countries with collectivistic cultures, like Indonesia and Taiwan (Paton et al., 2013; Paton, Sagala, et al., 2010). The ability of these theories and models to predict preparedness in developing countries with highly marginalised populations, like Ethiopia, is similarly successful (Ejeta et al., 2015). However, there is limited empirical evidence of theorising preparedness and its application in developing countries (Ejeta et al., 2015). Limited empirical evidence exists regarding the effectiveness of preparedness interventions in developing countries (Ejeta et al., 2015). Furthermore, disaster risk is high in developing countries,

and consequently reflects the strong demand for preparedness: due to limited financial resources and a lack of skills for contingency planning, disaster preparedness is isolated to the response stage (Mulligan et al., 2012; Nibanupudi & Shaw, 2016; Shaw, 2014). Therefore, there is an opportunity to apply theoretical research on natural hazard preparedness in developing countries.

2.7. Chapter summary

Earthquake disasters pose a significant risk to populations and societies, though earthquakes are a natural occurrence and part of a human-environment co-existence. There are mitigation and preparedness strategies to reduce earthquake risk to populations and societies. Mitigation actions, such as robust reconstructions of building infrastructure, are costly and cannot incorporate all the possible thresholds of risk for population safety. Therefore, people need to prepare themselves to reduce hazard risk. However, despite several attempts to engage with these risks, empirical research confirms only modest population preparedness. Several models and theories were developed to understand population behaviour and the reasons behind failures to adequately prepare for a disaster. While they are useful, most of these theories and models originated in developed countries. The application of these theories and models are limited to pre-disaster contexts. Finally, no single model exists to provide a comprehensive understanding of the factors contributing to disaster preparedness. This research attempts to integrate existing models to develop a more comprehensive preparedness model and takes the opportunity to study the preparedness of people in the developing country of Nepal, following the 2015 Nepal earthquake.;

Chapter 3: Conceptual Model Development

3.1. Introduction

As discussed in Chapter Two, existing theories consider several aspects of the preparedness process, but none of these theories provides a comprehensive set of variables for predicting preparedness. It is vital to conduct preparedness research during pre-event periods as people need to prepare during this time. However, it is challenging to identify valid predictors of voluntary actions at such times. In order to better understand the preparedness-recovery relationship, it is critical to developing a new conceptual model of preparedness capable of capturing the essential elements of the post-disaster recovery setting. This chapter proposes a comprehensive earthquake hazard preparedness model to investigate the population preparedness of the post-disaster recovery setting. In this chapter, Section 3.2 focuses on the elements and processes of preparedness in a post-recovery context. Section 3.3 identifies theories suitable for identifying the significant variables of preparedness based on the outcome of the literature review on existing theories and models (Chapter Two) and elements identified in post-event settings. The selected theories are integrated to develop a conceptual model capable of explaining preparedness in the post-disaster recovery setting. The final section of the chapter discusses model variables and introduces relevant hypotheses for statistical testing.

3.2. Processes and Factors of Preparedness in a Disaster Recovery

When significant earthquakes occur, a population experiences an enduring impact (Doocy et al., 2013; Guha-Sapir & Vos, 2011). The sample population of this study lived through the experience and consequences of the 2015 Nepal earthquake (Goda et al., 2015). This section explores the various factors and processes influencing

the preparedness-recovery relationship, beginning with experience-induced risk perception and coping.

3.2.1. Experience-induced risk perception and coping

Empirical evidence shows the role of direct experience in increasing risk perception (Becker et al., 2017; Davis & Tullio Ricci, 2004; Dooley et al., 1992; Kung & Chen, 2012; Lindell & Prater, 2000; Wachinger, Renn, Begg & Kuhlicke, 2013). McClure, Wills, Johnston and Recker (2011) found that the experience of the 2010 Darfield earthquake influenced people's risk perception. Similarly, Dooley et al. (1992) noted experience increased risk perception. Additionally, Paton, Millar and Johnston (2001) found that the hazards of minor volcanoes (e.g. ash fall), and its impact on people's livelihood activities, contributed to risk perceptions; however, such experience did not result in greater preparedness for volcanic hazards (Johnston, Bebbington Chin-Diew Lai, Houghton & Paton, 1999). For example, after the 1995 eruption of Ruapehu volcano, New Zealand, despite an increase in their risk perception, the level of preparedness in the affected population significantly decreased (Johnston et al., 1999). The reason for the decrease in preparedness was attributed to normalisation bias: people felt they had fared well in the recent eruption, and could, therefore, cope with future volcanic events. However, experience does not mean that people have the necessary information to mitigate exposure to risk (Davis & Tullio Ricci, 2004; Johnston et al., 2013). Johnston et al. (2013) assessed the influence of public education on earthquake and tsunami preparedness. They found that increased perception of the risk had not translated into preparedness, and they highlighted several factors that either facilitated or hindered risk perception-preparedness relationship.

Regardless of this, theories such as Protection Motivation Theory (PMT) has confirmed risk perception is critical for engagement with preparedness behaviours (Floyd et al., 2000; Milne et al., 2002; Rogers, 1983). PMT assumes that people will search for available coping methods only when they acknowledge that there is a risk to

them (Floyd et al., 2000; Milne et al., 2002; Rogers, 1983). Through their direct and indirect experiences, people realise the inevitability of the associated threat and therefore the relevance of preparedness (Becker et al., 2013).

People judge their exposure to risk relative to their memory and knowledge accrued from previous experiences (Blumer, 1986; Slovic et al., 1979, 1982). Unlike natural hazards, people directly or indirectly (e.g. watching television) experience everyday hazards, such as car accidents; and more often, the causes and consequences of these hazards are readily evident to them (Paton & McClure, 2013). People judge the importance of their beliefs by measuring the time elapsed since an event, and the urgency of the associated issues (Ajzen, 1991; Doll & Ajzen, 1992). As a result, people develop and sustain their risk beliefs and pursue appropriate coping behaviour to mitigate everyday issues (Becker et al., 2017; Paton & McClure, 2013; Slovic, 1987). The recurring experience allows people to understand the risks associated with imminent and inevitable hazards, like natural disasters; and thus promotes preparedness (Becker et al., 2017; Dooley et al., 1992; Lindell & Prater, 2002; Russell et al., 1995).

As discussed above, the risk interpretation process not only allows people to evaluate their exposure to the risk, but it enables them to develop the capacity to cope. However, infrequent and complex earthquakes offer people a limited chance to develop a realistic estimation of the risk (Slovic & Weber, 2002). People rarely face the impact of an earthquake directly: as they are unable to anticipate what happens next, their ability to form appropriate risk judgments is hindered (Paton & McClure, 2013; Slovic & Weber, 2002). Therefore, when coping with rare events such as earthquakes, people use the coping mechanisms developed from their everyday experiences (Becker et al., 2017; Paton & McClure, 2013).

When encountering an earthquake, people react to or cope with the consequences of the event (von Vacano, 2014; Zaumseil, 2014). People can neither take precautions nor avoid the earthquake risk: instead, they choose to cope (Maddux

& Rogers, 1983). An example of people's response to the immediate impact of the earthquake is the aftermath of the 2004 Indian Ocean Tsunami in Indonesia. Following the tsunami people initially reacted to the disaster by first securing their survival, locating immediate family members and rescuing those trapped in ruins, and assisting their neighbours (von Vacano, 2014).

Studies assessing preparedness for recurring wildfire hazards have identified severity, susceptibility, self-efficacy, and response efficacy as the components of risk perception and coping. Martin et al. (2007) in their study of wildfire hazards found components of risk perceptions, such as severity of susceptibility to the risk, as predictors of preparedness. Similalry, McLennan et al. (2014), in response to wildfire hazards in Australia, identified susceptibility as a contributing factor for people staying and defending their property. In a study of readiness-recovery in New Zealand and Taiwan, variables such as self-efficacy and personal responsibility were identified (Paton & Jang, 2016; Paton et al., 2014).

Furthermore, when people are exposed to a disaster, they also engage with other community members while coping: this allows them to interpret and give meaning to their unusual circumstances (Paton & Jang, 2016).

3.2.2. Collective efforts to respond and recover

During the earthquake disasters, it has been seen that family, friends, relatives, neighbours, and broader community commonly carry out initial search and rescue efforts, before the formal rescue operations led by government and international agencies (Mulligan & Nadarajah, 2011; Shaw & Goda, 2004; Shaw & Sinha, 2003; von Vacano, 2014). In the 2001 Gujarat earthquake, community members conducted initial search and rescue operations because the search and rescue efforts by the government were delayed (Shaw & Sinha, 2003). In the 2003 Bam earthquake in Iran, local people engaged in rescue and relief alongside government and voluntary agencies (Ghafory-Ashtiany & Hosseini, 2008). In the 1995 Kobe earthquake, family,

friends, and neighbours rescued most of the trapped people as they had the knowledge, skills, and local resources to do so (Shaw & Goda, 2004). Following the 2004 Indian Ocean Tsunami, community members not only conducted search and rescue but also arranged medical support, food and water supply, and temporary shelters. Mulligan and Nadarajah (2011); (von Vacano, 2014) reported a similar case in Sri Lanka after the 2004 Indian Ocean tsunami.

Community members in affected areas participate at different stages of response and recovery, including: search and rescue, relief distribution, temporary arrangement of shelters, deceased and debris management, recovery planning, and reconstruction (Mulligan & Nadarajah, 2011; Shaw & Goda, 2004; Shaw & Sinha, 2003; von Vacano, 2014). Community participation is an important variable to be considered when modelling preparedness. Variables such as a sense of community and social support are also indicators of preparedness during post-disaster recovery (Paton et al., 2014). Community participation also reflects the socio-religious orientation of the communities (Zaumseil, 2014). For example, Paton and Jang (2016) reported that Hakka beliefs guided affected people to accept disasters as experience: this not only facilitated people to draw social support within the community but also encouraged people to offer assistance to other community members. In some cases, a sense of community can be driven by a specific cultural context, and therefore encourages community participation.

Collective efficacy is the community competence (beliefs and abilities) accrued from everyday experiences of managing different issues collectively (Norris et al., 2008; Paton & McClure, 2013). Collective efficacy in communities develops from public engagement to solve challenges in everyday life (Paton & McClure, 2013). For example, people involved in day-to-day activities, such as meeting on the street, marriage ceremonies, and community meetings, enhance their knowledge of their social context, and therefore develop a sense of community which results in collective

efficacy (Paton & McClure, 2013). Furthermore, community participation in solving a particular issue, such as pollution, also promotes collective efficacy.

After the 1995 Kobe earthquake, Nakagawa and Shaw (2004) carried out case studies in the Mano community. During the 1960s, a community organisation was founded in Mano to address the issue of industrial pollution, and, as a result, had a long history in dealing with diverse stakeholders, such as city council planners and community members. Additionally, they worked toward welfare and community development: the efficacy of the Mano community developed through their extensive experience in dealing with community development and welfare. The Mano community facilitated response and recovery in their locality (Nakagawa & Shaw, 2004). The Mano community organisation, alongside community members and firms, carried out rescue, relief, social protection, and fire extinguishing in their area (Nakagawa & Shaw, 2004). The process of community planning and development was led by the Mano community, in coordination with the Kobe city administration (Nakagawa & Shaw, 2004).

The role of Mano community to respond to and recover from the impact of the 1995 Kobe earthquake illustrates the collective efficacy of a community capable of regulating its resources, people, and other resources to address the needs and demands of communities during a crisis (Nakagawa & Shaw, 2004). It also represents the ability of an empowering environment in a community to coordinate and collaborate with the Kobe City Council for recovery planning by accessing resources to execute the plan (Nakagawa & Shaw, 2004).

During a disaster, collective efforts to tackle the emerging demands and challenges may become inadequate for responding to and recovering from the impact of the hazards (Han & Waugh, 2017; Sanderson et al., 2014). Consequently, communities seek external assistance from government and international aid agencies to respond and recover effectively (Ganapati, 2014; Ghafory-Ashtiany & Hosseini, 2008; Waugh & William, 2017).

3.2.3. Community-agency collaboration

In an earthquake with significant impacts, coordination and collaboration among government, international agencies, local non-governmental organisations (stakeholders), and communities becomes critical, as seen during the 2004 Indian Ocean tsunami in Indonesia, the 2010 Haiti earthquake, the 2005 Pakistan earthquake, and the 2015 Nepal earthquake (Goda et al., 2015; Sanderson et al., 2014; von Vacano, 2014). Here, local capacity (government and community) overstretched to reduce the overall impact and recover, so the respective governments had to seek external aid (Mishra; Sanderson & Ramalingam, 2015; Shaw, 2014; Sheppard & Landry, 2016; Zaumseil, 2014). Shaw and Sinha (2003) highlighted a joint effort of the Gujarat State Disaster Management Authority, international agencies (World Bank and Asian Development Bank), communities, and NGOs, which made possible the rehabilitation and recovery of Gujarat. Similarly, in Tamil Nadu, India, in the recovery process of the 2004 Indian Ocean tsunami, Arlikatti and Andrew (2011) asserted that collaborative efforts between communities, local NGOs, state government and international funding agencies directly facilitated good quality housing structures. Similarly, Mulligan et al. (2012) noted the successful cases of housing and social recovery in areas where the Sri Lankan government, international agencies, such as Tzu Chi Foundation (Taiwan based organisation), Sri Lanka Solidarity (NGO), Foundation for Goodness (NGO associated with Sri Lankan cricketers), and affected communities collaboratively developed and implemented the community rebuilding schemes.

The quality of coordination and collaboration among concerned stakeholders determines the quality and quantity of external assistance communities receive during the recovery period (Ganapati, 2014; Nakagawa & Shaw, 2004; Paton & Jang, 2016; Paton & Tang, 2008; Shaw & Sinha, 2003). The effective coordination and collaboration between communities and DRM agencies provides an empowering (conducive) environment for the affected communities to access the resources

(knowledge, skills, financial) required for reconstruction and rebuilding (Nakagawa & Shaw, 2004; Norio, Ye, Kajitani, Shi & Tatano, 2011; Paton & Jang, 2016). In their analysis of the readiness and recovery in New Zealand and Taiwan, Paton et al. (2014) and Paton and Jang (2016) identified empowerment and trust as factors of community and agency relationships.

3.2.4. Section summary

In summary, households and communities initiate the coping process while confronting an earthquake disaster. Following their survival, people initiate contact with their family and community to interpret and give meaning to their new circumstances. During this process, they also draw on and exchange resources with their communities. However, collective efforts to respond and recover from the impacts of the disaster may be limited. Consequently, communities collaborate and negotiate with government and other concerned stakeholders: the effectiveness of the response and recovery hinges on the quality of the relationship among these stakeholders.

As discussed above, response and recovery occur on a personal/household, community, and society level. It is vital to consider personal, community and societal efforts to recovery for advancing a better understanding of disaster preparedness. Thus a review of relevant theories and models are necessary to lay a foundation for developing a suitable model to capture personal, community and societal efforts contributing to prepare for future events. Among various models reviewed in Chapter Two, it was vital to select relevant models that constitute model parameters similar to the variables identified in post-disaster recovery efforts.

3.3. A combined model of Earthquake Hazard Preparedness

From the discussion in the above section and Chapter Two, PMT can predict the volitional behaviour of people when they are exposed to a disaster. However, PMT

focuses only on individual behaviour; and, therefore, another theory comprising the social contextual variable is needed in order to paint a comprehensive picture of the preparedness in post-disaster recovery.

An overview of the theories explained in Chapter Two reflects that Community Engagement Theory (CET) is capable of capturing hazard-related social context as model variables. CET constitutes both variables of community and institutional phases (Paton, 2008). CET variables: community participation, collective efficacy, empowerment and trust has been qualitatively applied to assess preparedness during the recovery (see detail discussion in Chapter Two). These two theories are combined to develop an earthquake hazard preparedness model.

The PMT variables risk appraisal and coping appraisal replaced positive outcome expectancy and negative outcome expectancy in CET (Figure 3.1). PMT constitutes variables representing people's voluntary behaviour which are essential to tracing for understanding the behaviour of people when they face a dreadful earthquake (Discussed in Chapter Two). Outcome expectancy is equivalent to response efficacy; a component of coping appraisal (Bandura, 1998; Paton, Jang, et al., 2015).

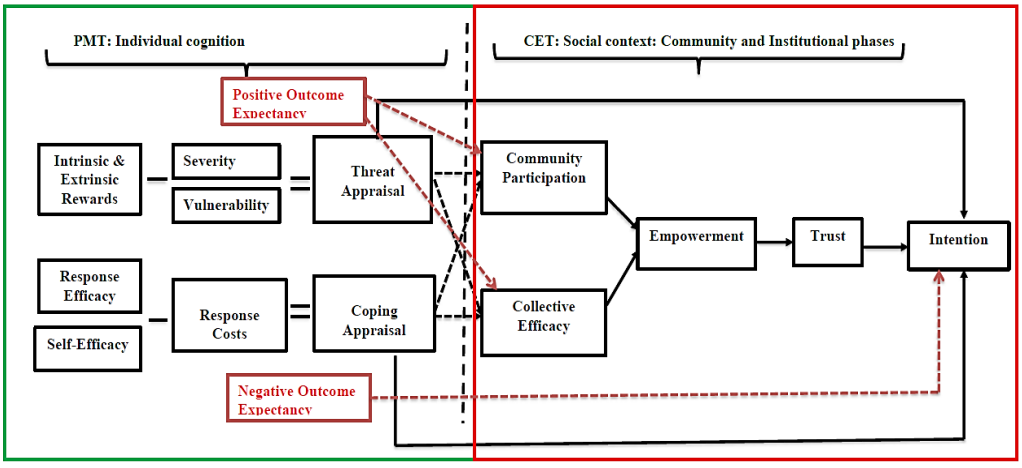

Figure 3.1. Integration of PMT and CET model[1]

Note PMT variables representing individual cognition (green box) and CET variables; positive outcome expectancy and negative outcome expectancy (small red boxes). The PMT variables (green box) replace the CET variables (small red box). The big red box display social contextual variables collective efficacy, community participation, empowerment, and trust.

A new model of earthquake hazard preparedness is developed by integrating the PMT and CET models capable of capturing individual, community and institutional levels.

The proposed model builds on an experience-response loop of PMT and proceeds to social contextual influence (as with CET) for understanding preparedness process (Figure 3.2). Using PMT makes clear the intricacies of people's current risk personalisation and their coping appraisal, thus building on their recent experience of the earthquake (Section 3.2.1). The risk acknowledgement and coping may result in the subsequent adjustment as people transit from the response to recovery (Section 3.2.1). However, people and communities interact with their significant others: family, friend, community members and multiple stakeholders to respond and recover from a disaster (Section 3.2.2 and 3.2.3). Affected people collectively engage themselves in their communities to cope with the disaster and impose a shared meaning of the novel situation (Section 3.2.2). Earthquakes produce a severe impact and pose significant challenges to communities: in order to respond and recover from the disaster, they must collaborate and negotiate with government and concerned stakeholders (Section 3.2.3). The CET variables; community participation, collective efficacy, empowerment, and trust capture the community and societal processes of response and recovery (Paton et al., 2014). Therefore, the inclusion of the PMT variables with CET variables

[1] The construct 'vulnerability' in PMT refers to the probability or chances of getting a disease or being impacted by a hazard of a given severity (Rogers, 1983). Whereas in natural hazard research, the term vulnerability is the expected degree of loss for a given magnitude of hazard and is influenced by the community/people's characteristics, not the magnitude of the hazard event (Birkmann, 2006; Cutter, Boruff & Shirley, 2003). Therefore, to avoid confusion, the term 'perceived probability' was adopted in place of the term 'vulnerability'.

provides an opportunity to develop a parsimonious model, which offers an insight into earthquake hazard adjustments during the post-disaster recovery period.

The assumption underpinning the conceptual model is that the earthquake hazard decision-making process commences with risk acceptance and coping at the individual level, and progresses to the community and institutional phases.

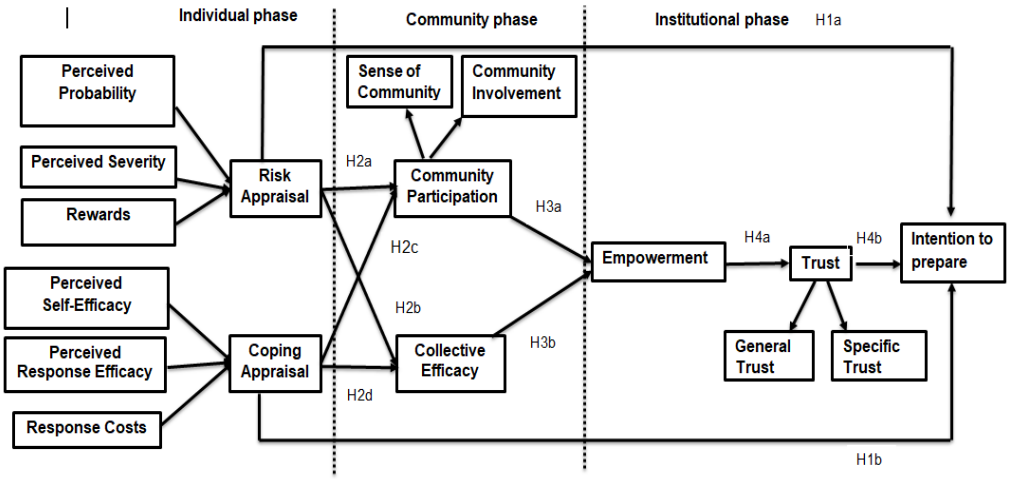

Figure 3.2. Earthquake hazard preparedness model.

The constructs and dimensions are abbreviated in Table 3.1. The model constitutes an individual, community, and institutional phases (Figure 3.2). Each phase comprises of different factors or constructs. The individual phase includes risk appraisal and coping appraisal, while the community and institutional phases consider community participation, collective efficacy, empowerment, trust, and intention as outcome variables. A detail discussion of the model variables is provided in the following sections.

Table 3.1. Model constructs dimensions and abbreviations

Phases	Construct and sub-construct	Abbreviation
Individual	Risk appraisal	RA
	Perceived probability	PP
	Perceived severity	PS
	Rewards	RW

	Coping appraisal	CA
	Perceived Self-Efficacy	PSER
	Perceived Response Efficacy	PRE
	Response costs	RC
Community	Community participation	CP
	Sense of community	SC
	Community Involvement	CI
	Collective efficacy	CE
Institutional	Empowerment	EM
	Trust	TR
	Trust specific	TS
	Trust general	TG
Outcome variable	Intentions to prepare	IP

3.3.1. Individual phase

This phase reflects the decision-making process an individual undertakes when they experience a hazard (Rogers, 1983). Protection Motivation Theory (PMT) argues that motivation for protection against any risk (e.g. health threat, environmental disaster) occurs when threat appraisal and coping appraisal interact (Maddux & Rogers, 1983; Mulilis & Duval, 1997; Rogers, 1983). Through risk appraisal and coping appraisal processes, the theory measures the current behaviour of an individual (Maddux & Rogers, 1983; Norman et al., 2005). Here, risk appraisal and coping appraisal are the predictors of individual cognition (Figure 3.2). It assumes that an evaluation of the perceived risk and coping options available determines behavioural intentions (Norman et al., 2005; Rogers, 1983). The PMT argument supports the belief that people exposed to disaster first attempt to evacuate themselves (cope) (Section 3.2.1).

3.3.1.1 Risk appraisal

Risk appraisal (RA) is a primary cognitive process (Figure 3.2) that motivates people to adopt protective measures (Rogers, 1983). Risk appraisal involves an assessment of the risk. In this process, people must recognise that they are at risk, and then evaluate the personal consequences of that risk (Norman et al., 2005; Rogers,

1983). Risk appraisal is a composite of perceived severity and probability, as well as intrinsic and extrinsic rewards. Perceived severity is the extent of a threat's consequences (Rogers, 1983). The perceived probability is the chance of facing a threat. Intrinsic (personal pleasure) and extrinsic (social approval) rewards are current behaviours that, despite the recognition of the threat, promote maladaptive responses, while the perceived severity and probability of a threat inhibits maladaptive responses (Maddux, Sherer & Rogers, 1982; Rogers, 1983). Risk appraisal is weighing the cost of not adopting protective behaviour against the present risk. Therefore, risk appraisal initiates coping.

3.3.1.2 Coping appraisal

A coping appraisal (CA) is the second appraisal process (Figure 3.2) that begins when people recognise the risk of an earthquake hazard through direct experience or information sources such as radio, TV, disaster management agencies and accept it (Norman et al., 2005; Rogers, 1983). A coping appraisal is a composite of perceived self-efficacy, perceived response efficacy, and perceived response cost (Rogers, 1983).

Perceived self-efficacy describes a person's belief in their ability to conduct protective actions (Bandura, 2000; Maddux & Rogers, 1983). Perceived response efficacy is the belief that the protective actions will be useful in reducing the threat (Maddux et al., 1982); response costs are the tangible and intangible resources (e.g., money, time) required to cope with the threat (Rogers, 1983); and perceived self-efficacy and perceived response efficacy promote adaptive responses, while response cost hinders adaptive responses (Maddux & Rogers, 1983; Rogers, 1983). Evaluation and acceptance of risk is a primary process to begin coping appraisal: evaluating the coping abilities to reduce the risk (Maddux & Rogers, 1983). A relative balance between these two processes leads to protection motivation (Maddux & Rogers, 1983; Norman et al., 2005; Rogers, 1983).

Personalising risk and coping with a hazard is an individual process contributing to protection motivation. There remains uncertainty about the risk, the availability of adaptive measures, and choice of appropriate adaptive measures in a recovery phase (Paton & Jang, 2016; Paton et al., 2014; Paton, Smith, Daly & Johnston, 2008). People interact with each other to draw information for addressing these concerns (Paton, 2008). In this process, people interpret the information relating to their prior beliefs and experiences (Becker et al., 2012, 2013; Blumer, 1986; Lion, Meertens & Bot, 2002; Rippl, 2002). They continue to reproduce and adjust their beliefs and experiences through these social relationships for coping with and adapting to a changing social environment (Blumer, 1986; Paton et al., 2014). This interactive process is referred to as the community phase (Paton et al., 2014).

3.3.2. Community phase: Social influence in the community

The community phase is critical when considering research both in pre- and post-disaster settings. The community phase represents the interaction within a community (Paton & McClure, 2013). In this phase, collective efforts derive from community competence and participation influencing adaptation in communities (Norris et al., 2008; Paton & Jang, 2016; Paton, Jang, et al., 2015; Paton & Johnston, 2017; Paton et al., 2014).

Due to the complex and unexpected nature of earthquake hazards in a post-disaster context, people face considerable uncertainty (Mulligan et al., 2012; Paton, Jang, et al., 2015; Paton et al., 2014; Shaw, 2014). They must rely on family, friends, and community members for guidance on how to interpret the event and its implications for them (Lion et al., 2002; Nakagawa & Shaw, 2004; Paton, 2008; Paton et al., 2014). They approach their significant others to validate their beliefs (desire to be right); ensure that their understandings are consistent with the community needs and expectations (social approval); further develop their beliefs (Deutsch & Gerard, 1955; Indian, 2008); and to access resources to recover. The effectiveness of this process is

a function of the quality of people's relationships with others, and their experience of dealing with challenging circumstances (Nakagawa & Shaw, 2004; Paton, Jang, et al., 2015). People rely on these information sources, with whom they share similar interests and values, and are therefore likely to produce an outcome similar to their needs and expectations (Earle, 2004; Lion et al., 2002; Poortinga & Pidgeon, 2004; Rippl, 2002). Community participation and collective efficacy represent collective efforts (Heller et al., 2005; Mileti & O'Brien, 1992; Paton, 2003).

3.3.2.1 Community participation

Community participation (CP) measures the degree of interaction between people, which facilitates the social construction of risk beliefs, risk management ideas, risk mitigation through collective efforts for providing support to other community members (Paton & McClure, 2013). In pre-event, collective activities develop through community involvement, volunteering in community activities, affiliation with community groups, mutual help, providing support to others in the community, and a sense of belongingness to the community: a culturally, place-based attachment (Paton & McClure, 2013; Turner, Nigg & Paz, 1986). The extent of involvement in the community and social bonding influences hazard preparedness (Heller et al., 2005; Mileti & O'Brien, 1992; Turner et al., 1986). Through interactions and information sharing in an informal environment, a sense of community promotes the development of common interests and values among members (Earle, 2004; Lion et al., 2002; Paton, Kelly, et al., 2006). Community involvement enhances social learning, interpersonal contacts, securing trustworthy information, and a sense of mutual contribution (Earle, 2004; Paton & McClure, 2013).

As introduced in Section 3.2.2, during the response and recovery process of the earthquakes, a sense of community reinforces the decision to take part in activities such as rescue, relief, and early recovery (Paton, Jang, et al., 2015). Furthermore, the involvement of the affected people (survivors) in community activities such as rescue, relief distribution, debris clearance, coordinating with relief organisations promotes a

sense of the collective (Paton et al., 2014). Therefore, community participation is measured using community involvement (CI) and the resulting sense of community (SC) (Figure 3.2).

3.3.2.2 Collective efficacy

Collective efficacy (CE) is the capacity of the community to identify hazard problems, and access the resources and skills required to address the hazard issues raised by concerned stakeholders (Bandura, 2000; Duncan, Duncan, Okut, Strycker & Hix-Small, 2003; Norris et al., 2008; Paton & Tang, 2009). Collective capacity is the level of cooperation and assistance available to the community to cope with the complicated and undesirable situation (Norris et al., 2008; Paton, Kelly, et al., 2006). Communities plan and evaluate all opportunities, constraints, strengths, and weaknesses when executing the response and recovery plan (Norris et al., 2008; Paton & McClure, 2013). During this process, they also evaluate the gaps in knowledge, skills, and resources required to activate their plan within the community (Norris et al., 2008; Paton & McClure, 2013). After this, they approach and articulate their needs to the concerned institutions, such as emergency management agencies (McIvor & Paton, 2007; Paton & McClure, 2013).

As introduced in Section 3.2.2, collective efficacy and community participation are essential to cope with the demands and challenges posed by a disaster. However, collective community efforts may not be enough when dealing with complexities and uncertainties during the recovery (Aldrich, 2011; Mulligan et al., 2012; Oliver-Smith, 1990; Shaw & Goda, 2004). Consequently, communities must acquire resources and information from external sources to respond to the needs and challenges they encounter (Paton & Jang, 2016; Paton, Jang, et al., 2015).

3.3.3. Institutional phase: Community-Agency interaction

The community and agency interaction is an inherent component of disaster risk management, in both pre-event and post-disaster contexts (Paton & Jang, 2016;

Paton & McClure, 2013). In a pre-event scenario, DRM agencies are accountable for communicating the risk of a potential hazard, and strengthening the capabilities of citizens to be self-reliant during future or imminent disasters (Coppola, 2015b; Paton & McClure, 2013; Phillips, 2015). People are responsible for not only interpreting the information they receive but also for following the recommended adaptative behaviours for the potential hazard and its consequences (Lindell et al., 2009). Accepting information and utilising it to prepare for a potential hazard risk is more likely if people trust the information source (Mayer, Davis & Schoorman, 1995; Poortinga & Pidgeon, 2004). Therefore, the quality of the relationship between community and DRM agencies during the pre-event plays a vital role in post-event response and recovery (Paton et al., 2014; Paton & Tang, 2008).

As explained above (Section 3.2.3), populations and communities exposed to disasters are required to collaborate and negotiate with multiple stakeholders in order to combat the demands and challenges that the disaster imposes on them. As collectives, communities attempt to solve the issues of earthquake hazard risk by themselves. However, they may not have the required information, skills, and resources to adapt to the risk: they turn to concerned stakeholders (Paton, 2008; Paton, Jang, et al., 2015). The quality of the relationship between communities and concerned disaster management agencies is contingent on the degree to which the concerned agencies cultivate an empowering environment, thus engaging communities to manage risk (Dalton et al., 2001; Earle, 2004; Poortinga & Pidgeon, 2004). Two factors, trust and empowerment, are considered essential to measure community agency relationship.

3.3.3.1 Empowerment

Empowerment (EM) is the abilities of the communities (knowledge, skills, resources) to deal with hazard consequences by seeking the external support from disaster risk management agencies (Paton & McClure, 2013; Speer, 2000; Zimmerman, Israel, Schulz & Checkoway, 1992). Empowerment is a result of two

processes in a society (Paton & McClure, 2013). The first process is community-driven collective processes, where communities strive for social justice, such as equitable sharing of resources (Nakagawa & Shaw, 2004; Paton & McClure, 2013). The second process is the capacity to build communities that can tackle issues including natural hazards (Nakagawa & Shaw, 2004; Paton & McClure, 2013). Empowerment derives from the quality of the relationship between community members, the community and the DRM agency (Paton & McClure, 2013; Poortinga & Pidgeon, 2004). If a community is empowered to seek information and has a fair relationship with the agency, it will increase adaptive capabilities and hence reduce risk (Paton & Tang, 2009; Poortinga & Pidgeon, 2004). However, the likelihood of seeking information and resources from DRM agencies increases if the community perceives its relationship with the DRM agencies is trustworthy, and the DRM agency act in the interest of the community (Paton, 2008).

3.3.3.2 Trust

Trust (TR) is the desire of people to rely on others for addressing their needs (Kee & Knox, 1970; Mayer et al., 1995). People expect others to complement their needs, despite acknowledging that there will be some level of risk in doing so (Kee & Knox, 1970; Mayer et al., 1995; McKnight & Chervany, 2000). The experience between two parties and familiarity with the information source builds trust (Kee & Knox, 1970). Shared values, norms, attitudes, beliefs, and feelings between two parties, in the course of interactions over a period, yields trust (Jones & George, 1998). The quality of a relationship may influence people's perceptions of others' motives, competence, and predictability (McKnight & Chervany, 2000).

In communities susceptible to natural hazard events, uncertainty persists despite some level of preparedness. They seek out information from external sources to reduce the uncertainty and prepare for the potential hazards. However, their familiarity with the nature and consequences of hazard defines their reliance on external sources (Paton, 2008; Paton & McClure, 2013; Paton et al., 2013).

Unlike the pre-event setting, uncertainty increases when communities have to adapt to the rising demands and challenges they encounter during the recovery period (Paton et al., 2014; Paton & Tang, 2009). As a result, communities are required to turn to external sources for information and resources to deal with the novel situation (Section 3.2.3). An increase in ambiguity increases the level of reliance on external sources to access the knowledge and resources required to handle the unique situation (Earle & Cvetkovich, 1995; Siegrist & Cvetkovich, 2000). Generally, people rely on DRM agencies with which they have an established, trusting relationship (Paton et al., 2013; Paton, Smith, et al., 2008; Siegrist, 2000). People are more likely to use the information; only the relationship is trustworthy. In the trustworthy environment, DRM agencies, through their sharing of skills and resources, are expected to strengthen the capacity of people to mitigate the potential hazard risk (Paton, Smith, et al., 2008; Siegrist, 2000). Trust is measured by the specific trust (TS) related to DRM agencies and general trust (TG) of communities to the local government, media.

3.3.4. Primary predictor variable: Intention to prepare

Intention to prepare (IP) is the primary dependent variable and is considered as an essential predictor of actual preparedness (Paton, Smith, et al., 2008). Why some people prepare for a hazard while others do not, although they live in the similar circumstances, is one of the crucial questions to be considered when designing disaster strategy (Kohn et al., 2012; Levac et al., 2012; Lindell & Perry, 2000). Exploring to what extent people are prepared, and how well are they are prepared, would positively contribute to designing hazard preparedness strategies. However, there is no precise definition of preparedness across countries and cultures (Paton & Jang, 2016). There may be many tangible factors, such as time and resources, that might prevent people from preparing, even though they might wish to (Kohn et al., 2012; Levac et al., 2012; Lindell & Perry, 2000, 2012). The intent to prepare has been used as a measurement by proxy of actual preparedness (Paton, Anderson, Becker &

Petersen, 2015; Paton, Burgelt, et al., 2008; Paton, Kelly, et al., 2006; Paton et al., 2013). The use of proxy measurements minimises the confounding influence that might arise if measures of actual preparedness were used.

3.4. Proposed hypotheses

The proposed model consists of PMT variables to represent the individual phase. When integrating PMT and CET, PMT variables risk appraisal and coping appraisal replaced outcome expectancy of CET (Figure 3.1). The assumptions underlying PMT were adopted for measuring the intent to prepare for the individual phase. It assumes that the evaluation of perceived risk and the coping options available determines the intentions to prepare (Norman et al., 2005; Rogers, 1983). In the proposed conceptual model risk appraisal and coping appraisal lead to intentions to prepare (Section 3.3.1). Thus, hypothesis H1 proposes to measure this relationship. (Figure 3.2, Table 3.2) H1 is further divided into H1a and H1b. H1a assumes a direct relationship between risk appraisal and the intention to prepare. Similarly, H1b assumes a direct relationship between coping appraisal and the intention to prepare.

Hypothesis (H2) proposes risk appraisal, and coping appraisal interacts with community participation and collective efficacy (Figure 3.2, Table 3.2). In CET, outcome expectancy interacts with community participation and collective efficacy at the community phase. The risk appraisal and coping appraisal replaced the outcome expectancy. The interaction between an individual (risk appraisal and coping appraisal) and community (community participation and collective efficacy) is hypothesised as being similar to the CET conceptualisation of individual and community interaction: CET assumes that people interact with their significant others to interpret the risk, impose common meaning of the situation, and draw on community resources to reduce the uncertainty (Section 3.3.4). Hypothesis (H2) is also divided into four H2a, H2b, H2c and H2d for explicitly representing the relationships discussed above.

H2a and H2b: Risk appraisal interacts with community participation and collective efficacy (Figure 3.2, Table 3.2). The individual and community interaction, represented by risk appraisal to community participation and collective efficacy, is elaborated as follows. As introduced Chapter Two, in a typical situation, people are likely to adopt specific behaviour if their significant others demonstrate favourable attitudes towards it (Doll & Ajzen, 1992; McIvor & Paton, 2007). Similarly, during a disaster, seeking information and the opinions of significant others becomes critical to interpreting the new circumstance for coping (Section 3.2.2). During a significant disaster, such as an earthquake, survivors instantly engage themselves as first responders to save their family, friends, and community members, despite the uncertainty and several cycles of risk (e.g. aftershocks) (Ghafory-Ashtiany & Hosseini, 2008; Shaw & Goda, 2004; Shaw & Sinha, 2003). Affected people or survivors may engage in the community to determine risk and provide assistance to others, but also collectively interpret the uncertainty (Section 3.2.2).

H2c and H2d: Coping appraisal interacts with community participation and collective efficacy (Figure 3.2, Table 3.2). The individual and community interaction, represented by coping appraisal and community participation and collective efficacy, is discussed. As a process of risk interpretation, people turn towards significant others and benefit from community resources. Individuals bring their knowledge and skills to the community (Paton & McClure, 2013). During a disaster, people might undergo several cycles of risk and cope, and lose their resources at the household/personal level (Section 3.2.2). Consequently, individual coping may be ineffective, and thus people attempt to draw resources available from their family, friends, and community (Paton, Jang, et al., 2015; von Vacano, 2014). After the disaster, people face several demands and challenges immediate need for food, medicine, water, and sheltering space (Section 3.2.2). People draw on knowledge, skills, and resources available in their communities to address these demands and challenges (Paton et al., 2014; Schwarz, 2014b; Shaw & Goda, 2004).

Hypothesis (H3) covers the interaction between community factors and empowerment (Figure 3.2, Table 3.2). CET assumes that communities interact with DRM agencies and concerned stakeholders in order to access the resources required to reduce risk, but only if the environment is empowering and trustworthy (Paton, 2008). It also asserts that the higher the level of uncertainty and unfamiliarity with the situation, the higher the reliance on DRM agencies for information (Paton, 2008). During an earthquake, people face high uncertainties and demands posed by the disaster (Section 3.2.3). Consequently, they turn towards DRM agencies and concerned stakeholders to better determine the level of uncertainty (Section 3.3.7).

Hypothesis (H4) proposes a direct relationship between empowerment and trust and trust and intention to prepare. Hypotheses (H4a) assumes a direct relationship between empowerment to trust and (H4b) assumes a direct relationship between trust and intention to prepare (Figure 3.2, Table 3.2). .As discussed above (Section 3.4.3), CET assumes that communities as collectives are likely to interact with DRM agencies to reduce the risk of hazard, but only in an empowering setting. Empowering settings reveal both community efforts and the efficacy of DRM agencies to provide a trustworthy environment. A trustworthy environment promotes intentions to prepare (Figure 3.2, Table 3.2).

Hypothesis (H5) proposes that community participation and collective efficacy mediate risk appraisal and coping appraisal to empowerment to promote intention to prepare (Figure 3.2, Table 3.2)

Hypothesis H6 and H7 are proposed to assess the mediating effects of community and institutional factors empowerment and trust on individual risk appraisal and coping appraisal (Figure 3.2, Table 3.2). The proposed model builds on the conceptual idea of CET for assessing community and institutional efforts. CET assumes that earthquake hazard preparedness decisions begin at the individual level and interact with community phase which is further mediated by community-agency relationship.

Table 3.2. Summary of hypotheses and identifiers

Identifier	Hypothesis
H1	**Risk appraisal and coping appraisal promotes intention to prepare**
H1a	Risk appraisal has a direct relationship with the intention to prepare
H1b	Coping appraisal has a direct relationship with the intention to prepare
H2	**Risk appraisal and coping appraisal interact with community participation and collective efficacy**
H2a	Risk appraisal interacts with community participation
H2b	Risk appraisal interact with collective efficacy
H2c	Coping appraisal interacts with community participation
H2d	Coping appraisal interacts with collective efficacy
H3	**Community participation and collective efficacy has a direct relationship with empowerment**
H3a	Community participation has a direct relationship empowerment
H3b	Collective efficacy has a direct relationship empowerment
H4	**Empowerment has a direct relationship with trust and trust has a direct relationship with the intention to prepare**
H4a	Empowerment has a direct relationship with trust
H4b	Trust has a direct relationship with the intention to prepare
H5	**Community factors mediate individual factors to empowerment**
H5a	Community participation mediates risk appraisal to empowerment
H5b	Community participation mediates coping appraisal to empowerment
H5c	Collective efficacy mediates risk appraisal to empowerment
H5d	Collective efficacy mediates coping appraisal to empowerment
H6	**Empowerment mediates community participation and collective efficacy to trust**
H6a	Empowerment mediates community participation in trusting
H6b	Empowerment mediates collective efficacy to trust
H7	**Trust mediates individual and community efforts to intention to prepare**
H7a	Trust mediates risk appraisal via community participation and empowerment to intention to prepare
H7b	Trust mediates risk appraisal via collective efficacy and empowerment to intention to prepare
H7c	Trust mediates coping appraisal via community participation and empowerment to intention to prepare
H7d	Trust mediates coping appraisal via collective efficacy and empowerment to intention to prepare

.

3.5. Chapter summary

In summary, a new model of earthquake hazard preparedness, suitable for capturing the elements of preparedness while people are recovering from the impact of a significant disaster, is formulated. The model is developed by evaluating the elements and processes illustrated in post-disaster recovery, and a detailed review of the theories and models developed and applied in pre-event scenarios. The next step is to test the empirical validity of the model.

Chapter 4: Research Methodology

4.1. Introduction

This chapter presents the research methodology for achieving the aims and objectives of the research. Schwandt (2007, p. 195) defines methodology as a ‘‘theory of how the inquiry should proceed’’. Methodology reflects the underlying philosophical assumptions, research design, and methods selected to investigate the research problem (Schwandt, 2007). It justifies the choice of specific philosophy, research design, and methods for the research from a range of philosophical paradigm, research design, and methods (Tashakkori & Teddlie, 2010).

The first section describes the philosophical perspective underpinning the research design. The subsequent sections include the research design and methods of data collection. The findings chapters include the discussion of data analysis methods. There are three findings chapters, and each chapter contains a different method and procedure of data analysis. The presentation of the method and procedure of data analysis and results in the same chapter provide a clear picture of the relationship between methods used for data analysis and the outcomes of the analysis. In summary, Figure, 4.1 provides an overview of the philosophical perspective, the research design, and the methods of data collection and analysis of the study.

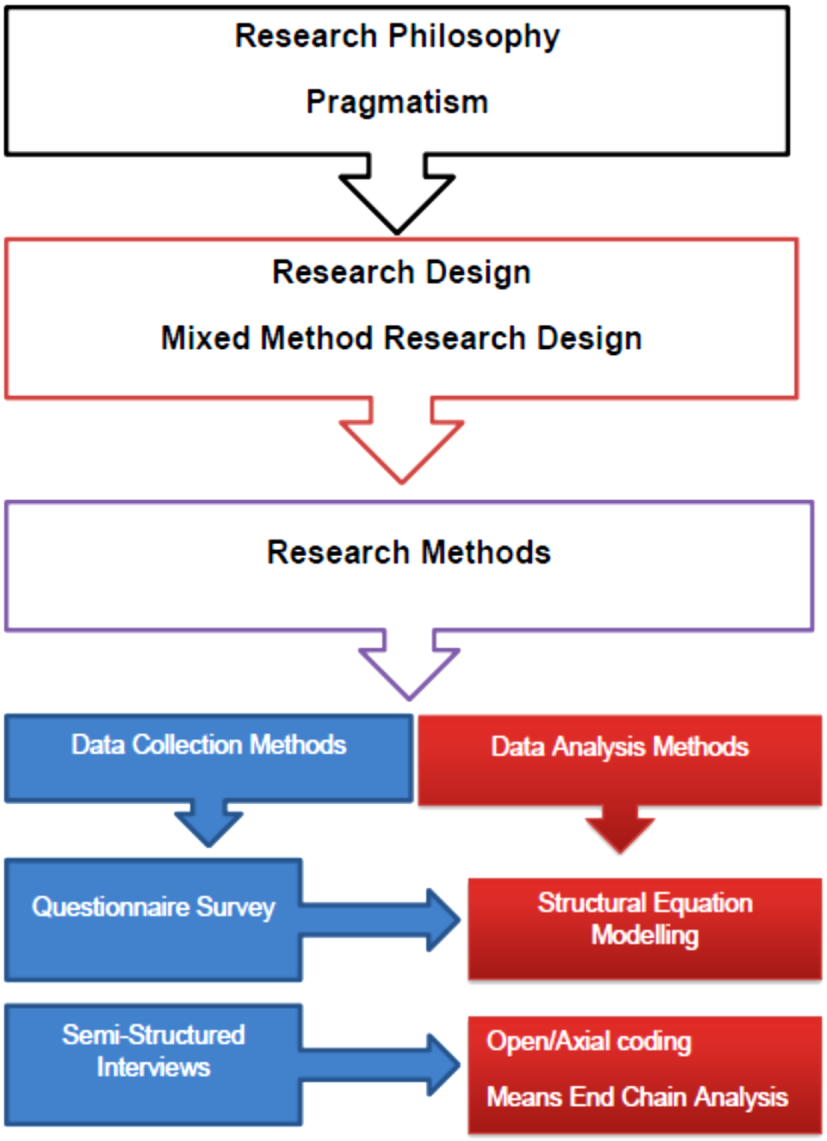

Figure 4.1. An overview of the epistemology, research methodology and methods

4.2. Research Philosophy

The theoretical perspective of the thesis indicates to the reader the researcher's assumptions about the nature of the data, their collection and process of analysis (Blaikie, 2009; Creswell, 2009; Guba & Lincoln, 1994a; Neuman, 2005). The assumptions or sets of beliefs or worldview are known as a research paradigm (Guba & Lincoln, 1994b). A research paradigm reflects the way the researcher views the world or their reality, and the approaches to obtain information about this reality (Tashakkori & Teddlie, 2010). The research paradigm a researcher holds determines the relationship of the researcher with the research (Babbie, 2015; Bryman, 2016;

Guba & Lincoln, 1994b; Tashakkori & Teddlie, 2010). It guides the selection of the research approach, the research process, the data gathering, and analysis method (Creswell, 2009; Tashakkori & Teddlie, 2010).

Various authors have attempted to classify research paradigms into different categories. Guba and Lincoln (1994b) pioneered the classifications of paradigms into positivism, post-positivism, critical theory, and constructivism. Creswell (2009) added the pragmatism and reclassified research paradigms into post-positivism, constructivism, advocacy/participatory and pragmatism. These paradigms hold different assumptions about worldviews, nature of reality, as well as the researcher's stance in the research and the methods for conducting the research. A brief discussion of paradigm classifications provided by Creswell (2009) are as follows:

4.2.1. Post-positivism

Post-positivism is one of the widely used natural science approaches to social research that views the world from a realist perspective (Bryman, 2012; Creswell, 2009). Realism assumes that a reality that exists independent of human thoughts such as the natural law of gravity and that can be measured independent of human influence (Bryman, 2016). The epistemology is objective, which means that the researcher maintains distance from the research to prevent any influence in the results (Bryman, 2016; Creswell, 2009). The methodology is experimental or manipulative: quantitative data and methods such as experiments, survey, and statistics are widely used to maintain a rigour (Neuman, 2005; Saunders, 2011). Hypotheses are deduced from the existing theories and tested. Another dominant research paradigm widely applied in social science research is constructivism.

4.2.2. Constructivism

Constructivism assumes that reality cannot exist without context (Denzin & Lincoln, 2011; Lincoln & Guba, 1985). It assumes that the views of the people create reality, and social interactions and experiences influence these realities (Denzin &

Lincoln, 2011; Lincoln & Guba, 1985). The epistemology of constructivism considers the researcher and participants as co-creators of the findings (Denzin & Lincoln, 2011; Guba & Lincoln, 1994b). It involves interaction between the researcher and participants. The methodology is qualitative, such as in-depth interviews, and context is well-described (Bryman, 2016; Denzin & Lincoln, 2011). In addition to the post-positivism and constructivism, advocacy and participatory paradigm are the third research paradigm often applied in action research and social change.

4.2.3. Advocacy/participatory

Advocacy/participatory paradigm focuses on a problem or social issue that originated due to an imbalance of power in the relationship between people in society instead of considering a particular worldview (Creswell, 2009) The researcher investigates a problem or political agenda to change the lives of participants involved in the research. The participants benefit directly from the research (Creswell, 2009). The interaction between the researcher and the participants defines the epistemological perspective. The values of the researchers influence the research outcomes and findings. The methodology is mostly through dialogue. This approach applies action research to bring social change (Creswell, 2009). In addition to the three research paradigms discussed above, another emerging research paradigm is pragmatism.

4.2.4. Pragmatism

Pragmatism acknowledges the view of both absolute truth (realism) and relative truth (relativism) (Hanson, Creswell, Clark, Petska & Creswell, 2005; Maxcy, 2003; Morgan, 2007, 2014). It argues that knowledge is both socially constructed and depend on the reality of the natural world people experience (Biesta, 2010). The pluralist stance offers an opportunity for researchers to deploy multiple methods for generating more realistic findings and thus enhances knowledge advancement (Johnson & Onwuegbuzie, 2004; Maxcy, 2003). The epistemology or process of the inquiry follows abductive reasoning, which means moving back and forth between induction and

deduction (Creswell, 2009; Morgan, 2007; Tashakkori & Teddlie, 2010). It considers the dichotomy of subjectivity and objectivity between the researcher and the research process as artificial, as it is not possible to be wholly subjective or objective (Morgan, 2007; Tashakkori & Teddlie, 2010). For example, a quantitative researcher develops survey instruments and measurement scales items (e.g. Likert scales) to measure perceptions of people by the qualitative information obtained from interviews with experts and participants. After finalising the instruments, it is applied to the broader survey to assess the issue. Here, the research begins, with the qualitative information embedded in the quantitative study. So, the qualitative findings serve as an input to achieve the goal of quantitative research.

Moreover, this relationship can be vice-versa. Pragmatism emphasises the research questions as the critical elements to research design (Creswell, 2009). It emphasises that the nature of research questions, and the expected outcomes, are the pursuits of the inquiry (Creswell, 2009; Morgan, 2007).

An analysis of the research paradigms reflects a dichotomy of realism and relativism in general. Post-positivism accepts the realist worldviews that is the existence of a reality independent of human thoughts (Bryman, 2016; Creswell, 2009). The advocacy/participatory research accept the existence of a reality independent of human perceptions, but debates for a human created reality through their interaction with the physical and social-cultural environment for achieving a particular political agenda (Creswell, 2009). Pragmatism acknowledges the existence of both absolute reality and the socially constructed reality (Creswell, 2009; Tashakkori & Teddlie, 2010). In contrast, constructivism rejects the existence of a reality independent of human thoughts and asserts that reality is a perception of human minds (Bryman, 2016; Lincoln & Guba, 1985). Between each of these paradigms, the ontological level reflects a developmental difference and a dichotomy of realism versus relativism. The variation on the ontological views has an impact on the selection of research design and methods.

4.2.5. The Rationale for Adopting Pragmatist Philosophy

As discussed above choice of the epistemological stance guides the research design and approach to data collection and analysis (Bryman, 2006; Creswell, 2009). However, it is critical to consider the nature of the research problem when choosing a philosophical lens to investigate the research problem (Creswell, 2009).

Disaster risk reduction research is multidisciplinary and involves consideration of social, psychological, economic, cultural and engineering aspects. Disaster risk reduction research which looks at the ability of the population to anticipate, respond to and recover from the potential future disaster risk as is the case in this study can be classified as social science research (Rohrmann, 1998). However, natural hazards, particularly earthquakes, are unknown and complex events (Jordan et al., 2011). The uncertainties associated with earthquake hazards, such as where and when an event is likely to occur, and their associated complexities, hinder people's ability to draw reliable inferences or perceptions (Slovic et al., 2004; Slovic et al., 1979). As a result, people's experiences and current knowledge of the hazard influence their decisions about future events (Becker et al., 2017; Slovic et al., 2004).

Additionally, people interact with their family, neighbours, and community to determine the level of uncertainty and give meaning to the emerging social context before and after the disaster (Paton et al., 2014). For assessing people's understanding of unknown reality in a given social context requires a choice of multiple methods that are best suited to accommodate the complexity of the research grounded in social science. As introduced above (section 4.2.1 – 4.2.4) post-positivist paradigm directs towards theory-driven research with a quantitative approach such as quasi-experiments to study reality. The constructivism and advocacy/participatory action research allow for data-driven qualitative research that involves studying realities from the perspective of research participants. Contrary to these research paradigms, pragmatism acknowledges duality of knowledge/reality and argues for utilisation of multiple methods to study the research problem and validate the reality. Pragmatist

philosophical perspective permits the use of both quantitative and qualitative methods to examines the current behaviour, knowledge, and values of people that seemingly influence a decision to prepare. Pragmatist epistemology allows to integrate multiple methods for generating more realistic findings and thus enhances knowledge advancement. Hence, this research adopts a pragmatist epistemological stance.

The epistemological perspective guides the choice of research design, so a discussion of the research design is presented in the following section.

4.3. Research Design

The research design is a framework consisting of research strategies and procedures required to address the research problem coherently (Bryman, 2016; Creswell, 2009). It consists of the clearly stated research problem, research questions and objectives reflecting the research problem, the required data to answer the research questions, data collection, and analysis methods (Denzin & Lincoln, 2011; Teddlie & Tashakkori, 2009). In other words, it is a “blueprint” for the process, methods and tools for data collection, and analysis required to address research questions (Bryman, 2016; De Vaus, 2001). The questions are generated to fill some of the gaps revealed in the literature reviews (Blaikie, 2009; Bryman, 2006; Tashakkori & Teddlie, 2010). The research questions being asked, generating the information and data required to achieve the aims and objectives of the research study, are a critical aspect to consider when selecting the research design (Bryman, 2016; Creswell, Plano Clark, Gutmann & Hanson, 2003).

4.3.1. Consideration of Research Questions and Objectives

When choosing appropriate research design and methods, the nature of the research questions and objectives of the study plays a significant role (Bryman, 2016). Yin (2009) classified research questions based on whether they are ‘why’, ‘how’, or ‘what’ questions in order to decide upon the use of specific research design and the

quantitative or qualitative methods. 'Why' and 'how' questions are best answered through qualitative approaches while 'what' questions are best answered through quantitative approaches.

The research questions addressing the research problem being investigated in this study are:

1) What factors influence the individual/household's decision to prepare for an earthquake hazard?
2) To what extent do community and societal processes influence household decisions during recovery?
3) How does the experience of a hazard influence a household's / an individual's estimations of their risk and coping capability in a recovery context?
4) How does the social context influence the individual/household's decision to prepare for an earthquake hazard during the recovery period?

The objectives to answer the research questions are:

1) Conduct a review of cognitive models applied to assess natural hazard preparedness decision making.

2) Assess the capabilities of the models to measure the earthquake hazard decision making in post-disaster context and improve the model as required

3) Empirically test the validity of the model

4) Assess the factors and process of earthquake hazard preparedness decision-making at the household level in a recovery setting.

5) Assess the influence of post-disaster recovery context on household preparedness decisions

Since the research questions consist both 'what' and 'how' questions both quantitative and qualitative research methods seem appropriate. 'Mixed method' research uses a combination of qualitative and quantitative approaches to perform

research (Creswell, 2009; Creswell et al., 2003). Tashakkori and Teddlie (2003) describe a mixed method or multi-method research as having the ability to answer research questions in more depth than could be answered using a single method. Mixed method research is also useful as a method of triangulation of data to confirm and verify data gathered in different ways, as well as for reliability and validity of the findings (Tashakkori & Teddlie, 2003; Teddlie & Tashakkori, 2009). So, a mixed method research strategy consisting of both quantitative and qualitative methods is used to answer the research questions and objectives. The following sections describe the quantitative and qualitative research phases used in this study in further detail (Figure 4.2).

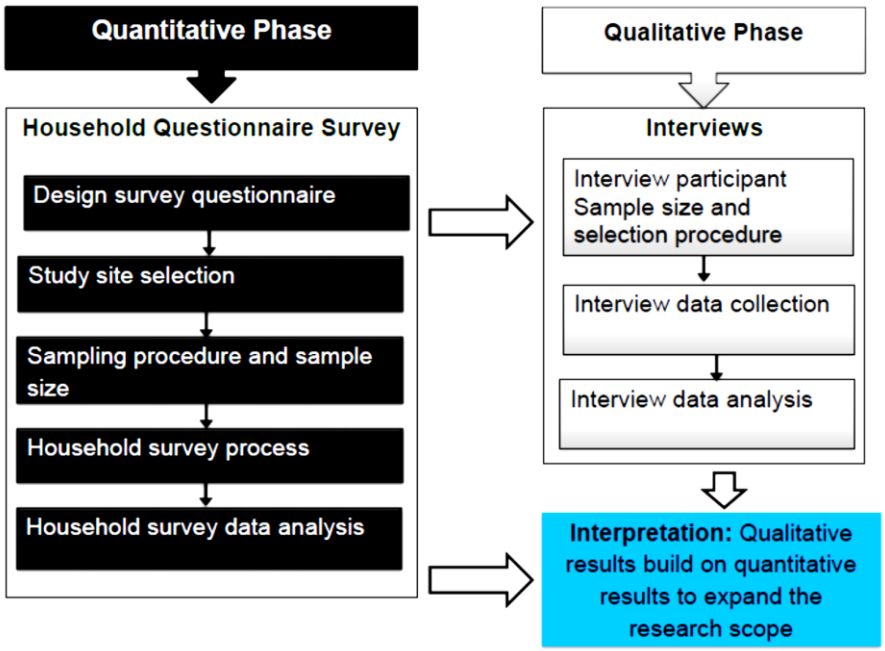

Figure 4.2. Mixed method research design

4.4. Quantitative Research Phase

The quantitative phase (Figure 4.2) of the research focuses on achieving the first research goal. Quantitative methods are appropriate for testing a theory-driven model, obtaining statistically valid and generalised results. Existing knowledge forms a

basis for deriving the conceptual structure and theoretical assumptions behind the research problem (Bryman, 2016; Tashakkori & Teddlie, 2010). The conceptual model and the parameters are operationalised before beginning the empirical research (Creswell, 2009; Tashakkori & Teddlie, 2010). Quasi-experiments and surveys are the most widely used data collection methods (Creswell, 2009). Statistical procedures and tools of data analysis are used to produce generalisable results in quantitative research (Creswell, 2009).

The objective of this phase was to test the empirical validity of the proposed model (Chapter 3) by drawing a large sample of the population for obtaining generalisable and valid results. So, a questionnaire survey was chosen to collect data from a large sample of the population.

4.4.1. Household Questionnaire Survey

A questionnaire survey is considered more suitable for measuring data, by representing model variables measuring population perceptions (Bryman, 2016; De Vaus & de Vaus, 2013; Marshall & Rossman, 2014). Questionnaire surveys allow people to self-report their perceptions of preparedness. Questionnaire surveys also permit data collection in a large sample of the population, which is required to establish model validity (Bryman, 2016). Therefore, the household questionnaire survey is the data collection method for testing the empirical validity of the model (Figure 4.2). The household is the unit of data collection. Beforehand, when administrating a survey, it is crucial to design an instrument or questionnaire of data collection, as well as selecting a study site and sample population.

4.4.2. Questionnaire Design and Improvement

The questionnaire is an instrument to collect data (De Vaus, 2014). It is crucial to develop an instrument that represents the model constructs, measurements, and scales accurately. An ill-prepared questionnaire will result in inappropriate domain sampling, low factor structure, and low internal consistency of the constructs, which

weakens the results of the research (Bryman, 2016). Literature suggests two ways of developing survey instruments. First, define the constructs and measurements based on the review of theories or knowledge, and then test the scale developed by assessing the content validity, criterion validity, and internal consistency (De Vaus, 2014). Another way is to examine the constructs and measurements from the qualitative research, develop the scale, and then test it (Bryman, 2016).

Questionnaire Design

In this research, CET and PMT were integrated to formulate the new model of earthquake hazard preparedness (Chapter Three). Both of these theories have well defined model constructs and operationalised measures representing the constructs. The questionnaires relating to these constructs have been widely applied in both a developed and developing country context (Paton, Bajek, et al., 2010; Paton et al., 2013; Paton, Sagala, et al., 2010).

For the proposed model of earthquake hazard preparedness, risk appraisal and coping appraisal are defined based on the work of (Rogers, 1983). PMT has also been used in natural hazards, and the measurement scale for the risk appraisal and coping appraisal constructs, and their associated dimensions, are adapted to natural hazards (Grothmann & Reusswig, 2006; Martin et al., 2007; McLennan et al., 2014; Paton, Kelly, et al., 2006). Among different authors, McLennan et al. (2014) used a five-point scale while and Paton (2003) used multiple items on a five-point scale. The measurement items and scale for perceived probability, perceived severity, reward, perceived self-efficacy, perceived response efficacy and response costs are adapted from McLennan et al. (2014) and Paton (2003) (Table 4.1). Paton and colleagues applied the original measurement scales of these constructs for earthquake and all hazards in a cross-cultural context (Paton, 2013; Paton & Jang, 2013; Paton et al., 2013; Paton, Sagala, et al., 2010). In this study, original scales of community participation, collective efficacy, trust, and empowerment adapted to earthquake hazards by (Paton, Kelly, et al., 2006; Paton et al., 2005) were used (Table 4.1).

Table 4.1 Constructs, Dimensions, Number of items and Measurement Scales

Construct	Dimension	Number of items	The measurement scale for assessment		Questions related to the constructs
			Original scale	The scale used in this study	
Risk appraisal (RA)	Perceived probability (PP)	2	(Rogers, 1983)	(McLennan et al., 2014) (Paton, 2003)	15
	Perceived severity (PS)	3	(Rogers, 1983)	(McLennan et al., 2014) (Paton, 2003)	16
	Rewards (RW)	4	(Rogers, 1983)	(McLennan et al., 2014)	17
Coping appraisal (CA)	Perceived Self-efficacy (PSE)	6	(Rogers, 1983)	(Paton, 2003)	18
	Perceived Response efficacy (PRE)	6	(Rogers, 1983)	(Paton, 2003)	19
	Response costs(RC)	4	(Rogers, 1983)	(Paton, 2003)	20
Community participation (CP)	Sense of community (SC)	6	(Eng & Parker, 1994)	(Paton, Kelly, et al., 2006)	25
	Community Involvement (CI)	5	(Eng & Parker, 1994)	(Paton, Kelly, et al., 2006)	26
Collective efficacy (CE)		9	(Zaccaro, Blair, Peterson & Zazanis, 1995)	(Paton et al., 2005)	27
Empowerment (EM)		7	(Speer & Peterson, 2000)	(Paton et al., 2005)	28
Trust (TR)	Trust General (TG)	6	(Paton et al., 2005)	(Paton et al., 2005)	29,
	Trust Specific (TS)	16	(Paton et al., 2005)	(Paton et al., 2005)	30
Intention to prepare (IP)		6	(Paton, Kelly, et al., 2006)	(Paton, Kelly, et al., 2006)	31

Questionnaire Translation

Conducting qualitative research with non-English speaking population and presenting the findings in English has its implications. Since the sample population cannot respond to the questionnaire written in English, it needs to be translated into the language of the respondents, Nepali. However, the translated version of the text may vary in meaning by word choice, sentence length, and structure (Boutain, 1999). The most common and highly recommended method is back translation. Back translation is

translating the target language (e.g. English) to back to the source language (e.g. Nepali) (Brislin, 1970; Candell & Hulin, 1986).

The questionnaire was written in English and then translated into the Nepali language by the principal researcher. Then an independent expert was deployed to translate the Nepali version of the questionnaire into English to ensure consistency in translation. The principal researcher compared the translated version of the questionnaire with the original English questionnaire to maintain quality.

Questionnaire Improvement

Furthermore, the disaster management experts of Nepal provided feedback on the suitability of the questionnaire through remote communication such as email, online, telephone, or Skype. Before launching the actual survey, participant consultation was also carried out to improve the questionnaire in the field. Participants were provided with the survey questionnaire and requested to fill up the questionnaire. Once they completed and handed in the questionnaire to the principal researcher, she seeks survey participant's feedback on issues such as readability and eases to answer.

After developing the questionnaire, the next step was to select a study site.

4.4.3. Study Area Selection

The selection of research site for the study centres on the Nepal earthquake 2015 also known as the Gorkha earthquake that occurred in the central region of Nepal. Populations located fourteen districts of Nepal including the Dhading were affected severely; an adjoining district to the epicentre of the Gorkha earthquake. A short description of the Gorkha Earthquake 2015 is presented below.

The Gorkha Earthquake 2015

On 25 April 2015, an earthquake of magnitude 7.8 M_w struck Nepal, with the epicentre located in Gorkha district (around 80 kilometres north-west of Kathmandu). The earthquake occurred at the subduction zone of the Himalayan arc, between the

Eurasian plate and Indian plate boundary (Ader et al., 2012; Bilham, Gaur & Molnar, 2001). The 2015 Nepal earthquake was the most significant event after the 1934 Nepal-Bihar earthquake (Ambraseys & Douglas, 2004). Following the main event, several significant aftershocks were reported, including a 6.3 M_w and 7.3 M_w magnitude. The 2015 mainshock claimed 8510 lives and left millions homeless, destroyed private buildings and infrastructure, and had a financial loss of 10 billion US dollars, almost half the gross domestic product of Nepal (Goda et al., 2015).

The Nepal Government Ministry of Home Affairs (2015) published a report on the human causalities and property losses in 31 districts caused by 7.8 M_w Nepal earthquake and aftershocks. A total of 14 districts were declared to be severely affected areas. Dhading district is one of the severely affected districts by the 7.8 M_w Nepal earthquake and aftershocks (Nepal Government Ministry of Home Affairs, 2015).

Following the disaster, the Government of Nepal declared a state of emergency in the earthquake affected districts. The government of Nepal, cabinet declared an emergency area to 14 profoundly affected districts that included Dhading district and appealed to International Communities for assistance. More than 87 international medical teams mobilised for the treatment of injured. The humanitarian support from various organisations including government (army), international non-governmental organisations (INGOs), NGOs, social networks and individual volunteers were mobilised to conduct the rescue and relief operation. Once the humanitarian response subsided, the early recovery process began. During the early recovery process, the government and other partners organisations including INGOs and NGOs begin to become visible in the scene for resuming the disrupted essential services and facilities such as water, electricity, internet, transportation to the people.

During the response and early recovery period, the government adopted one door policy for monitoring the activities of the people, service providers, concerned institutions and agencies interested in serving or working in the affected communities. As a result, the principal researcher had to obtain permission to go to the study site and

collect data from households in Nepal. Besides, the principal researcher has to get a full research ethics approval from Massey University Ethics Committee to conduct the research (Appendix A).

Full Ethics Approval and Permission to Carry out the Research

Before, beginning the research, while the principal researcher-initiated the full ethics approval process from the Massey University Ethics Committee at the same time correspondence with the Ministry of Home Affairs and FOCUS Nepal was also initiated simultaneously to get approval from both parties.

According to the provision and process of the Massey University Ethics Committee, a full ethics application was applied and approved from the University for the research under Human Ethics SOA-16/5. Independent researchers are bound to abide the ethical code of conduct for research and will not reveal any raw data to either government or other authorities unless there is an agreement between the researcher and concerned parties about data sharing before the research. In the case of this research also raw data will not be disclosed and only the summary of findings was agreed to share with the concerned authorities.

About this research, the principal researcher-initiated a dialogue with the Ministry of Home Affairs representative to get permission and discussed the importance of the research in Nepal. The Ministry of Home Affairs approved the proposed research.

The principal researcher undertook a short consultation with MOHA and collected the letter of approval upon arrival in Nepal from Wellington for the field work. After that, the primary researcher moved to the Dhading district to further initiate the process of data collection. In Dhading, in coordination with FOCUS Nepal, the principal research met in person and informed the District Administrative Officer about the research aim, process and data collection procedure and duration before initiating the data collection process. In the next section, a description of the study site and selection criteria is presented.

Description of the Study Site

The Dhading district lies in the central region of Nepal, with an area of 1926 square kilometres. It has a population of 336067 (Nepal Government Central Bureau of Statistics, 2016). The primary occupation of the people is farming (Nepal Government Central Bureau of Statistics, 2016). In addition to the earthquakes, the Dhading district is prone to hazards such as flash floods, landslides, and glacial lake outbursts (Dhading District Coordination Committee, 2018).

The administrative boundary of the Dhading district and location of the study areas in the district is shown in the map below (Figure 4.3). The map shows the new administrative units enforced the state restructuring process that occurred in Nepal following 2015 political transition.

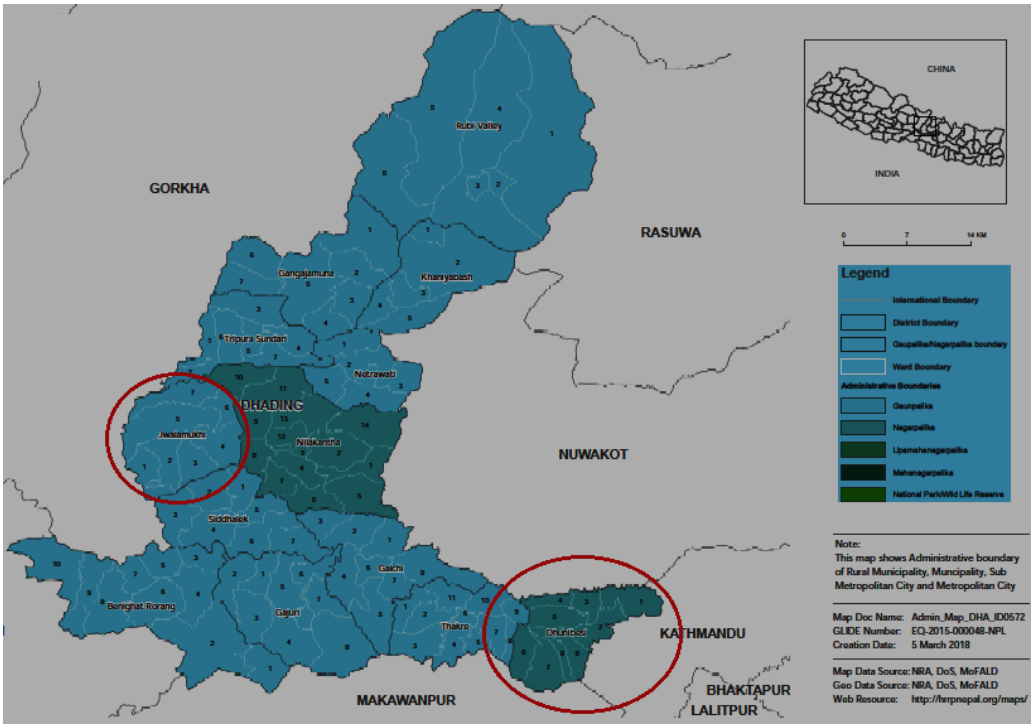

Figure 4.3. Map of the study area highlighted with red circles (HRRP, 2019).

After the enforcement of the Constitution of Nepal 2015, as a part of the state restructuring process, the Gaupalika (Rural Municipal) system, established in 2017,

replaced the Village Development Committee (VDC) system, which was established in 1990 (Nepal Government Ministry of Federal Affairs and General Administration, 2018). The Dhading district was subdivided into two municipalities (3rd level administrative units) and eleven rural municipals (4th level administrative unit). Before this, it consisted of a municipality and 46 Village Development Committees (VDC). Municipalities and rural municipals were reformed, integrating these VDCs. As a result, the study site Chainpur VDC (Study site 1) was integrated into Jwalamukhi Rural Municipal, whereas Jeewanpur VDC (Study site 2) was integrated into Dhunibesi Municipality. However, this study was conducted before the state restructuring process, so VDC names are used instead of the new rural municipal names. The selection of these two VDCs was made by following site selection criteria.

Site Selection Criteria

The study sites were selected based on accessibility, availability of VDC direct loss and damage data, same jurisdiction, and sensitive to secondary hazards (Table 4.2).

Table 4.2. Accessibility, loss and damage data

	VDC name	Population	#hh in 2015	Deaths	Injured	#completely destroyed	#hh partially destroyed	Accessibility
1	Chainpur	6349	1834	0	6	1830	4	1
2	Jeewanpur	8789	2016	52	16	1992	21	1

Source: Nepal Government (2015).

After selecting the study sites, it was critical to identify the sample size and sampling procedure.

The sample population and sampling procedure were chosen based on the population size of what was then the Chainpur and Jeewanpur VDCs.

Sample Size

The objective of sampling in survey research is to collect data representative of a population. The researcher uses the survey information collected to generalise the

findings, within the limits of an error margin (Bartlett, Higgins & Kotrlik, 2001). (Bartlett et al., 2001) The estimated sample size for a given population with error margins of 0.03 for continuous variables and 0.05 for categorical variables and at alpha level 0.10, 0.05, 0.01. The sample size for the study sites was determined using the information for the given population size.

Table 4.3. Population, number of households and sample size

Study site	VDC name	Population	Number of households In 2015	Sample size
1	Chainpur	6349	1834	119
2	Jeewanpur	8789	2016	119
Total		15138	3850	238

According to the information provided by (Bartlett et al., 2001) for a population size of 2000, the sample size is 112, at an error margin of 0.03 and alpha at 0.05. Similarly, for a population of 4000-10000, the sample size is 119, at alpha 0.05 with an error margin of 0.03. In this study, in population size is above 4000, so a sample size of 119 for each site is required, at alpha 0.05 with error margin 0.03. The survey participants are household heads above 18 years-of-age.

Sampling Procedure

After selecting the sites, each site was divided into nine clusters by their wards (administrative boundary). Each VDC consisted of nine wards, so they were treated as nine clusters for data collection. Out of the nine clusters in a VDC, four clusters were randomly selected using a lottery. The households located in the selected clusters were chosen at random for the survey. Cluster sampling was applied to obtain a representative sample of the data as the population settlements from scattered settlements in the VDC. After determining the sample size and sampling procedure, the principal researcher contacted and coordinated with FOCUS Nepal a non-governmental organisation (NGO) based in Central Region of Nepal with its

headquarter in Dhading district for planning data collection and facilitating logistics during the field work.

Hiring and Training of Survey Assistants

A meeting with the FOCUS Nepal and principal researcher was organised for arranging logistics support for the field work and recruiting and training survey assistants. Experienced survey assistants and those willing to survey in the Dhading district were hired for two months.

The survey assistants were trained in a one-day workshop. The principal researcher conducted a few demonstration surveys along with the survey assistants before the actual survey. Following details were discussed in the workshop: research purpose and objectives; Massey Ethical Code of Conduct for research; data collection processes, including household and participant selection; how to get informed consent from participants; how to conduct a survey; and, importantly, how to maintain the confidentiality of the information. At the end of the workshop, survey assistants were requested to sign a confidentiality agreement. The actual survey process was initiated after the formal training of the survey assistants.

Household Survey Process

The principal researcher and the survey assistants distributed the questionnaire among a random sample of 700 households of the Chainpur and Jeewanpur VDCs. The survey started from Cluster 1 of Chainpur VDC on 17th of April 2016 and ended on 31st May 2016 in Cluster 3, Jeewanpur VDC. Surveying began in the next cluster once the survey completed in the previous cluster. The principal researcher and the trained survey assistants visited households in person, requested households to participate in the survey and provided them with a questionnaire. They followed-up by visiting each household to collect the filled up questionnaire. Research assistants provided help to those respondents who could not read and write. The principal researcher and survey

assistants recorded collected data in an excel sheet in the field. An analysis of the survey data informed the qualitative phase of the research (Figure 4.2).

4.5. Qualitative Research Phase

Qualitative research focuses on exploring the relative reality that human beings create through interaction, and the subsequent interpretation of their actions (Bryman, 2016; Denzin & Lincoln, 2011). It seeks to reveal behaviour, experience, and actions of the people that are derived within a social context; and provides a detailed analysis of the relationships between people and the social context: family, community, institutions, rules, norms (Babbie, 2015; Bryman, 2016; Lincoln & Guba, 1985).

The qualitative section of the research builds on the findings of the quantitative study and adds value to the scope of the overall research — the quantitative study identified and tested the variables of the social environment. The model identifies the critical variables representing social context in a recovery setting (Chapter Five). However, it does not explain how the individuals interact with their social context and how the interaction process influences their interpretation of risk, and thereby their action towards preparedness. Therefore, follow-up research was conducted to explore people's lived experience of the earthquake, constructing a comprehensive account of the specific context that has arisen in a recovery phase in Nepal. A qualitative approach was deemed essential to capture the oral histories of people's experiences in the post-disaster recovery context following the 2015 Nepal earthquake. The qualitative method provides an in-depth understanding of the social context in which people cope with, adapt to and co-create the meaning of their social context (Bryman, 2016).

The most popular qualitative research methodologies i.e. ethnography, phenomenology and grounded theory involve studying realities from the perspectives of research participants. The participant-focused methodologies require a prolonged period of data collection and a relatively stable environment to conduct research

(Bryman, 2016; Denzin & Lincoln, 2011). Therefore, one of these methodologies may not be feasibly applied to natural hazards.

Natural hazards, particularly earthquakes, are unknown and complex events (Jordan et al., 2011). The uncertainties associated with earthquake hazards, such as where and when an event is likely to occur, and their associated complexities, hinder people's ability to draw reliable inferences or perceptions (Slovic et al., 2004; Slovic et al., 1979). In this study, the attempt is to measure people's understanding of the unknown reality. The goal of investigating preparedness is to contribute to knowledge that can reduce the uncertainty of concerned nations, agencies, communities, and individuals in natural hazards.

Furthermore, this research explores peoples' lived experience of an earthquake, what they had to contend with, and what they need to do in order to reduce potential future risk. People's experiences and their current knowledge of the hazard influence their decisions about future events (Becker et al., 2017; Slovic et al., 2004). Additionally, people interact with their family, neighbours, and community to determine the level of uncertainty and give meaning to the emerging social context after the disaster (Paton et al., 2014). Therefore, this study requires a qualitative method that examines the current behaviour, knowledge, and values of people that seemingly influence a decision to prepare. It also should take into account the effect of social context on the decision-making process. Therefore, the Means-End Chain (MEC) Theory is an alternative to the theories discussed above for data collection and analysis.

4.5.1. Means-End Chain Theory

Means-End Chain (MEC) Theory seeks to understand how values, social and personal, influence people's behaviour and actions (Gutman, 1982; Pieters, Baumgartner & Allen, 1995). This theory argues that knowledge is organised in a hierarchical order from values' abstract knowledge to the social and psychological

consequences of behaviour and actions, or concrete knowledge (Gutman, 1982; Rokeach, 1973; Woodside, 2004). Values are abstract knowledge ingrained in people's subconscious mind, acquired from society and therein internalised (Rokeach, 1973). Values are related to the consequences that people expect to get by performing specific behaviour or actions (Bagozzi & Warshaw, 1992; Pieters et al., 1995). The consequences are related to behaviour that people demonstrate through actions (Reynolds & Gutman, 1988). People relate to consequences of behaviours when choosing one action over another. However, values influence the selection of a particular behaviour and its consequences (Bagozzi et al., 2003a; Gutman, 1982).

Means End Chain Theory interprets how people relate their behaviour, consequences, and values in a hierarchy across three interconnected levels: attributes (action/behaviour), consequences of the actions, and values (Gutman, 1982). People interact with their social environment, assign meaning to behaviours and actions, and communicate these meanings through language (Blumer, 1986). During this process, they also judge the actions as appropriate or inappropriate (Bagozzi & Dabholkar, 2000). People's actions produce specific outcomes. However, they choose appropriate actions that produce desired outcomes and minimise the undesired outcomes (Gutman, 1982). People realise the desired outcomes of the actions through direct experience (Reynolds & Gutman, 1988). This is consistent with the rationale of earthquake hazard preparedness model (Chapter Three). The earthquake hazard preparedness model proposes that the direct experience of an earthquake hazard encourages assessment and acceptance of risk, which in turn stimulates the coping process. The relative balance of these processes initiates the intention to prepare (Chapter Three). Experiencing and accepting the risk, as well as coping, are actions or attributes that lead to intentions to prepare: the consequence that may culminate into protection or safety from the disaster impacts. Therefore, ''safety'' from disasters is a desired end state, or goal, for the risk personalisation and coping behaviour.

Furthermore, earthquake hazard preparedness is a social process, and the community and institutional processes influence individual cognition (Paton, Kelly, et al., 2006; Paton & McClure, 2013). Discourses at community and institutional phases modify individual intentionality to prepare, which in turn may affect the consequences and safety goals (Paton, 2008; Paton, Kelly, et al., 2006). MEC Theory uses a laddering semi-structured interview technique to collect data that facilitates to articulate the cognitive structure of each interview participant in a series of attributes, consequences and values.

4.5.2. Semi-Structured Interview

In this study, a semi-structured interview combined with the laddering technique was used to collect the interview data. A semi-structured interview may not articulate the reasoning process regarding people's behaviour and actions during the recovery period. Therefore, laddering is a technique of in-depth interviewing for eliciting the purpose of underpinning activity or a series of activities (Reynolds & Gutman, 1988). In MEC Theory, the primary objective is to identify how people achieve the value or end-state goal. Reynolds and Gutman (1988) developed a laddering interview technique to explore the implicit knowledge, i.e. the relationship between value, consequence, and behaviour. Laddering is an in-depth interview technique to understand better how people translate their behaviour (or attributes) into values (Pieters et al., 1995; Reynolds & Gutman, 1988). In a laddering interview, participants are asked a series of ''why'' questions to extract answers that reveal the association between their behaviour, consequences of the behaviour, and their values. Laddering is in-depth, a semi-structured interview for eliciting the connection between values, consequences, and behaviours of people about the issue under investigation (Costa, Dekker & Jongen, 2004; Reynolds & Gutman, 1988). The activities are related to a series of consequences that reflect the values associated with the activities under investigation.

Before conducting the interviews, the participants for the interview were invited to participate in the research.

4.5.3. Interview Participant Sample Size and Selection Procedure

The eligible participants for the qualitative research were those respondents who took part in the quantitative research. However, in the quantitative survey, 471 respondents participated. To select a group of participants from the 471 respondents, a notice was announced in local radio, and written notices were published at respective sites via the survey assistants. The notice requested those respondents who participated in the earlier research process to participate in another interview, as part of follow-up research. Survey assistants contacted those participants willing to take part in the follow-up survey with the researcher. The number of interview participants was determined based on data saturation. In qualitative research, participant sampling is determined by data saturation (Bryman, 2016). So a total of eleven participants who were willing to participate in the interview were interviewed.

4.5.4. Interviews Administration

In this research, the laddering technique is used to explore how the experience of a deadly earthquake stimulates risk personalisation and coping mechanisms in people. Moreover, then, it seeks to examine how the realisation of risk and coping leads to intentions to prepare, and the end goal of safety from future earthquake disasters. Further probing using ‘why’ questions enabled an exploration of the reasons behind choosing a particular behaviour and consequence. For instance, participants were asked to identify their overall stance on preparedness (Appendix C, interview guide). The purpose of starting the interview with such a question was to allow the participant to express their specific stance on the issue of importance and build up a relationship with the principal researcher. Following this, a sequence of ‘why’ questions

(laddering technique) was asked of the participants to examine the reasons for their expressed stance or views further. This process was carried out until the interview participant could no longer answer the ‘why’ question. Once this point was researched, the next question was asked: the same process was repeated throughout the interview process. The data consisted of a given set of interconnected and ordered reasons to explain their stance on preparedness. The data analysis process and methods are discussed in the specific findings chapters to provide a clear link between the outcome and analysis process.

4.6. Chapter Summary

This chapter presents a roadmap to achieve the goals of the research: to develop the pathway, a detailed analysis of the research philosophy, specific research designs and methodologies were adopted. The review of the literature provided the information to select the appropriate research paradigm and methodology necessary to achieve the research aims and objectives. This study follows a pragmatist research philosophy and mixed method research design to answer its research questions.

Chapter 5: Empirical Validity of Earthquake Hazard Preparedness Model

5.1. Introduction

This chapter presents the results of a household survey administered in Jeewanpur and Chainpur Village Development Committees, in the Dhading district, Nepal, from April to May 2016. The survey was undertaken to gather the data necessary to empirically validate the conceptual model of earthquake hazard preparedness, proposed in Chapter Three.

This chapter is divided into five major sections. The first section introduces the data preparation. The second section provides an overview of the model specification. The third section elaborates the justification for structural equation modelling for data analysis. The subsequent sections elaborate on the measurement model, structural model evaluation, mediation, and multi-group analyses. The final section presents a conclusion and discussion of the results.

5.2. Data Preparation

The variables described in the model were compiled into a questionnaire. The questionnaire was distributed among a random sample of 700 households in the Chainpur and Jeewanpur VDCs. 471 (67%) were returned out of the 700 questionnaires. The return rate was sufficient to ensure the required sample size recommended for structural equation modelling (Chin, 1998; Hair, Hult, Ringle & Sarstedt, 2016).

The data preparation is the cleaning of the data, identifying and treating missing data, outliers, and normality (Hair et al., 2016). All the raw data was transferred from Excel to statistical software SPSS 23.0 for data screening. A total of 471 responses were filtered for data analysis. The data cleaning was completed in three steps: treating missing data, unengaged responses, and checking the distribution pattern of data.

5.2.1. Missing data

Missing data occurs with survey non-response, or the respondent is not filling out the questionnaire (Sarstedt & Mooi, 2014). A total of 471 respondents returned the questionnaires. There were 161 cases of complete non-response, which were consequently deleted. After removing the cases with complete non-responses, MCAR (missing completely at random) test was conducted to analyse the missing value.

Univariate statistics showed that no systematic relationships existed between variables indicating there was no pattern to the missing data. For an overall assessment of randomness, a Missing Completely At Random (MCAR) test was performed (Chi-square = 528.036, p = 0.479). The non-significant finding indicates that there was no difference between the actual patterns of missing data and the expected randomly distributed missing data.

The remaining 310 cases were further scrutinised to identify missing responses. A total of two cases (out of 310) had responded to less than 50% of the questions: these cases were also removed from the dataset. One treatment for missing data is imputing. However, imputing a lot of missing values may decrease the variability in the dataset, and reduce the chance of obtaining meaningful results (Hair et al., 2016). Casewise deletion was an appropriate treatment for cases with an excessive level of missing data (Sarstedt & Mooi, 2014; Stone, 1974). After removing the missing data, the unengaged responses were removed.

Removing unengaged responses

In this study, the questionnaire contained all responses in nominal and ordinal (Likert scale) values for the survey. Unengaged responses were checked. Unengaged responses were checked. Unengaged responses are those cases in which respondents have answered the questions without carefully paying attention to the question. To check the unengaged responses attention trap that is questions or answer options are set in reverse order in the question to check if the respondent has

answered the question by carefully reading the questions. After removing the cases with missing data, there were 308 responses left. From these cases, two were excluded because of unengaged responses. Unengaged responses were identified by checking the attention traps, and by calculating the standard deviation for each case; if the standard deviation was zero, then the case was visually scrutinised for removal.

5.2.2. Normality check

Partial Least Squares-Structural Equation Modelling (PLS-SEM) is a non-parametric statistical method that does not assume the normal distribution of data (Hair et al., 2016). While it can handle non-normal data, extreme deviation from normality might be an issue of concern. Hugely non-normal data inflates the standard error obtained from bootstrapping and may render the relationship of variables insignificant (Hair et al., 2016). Therefore, evaluating the distribution pattern of the data is crucial to ensure that the data is not hugely non-normal. For assessing the distribution pattern of the data, skewness and kurtosis was calculated in SPSS 23.0.

There are different principles when checking the skewness and kurtosis of a data set. Here, skewness and kurtosis values for each variable were assessed using the +/-1 principle. It means if the absolute value of skewness for each variable is higher than +1 or less than -1 then the data is skewed (Hair et al., 2016). The skewness of the data was within the threshold except for PP3 and CI2 (Appendix B). Kurtosis was assessed using the same +/-1 principle. Some of the items were positively kurtoed (Appendix B). The items with excess kurtosis were observed and scrutinised while conducting the factor analyses.

5.2.3. Power analysis of a sample

A good research design must use an adequate sample size from the population. When designing the research, the required sample size is usually estimated, and attempts are made to achieve that target (Cohen, 1992; Hair et al., 2016). However, in observational studies, the sample populations may refrain from

responding, and if they responded also, they might not adequately answer all the questions. Therefore, to provide the statistical power of the sample, a post-hoc power analysis was conducted using G*Power software (Heinrich-Heine-University of Dusseldorf, 2018). The sample size power is 0.99 with a 95% confidence interval, and the effect size is 0.15 for ten sub-constructs and six independent constructs and a sample size of 306 (Appendix B).

5.2.4. Descriptive Statistics of Sample Population

The sample demographics of the population and descriptive statistics of the constructs are presented in this section. Sample demographics provide a general idea of the nature of population and pattern of data.

Table 5.1. Sample population demographics

Dempgraphics			
A. Gender			
	Male	Female	
	183	123	
B. Age			
	Above 18 – 40 years	40-60 years	Above 60 years
	145	118	43
C. Education			
	No formal education	School Education	High Education
	58	231	17

In a total of 306 respondents, there were 183 men and 123 women (Table 5.1.). The age of the sample population ranged from 20 years to above 60 years. The majority of the sample population (231) have school education while 17 of the 306 respondents had University education and 58 of the respondents could not read and write.

The descriptive statistics include the constructs, number of items used in the constructs, median, the range of the scale, Cronbach alpha and the source of the scale (Table 5.2).

Table 5.2. Descriptive statistics

Construct	Dimension	Number of items	Cronbach alpha	The measurement scale for assessment	
				Original scale	The scale used in this study
Risk appraisal (RA)	Perceived probability (PP)	2	0.474	(Rogers, 1983)	(McLennan et al., 2014) (Paton, 2003)
	Perceived severity (PS)	3	0.835	(Rogers, 1983)	(McLennan et al., 2014) (Paton, 2003)
	Rewards (RW)	4	0.550	(Rogers, 1983)	(McLennan et al., 2014)
Coping appraisal (CA)	Perceived Self-efficacy (PSE)	6	0.558	(Rogers, 1983)	(Paton, 2003)
	Perceived Response efficacy (PRE)	6	0.798	(Rogers, 1983)	(Martin et al., 2007), (Lindell et al., 2009)
	Response costs(RC)	4	0.650	(Rogers, 1983)	(Paton, 2003)
Community participation (CP)	The sense of community (SC)	6	0.598	(Eng & Parker, 1994)	(Paton, Kelly, et al., 2006)
	Community Involvement (CI)	5	0.661	(Eng & Parker, 1994)	(Paton, Kelly, et al., 2006)
Collective efficacy (CE)		9	0.745	(Zaccaro et al., 1995)	(Paton et al., 2005)
Empowerment (EM)		7	0.739	(Speer & Peterson, 2000)	(Paton et al., 2005)
Trust (TR)	Trust General (TG)	6	0.696	(Paton et al., 2005)	(Paton et al., 2005)
	Trust Specific (TS)	16	0.935	(Paton et al., 2005)	(Paton et al., 2005)
Intention to prepare (IP)		6	0.812	(Paton, Kelly, et al., 2006)	(Paton, Kelly, et al., 2006)

The standard deviation of the items of the constructs are provided in annexe B.

The correlation matrix of the constructs is provided in Table 5.3.

Table 5.3. Correlation Matrix of the Constructs

	CE	CI	CP	CA	EM	IP	PP	RC	PRE	RW	RA	PSE	SC	PS	TR	TS	TG
CE	1																
CI	0.299	1															
CP	0.507	0.622	1														
CA	0.353	0.165	0.364	1													
EM	0.529	0.388	0.604	0.456	1												
IP	0.371	0.341	0.409	0.511	0.483	1											
PP	0.352	0.059	0.337	0.373	0.385	0.259	1										
PC	-0.042	0.079			0.082	0.108	0.174	1									
PR E	0.347	0.129	0.307	0.888	0.452	0.532	0.335	0.135	1								
RW	0.226	0.198	0.335	0.382	0.295	0.322	0.146	0.077	0.334	1							
RA	0.334	0.287	0.425	0.405	0.437	0.491	0.607	0.194	0.364		1						
PS E	0.234	0.145	0.293	0.706	0.256	0.243	0.233	0.073	0.326	0.284	0.257	1					
SC	0.453	0.176	0.879	0.348	0.518	0.296	0.389	0.014	0.306	0.295		0.276	1				
PS	0.161	0.279	0.231	0.171	0.252	0.389	0.239	0.143	0.156	0.074	0.836	0.082	0.129	1			
TR	-0.195	0.061	-0.256	-0.245	-0.263	0.271	-0.041	-0.102	-0.212	-0.257	-0.006	-0.236	-0.283	-0.146	1		
TS	-0.147	0.023	-0.203	-0.169	-0.177	0.221	-0.013	-0.168	-0.135	-0.222	-0.029	-0.202	-0.239	-0.148	0.922	1	
TG	-0.199	0.102	-0.248	-0.279	-0.309	0.250	-0.115	-0.028	-0.260	-0.222	-0.066	-0.195	-0.251	-0.091	0.763	0.453	1

5.3. Model Specification

Proper model configuration is essential before beginning data modelling (Chin, 1998; Hair, Ringle & Sarstedt, 2011). A path model is composed of the measurement and structural model (Hair et al., 2011). The outer model, or the measurement model, shows the relationship between latent constructs and their respective indicators (Hair et al., 2016). The structural model shows the relationship between the latent constructs, representing the hypotheses derived from the theory (Cataldo, Grassia, Lauro & Marino, 2017; Chin, 2010; Hair et al., 2016).

Before moving onto the model configuration, the terms ‘reflective indicator’ ‘formative indicator’, observed variable’ and ‘construct’ are described briefly.

Reflective indicator: ‘‘the indicator of the reflective construct is a reflective indicator as they represent manifestations, reflection and function of that construct’’ (Polites, Roberts & Thatcher, 2012).

Formative indicator: ‘‘the indicators of a formative construct are formative indicators as for when they are combined in an algebraically predetermined way they form a construct.’’ (Polites et al., 2012).

Observed (manifest) variable: “A concept that is directly observable and measurable with a single indicator’’ (Hair et al., 2016, p.11).

Construct: “A concept that cannot be directly observed or measured but can only be inferred from observed variables” (Hair et al., 2016, p.11).

They are identifying whether the indicators, variables and constructs are formative or reflective or a combination of both is necessary for configuring the type of model. Incorrect specification of indicators can increase type I and type II errors as factorial validity is different for reflective and formative indicators (Hair et al., 2016; Lowry & Gaskin, 2014).

Formative construct

For a formative construct, indicators induce the construct (Chin, 2010; Petter, Straub & Rai, 2007). The direction of casualty flows from indicators to construct; the indicators explain the meaning of the construct entirely (Figure 5.1a). Dropping an indicator changes the meaning of the construct: here, indicators are not interchangeable (Coltman, Devinney, Midgley & Venaik, 2008).

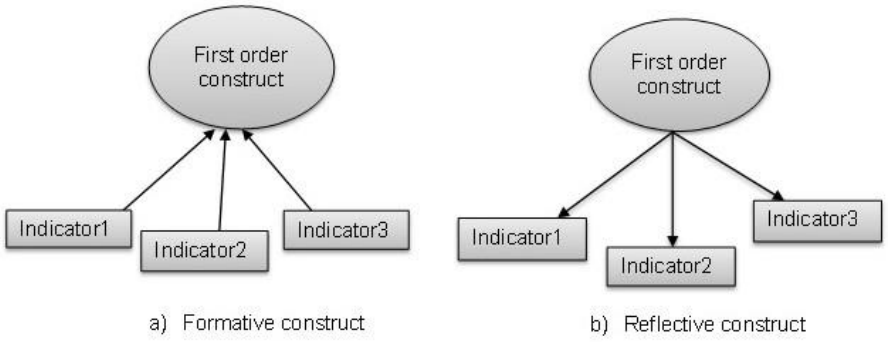

Figure 5.1. a) Formative construct and b) Reflective construct.

Reflective construct

For a reflective construct, the direction of causality is from construct to indicators (Figure 5.1b). The indicators are correlated as they reflect the same

construct. Dropping an indicator does not alter the meaning of the construct: here, indicators are interchangeable (Chin, 2010; Coltman et al., 2008; Polites et al., 2012).

This study conceptualises a complex model composed of first-order reflective constructs and second-order reflective and formative constructs. All the first-order constructs are reflective as they contain reflective indicators arrows emerging from the construct towards indicators in the model (Figure 5.2a). The model also contains second-order formative and second-order reflective constructs. The risk appraisal and coping appraisal are two-second order formative constructs, the composites of perceived probability, perceived severity, rewards, self-efficacy, response efficacy, and response costs (Rogers, 1983). Risk appraisal is a composite of perceived probability, perceived severity, and rewards. The interaction between these three constructs results in risk appraisal (Cismaru & Lavack, 2006; Norman et al., 2005; Rogers, 1983). The arrows emerge from perceived probability, perceived severity, and rewards, and point towards risk appraisal and their respective indicators (Figure 5.2). Similarly, coping appraisal constitutes self-efficacy, response efficacy, and response costs. The direction of causality from these constructs is towards coping appraisal and their indicators respectively.

In contrast, trust is a second-order reflective construct consisting of trust specific and trust general (two first-order reflective) constructs, with arrows emerging from trust towards trust general and trust specific, to their respective indicators (Figure 5.3).

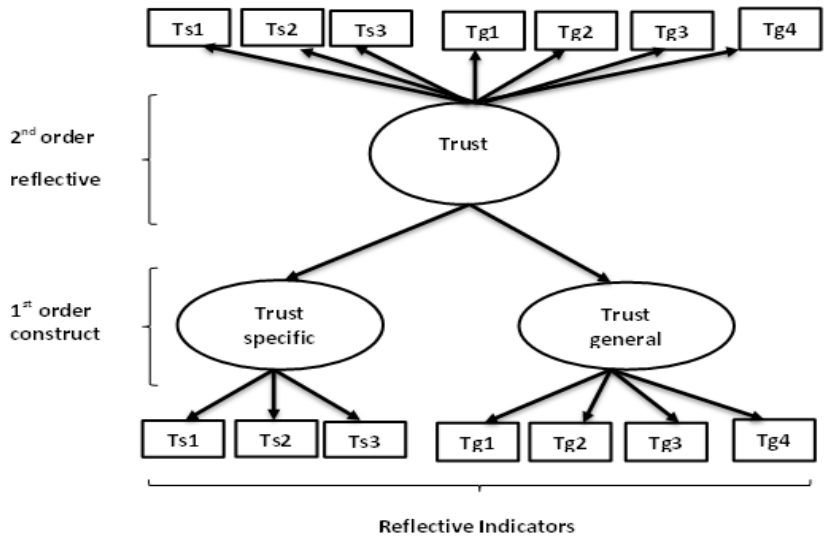

Figure 5.2. Second order reflective constructs

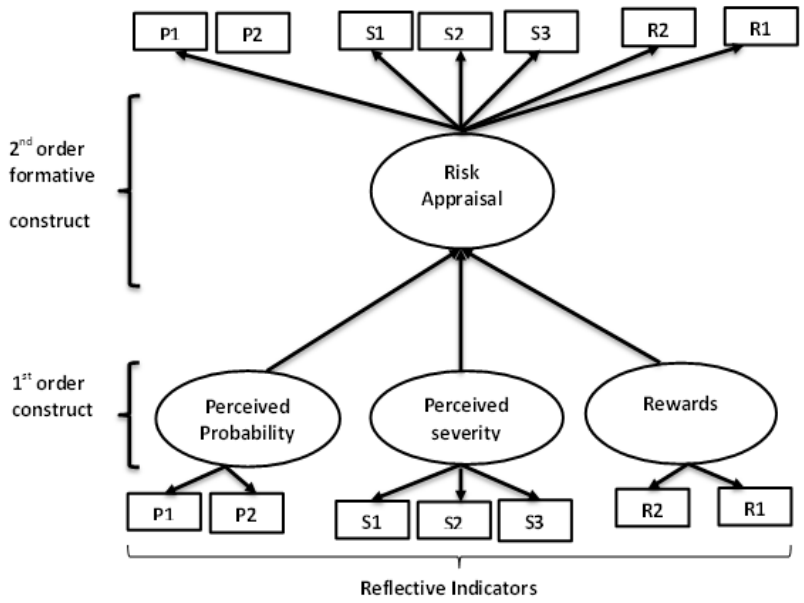

Figure 5.3. Second order formative construct (Risk Appraisal).

A common aspect to be noted in this configuration is that all the indicators of first-order constructs are used as indicators of second-order constructs (in both reflective and formative constructs). All the indicators of first-order constructs measure the second order construct (Chin, 2010; Wetzels, Odekerken-Schröder & Van Oppen, 2009). This process is called repeated indicator approach. Repeated indicator approach works well when the second-order formative construct is either exogenous or reflective (Podsakoff, Shen & Podsakoff, 2006; Polites et al., 2012). However, when the second-order construct is endogenous and formative (Figure 5.3), all the potential effects of the other predictors are swamped out; and the R^2 for the second-order formative construct is 100% (Hair et al., 2016). A two-stage approach is appropriate to resolve this problem (Hair et al., 2016). In this approach, first, the measurement model is estimated, and then a new structural model is created considering the latent scores of the constructs (Hair et al., 2016; Ringle, Silva & Bido, 2014; Wetzels et al., 2009).

After specifying the model type, the next step is to identify the statistical method and tool to analyse the data.

5.4. Structural Equation Modelling

There are different strategies to analyse the effects of independent variables on independent variables. Factor analysis, path analysis, and regression analysis are three methods (Lowry & Gaskin, 2014). Factor analysis is an exploratory data reduction method. Factor analysis is used to identify latent variables or constructs by reducing individual items into a small number of dimensions (Lowry & Gaskin, 2014). It is used to simplify data into a small number of variables for regression analysis (Hair, 2009; Lowry & Gaskin, 2014). Regression analysis is a robust method to analyse the relationship between independent and dependent variables (Lowry & Gaskin, 2014). It provides the effects of independent variables on the variance of dependent variables (R^2) (Hair, 2009). Path analysis is a form of regression analysis in which the causal relationship between the independent and dependent variables is estimated (Hair, 2009). Path analysis provides the magnitude and significance of the causal relationship between variables (Hair, 2009).

Structural equation modelling (SEM) is a multivariate analysis of a method that combines regression, factor analysis, and path analysis (Hair, 2009; Hair et al., 2016). SEM is suitable for validating predictive models (Albright & Park, 2009). It is designed to test substantive theory from empirical data. It enables to assess the processes and relationships between preparedness and individual, community, and societal causal factors. There are two forms of SEM. Covariance-based structural equation modelling (CB-SEM) and Partial Least Squares or component-based SEM (PLS-SEM) (Hair et al., 2016; Lowry & Gaskin, 2014).

CB-SEM is popular and widely used in social science research (Table 5.4). However, another form of SEM is PLS-SEM. PLS-SEM has been applied in marketing

research (Hair et al., 2016). However, recently it has been adopted to conduct SEM in social science research.

Table 5.4. CB-SEM and PLS-SEM (Hair et al., 2016; Lowry & Gaskin, 2014).

CM-SEM	PLS-SEM
Covariance-based SEM and represents constructs through factors	Least squares or component based and represents constructs through components
A measure of fit is based on covariance-based matrix	A measure of fit is based on the explained variance on the endogenous variables
Model fit criteria for established theory testing and confirmation	Suitable for theory development and testing by examining and constructs and their relationships in complex models
Requires a large sample	Can be used with a small sample size
CB-SEM is maximum likelihood approach which follows a normal distribution of data	PLS-SEM does not require normally distributed data

This study uses the Partial Least Squares (PLS) technique of structural equation modelling, an approach suitable for validating predictive models, especially those with small size samples (Chin, 1998; Hair et al., 2016). The PLS supports two measurement models: (a) the assessment of the measurement model and (b) the assessment of the structural model. The measurement model is evaluated by the following criteria: internal consistency, convergent, and discriminant validities. The structural model presents information about the path significance of hypothesised relationships using the path coefficients (b) and the squared R (R^2) (Chin, 1998; Hair, Sarstedt, Ringle & Mena, 2012). The next section provides the model estimation and evaluation results.

5.5. Model Estimation and Evaluation

The path model and parameter were estimated in Smart PLS 3.2.7. Recent guidelines for PLS-SEM given were used to assess the measurement model before evaluating the structural model (Chin, 2010; Hair et al., 2016; Henseler, Hubona & Ray, 2016). The screened data, taken from a sample size of 306 questionnaire

respondents, was converted into a comma-delimited excel file and transferred to SmartPLS 3.2.7, software for factor and path analysis. First, a factor analysis of the constructs was carried out: for example, trust specific is a first order construct with 16 indicators, but only four indicators passed the thresholds of factor loadings. The 12 indicators that did not pass the threshold were removed. This process was applied to all the indicators of the first-order constructs before evaluating the measurement model.

5.6. Measurement model evaluation

In the model, all the first-order constructs were reflective (Figure 5.4). The nomological validity of the measurement model was established using the indicator reliability of the construct, internal consistency, composite reliability, convergent validity, and discriminant validity. As introduced in Chapter Three, the names and abbreviations of the model constructs and indicators are outlined in Table 5.5.

Table 5.5. Constructs and their abbreviations

First order construct	Abbreviation	Abbreviation of indicators
Perceived probability	PP	PP1, PP2,
Perceived severity	PS	PS1, PS2..
Rewards	RW	RW1, RW2
Perceived self-efficacy	PSE	PSE1, PSE2
Perceived response efficacy	PRE	PRE1, PRE2
Response Costs	RC	RC1, RC2
Sense of community	SC	SC1, SC2.
Community involvement	CI	CI1, CI2
Trust general	TG	TG1, TG2
Trust specific	TS	TS1, TS2
Empowerment	EM	EM1, EM2
Collective efficacy	CE	CE1, CE2
Second order constructs		
Risk appraisal	RA	
Coping appraisal	CA	
Community participation	CP	
Trust	TR	

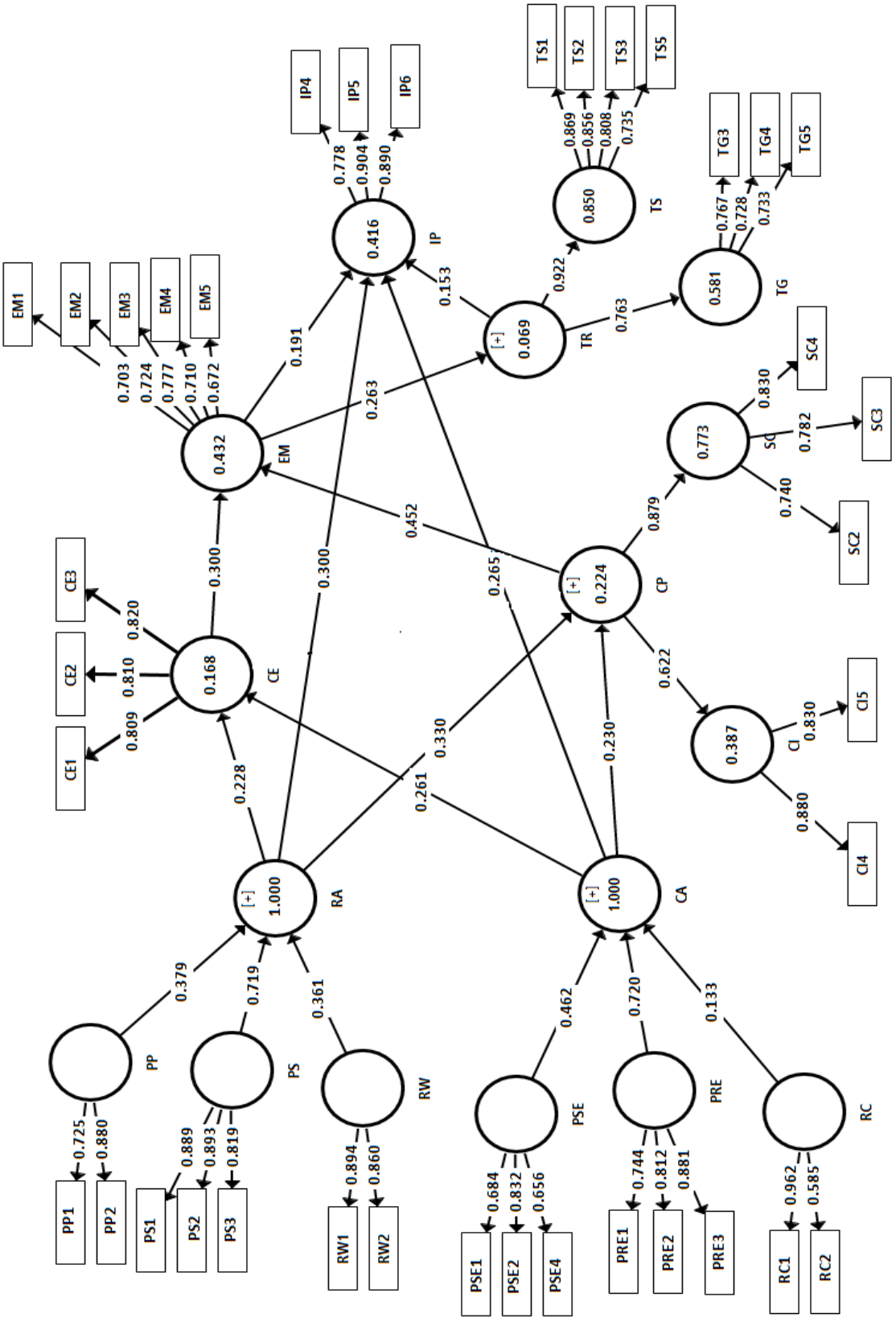

Figure 5.4. Measurement model of earthquake hazards preparedness

5.6.1. Indicator reliability and construct validity

Indicator reliability was established using indicator loadings of the items in each construct. The loadings were above 0.70 except for four items (PSE1, PSE4, RC2, and EM5) (Table 5.6). The loadings for these four items were between 0.585 and 0.684 and were still retained because they are higher than the commonly used thresholds of 0.40 or 0.50 in factor analysis (Chin, 2010; Hulland & Business, 1999). The composite reliability for all the constructs ranged from 0.76 to 0.90 which was higher than the recommended threshold≥ 0.70 (Table 5.3). Thus, the internal consistency reliability of the model was confirmed.

All the average variance extracted (AVE) values were higher than the threshold value of 0.50 (Table 5.6) providing evidence for the adequate convergent validity of the measurement model.

Table 5.6. Construct validity and composite reliability of reflective constructs

Construct	Indicators	Number of indicators	Loadings	Composite reliability	Average variance extracted (AVE)
PP	PP1	2	0.725	0.786	0.650
	PP2		0.880		
PS	PS1	3	0.889	0.901	0.753
	PS2		0.893		
	PS3		0.819		
RW	RW3	2	0.894	0.869	0.769
	RW4		0.860		
PSE	PSE1	3	0.684	0.77	0.530
	PSE2		0.832		
	PSE4		0.656		
PRE	PRE1	3	0.744	0.855	0.663
	PRE2		0.812		
	PRE3		0.881		
RC	RC1	2	0.962	0.766	0.634
	RC2		0.585		
SC	SC2	3	0.740	0.828	0.616
	SC3		0.782		
	SC4		0.830		
CI	CI4	2	0.880	0.844	0.731
	CI5		0.830		
CE	CE1	3	0.809	0.854	0.661
	CE2		0.810		
	CE3		0.820		
EM	EM1	5	0.703	0.841	0.516
	EM2		0.724		
	EM3		0.777		
	EM4		0.710		
	EM5		0.672		
TS	TS1	4	0.869	0.890	0.670
	TS2		0.856		
	TS3		0.808		
	TS5		0.735		
TG	TG3	3	0.767	0.787	0.552
	TG4		0.728		
	TG5		0.733		
IP	IP4	3	0.778	0.894	0.738
	IP5		0.904		
	IP6		0.890		

5.6.2. Discriminant validity

There are different criteria for establishing the discriminant validity: checking the cross-loadings, and Fornell-Larcker criterion and heterotrait-monotrait (HTMT) criterion.

HTMT is a new criterion to assess the discriminant validity in PLS and is recommended as a better approach, compared to cross-loadings and Fornell-Larcker criterion, for testing discriminant validity in PLS-SEM (Hair et al., 2016). HTMT is defined as ‘‘the average of correlations of indicators across constructs measuring different phenomena relative to the average of the correlations of indicators within the same construct’’ (Hair et al., 2016, p. 115).

HTMT criterion was used to assess the discriminant validity of the measurement model. The threshold for HTMT is ≤0.85. The discriminant validity of the reflective constructs was established, as the HTMT is below the threshold of 0.85 (Table 5.7).

Table 5.7 Heterotrait-Montrait Ratio (HTMT)

	1	2	3	4	5	6	7	8	9	10	11	12
1.CE												
2.CI	0.429											
3.EM	0.682	0.549										
4.IP	0.465	0.482	0.593									
5.PP	0.542	0.115	0.575	0.379								
6.PRC	0.07	0.201	0.139	0.154	0.383							
7.PRE	0.46	0.181	0.59	0.679	0.523	0.185						
8.RW	0.309	0.302	0.39	0.423	0.226	0.111	0.464					
9.PSE	0.349	0.242	0.387	0.357	0.424	0.202	0.495	0.463				
10.SC	0.612	0.289	0.691	0.372	0.608	0.132	0.413	0.415	0.436			
11.PS	0.204	0.38	0.314	0.46	0.37	0.246	0.199	0.095	0.138	0.196		
12.TS	0.19	0.053	0.228	0.267	0.152	0.239	0.179	0.291	0.321	0.309	0.177	
13.TG	0.306	0.167	0.466	0.363	0.227	0.194	0.397	0.331	0.335	0.393	0.167	0.626

5.6.3. Construct validity of second-order formative constructs

In the measurement model, all the indicators of first-order constructs are reflective. The validity and reliability of the constructs incorporated in the measurement model were established in the above section. If the first-order construct is reflective, then a redundancy analysis is carried out to assess the convergent validity of the construct (Hair et al., 2016). Redundancy analysis involves evaluating the correlation

between the formative measures of the construct and the reflective measures of the same construct using different indicators (Hair et al., 2016).

However, the measurement model consists of two second-order formative constructs: risk appraisal and coping appraisal. In the case of the second-order formative construct, first-order constructs contribute to form second-order constructs. It may not be valid to use different reflective indicators representing a second-order construct to assess convergent validity. There is no guideline to assess the convergent validity of second-order formative factors (Hair et al., 2016)

Separate models for risk appraisal and coping appraisal were run to examine the validity of these two constructs. Since risk appraisal is a second order construct (Figure 5.5b), the perceived probability (PP), perceived severity (PS), and rewards (RW) contribute as indicators, and their path coefficients are contributing to the risk appraisal (RA) can be reported as the weights. A similar process was carried out to measure the validity of coping appraisal (Figure 5.5a). The significance of the path coefficients of the first-order constructs was assessed using bootstrapping of 1000 subsamples at alpha 0.05 and p values 0.001 and 0.005. The weights/path coefficients were significant at alpha 0.05 and $p<0.001$ *and* $p<0.005$.

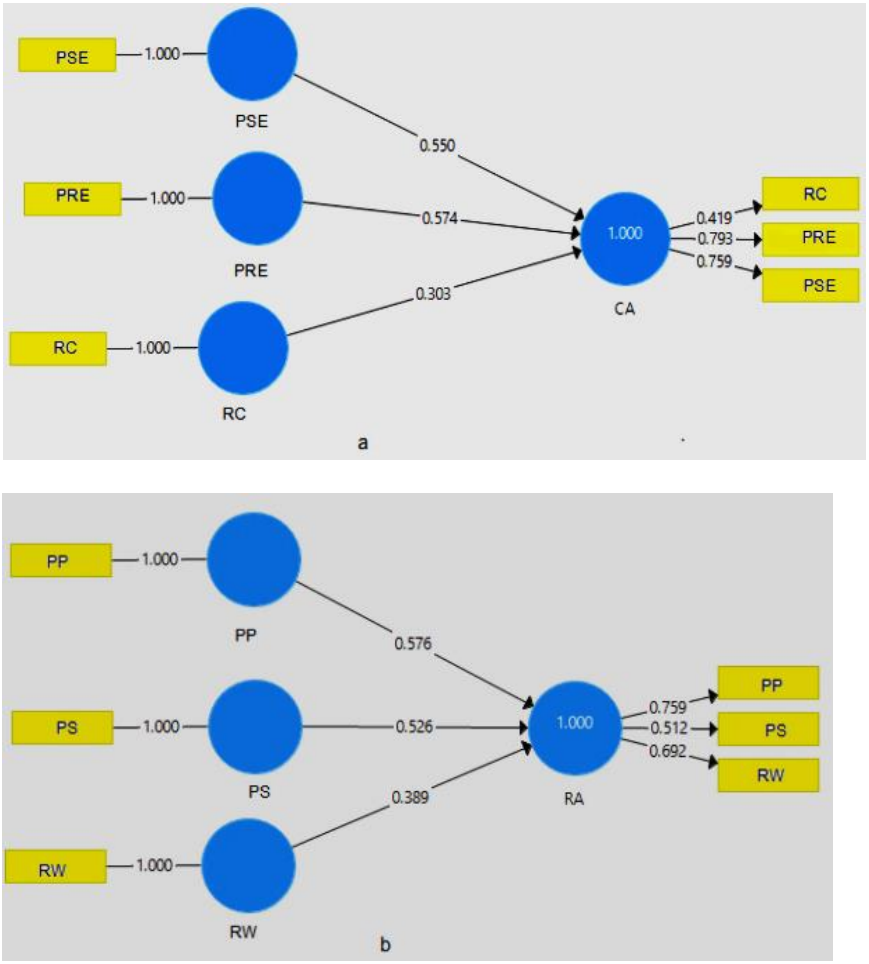

Figure 5.5. a) Coping Appraisal and b) Risk Appraisal modelled for construct validity.

5.6.4. Multicollinearity

Multicollinearity can pose a problem in the analysis of formative indicators; it is essential to check for multicollinearity to assess the formative validity (Hair et al., 2016). The variance inflation factor (VIF) indicates multicollinearity. The VIF for formative indicators should be less than 5 (Hair et al., 2016). However, for the more rigorous test, it should be below 3.3 (Petter et al., 2007). The VIF for all of the first-order constructs of risk appraisal and coping appraisal were within the threshold of 3.3 (Table 5.8).

Table 5.8. VIF for first-order constructs

Indicators	VIF
PP	1.08
RW	1.024
PS	1.062
RC	1.018
PRE	1.133
PSE	1.12

The measurement model substantiates that all the measures of the constructs are reliable and valid. Based on these findings, the structural model was evaluated for the hypothesised relationships between constructs.

5.7. Structural Model Evaluation

The model scrutinised for structural validity is a complex model. The model is composed of both reflective and formative constructs, and second-order constructs that include all the indicators of first-order constructs. As discussed in Section 5.4 all the indicators of first-order constructs measure the second-order construct. The same indicators used to estimate the first-order constructs are simultaneously applied in the second-order constructs (Chin, 2010; Wetzels et al., 2009). In this model configuration, the measurement model estimation results in the R-square value of 1 (100%) for risk appraisal and coping appraisal (Figure 5.4). Therefore, latent scores of the risk appraisal, coping appraisal and all the other constructs were used to construct the structural model (see appendix B for latent scores).

The structural model presents information about the path significance of hypothesised relationships between constructs using the path coefficients (β), R^2 and Q-Stone-Geisser's Q^2. In PLS-SEM Q-Stone-Geisser's Q^2 is an important criterion to evaluate the predictive relevance of the structural model (Hair et al., 2016).

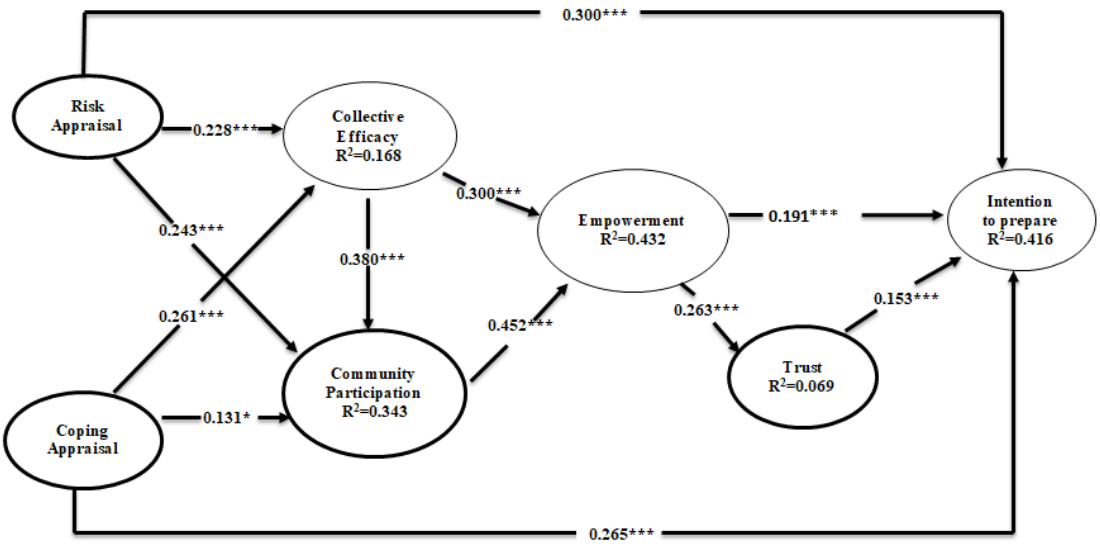

Figure 5.6. Earthquake hazard preparedness structural model using a two-stage approach

Notes: RA and CA are second-order formative constructs composed of first-order reflective constructs of PP, PS, RW, and PSE, PRE and RC. CP and TR are second-order reflective constructs composed of first-order reflective constructs of an SC and CI, TG and TS. CE, EM and IP are first order reflective constructs. *p< 0.05; ***p <0.001, based on PLS bootstrapping at t(4999), two-sided test and alpha at 0.05.

5.7.5. The coefficient of determination (R^2) value

The coefficient of determination (R^2) value is a measure of the predictive power of the model (Hair et al., 2016). It represents the percentage of variance in the model from 0 -1; with higher levels indicating higher accuracy (Hair et al., 2016). However, it depends on the model complexity and the research discipline (Hair Jr, Hult, Ringle & Sarstedt, 2016).

The R^2 values of 0.67, 0.33 and 0.19 are a substantial, moderate, and weak variance for a model, respectively (Henseler, Ringle & Sinkovics, 2009). The intention to prepare (IP) accounted for moderate (41.6) variance explained by the model indicating the predictive validity of the model (Figure 5.6). The R^2 values of collective efficacy (CE), community participation (CP), empowerment (EM), and trust (TR) accounted for 16.8%, 22.4%, 43.2% and 6.9% of the variance respectively (Figure 5.6).

5.7.6. Path coefficients (β) values

The next criteria to assess the predictive power of the model are path coefficients (β). β values represent the strength of the relationship between constructs and range from 0.000 to 1.000 on paths between two constructs along with the direction (Hair et al., 2016). The β values closer to 0.20 and 0.30 or higher represent the good predictive power of the model (Chin, 1998, 2010). However, in SmartPLS bootstrapping results are used to evaluate the significance of the β values along with the β value's thresholds (Hair, Ringle & Sarstedt, 2013). The β values were above the recommended threshold of 0.20 except for paths from CA to CP (0.131), EM to IP (.191) and TR to IP (0.153) (Figure 5.6). A bootstrapping of 5000 subsamples was conducted to obtain the *t*-scores and p-values at a significance level of 0.05 (two-sided test) for assessing the significance of path coefficients. The bootstrapping results revealed the significance of all the path coefficients at $p<0.05$ *and* $p< 0.001$ which confirms the predictive validity of the model (Figure 5.6).

5.7.7. Predictive relevance (Q^2)

Stone-Geisser's Q^2 value is an important criterion to evaluate the structural model in PLS-SEM, in addition to (R^2) values and β values (Geisser, 1974; Hair et al., 2011; Stone, 1974). In SmartPLS the Q^2 is estimated by using the blindfolding procedure. A Q^2 larger than 0 indicates that the exogenous constructs have predictive relevance for the endogenous construct under consideration (Hair et al., 2016). After running the blindfolding procedure, the Q^2 value for IP (0.396) was obtained, which was above zero, indicating the predictive relevance of the PLS path model. The Q^2 values for collective efficacy (CE), community participation (CP), empowerment (EM), trust (TR), were also obtained and accounted for values larger than 0 (Table 5.9). Risk appraisal (RA) and coping appraisal (CA) are formative constructs, so the Q^2 is not applicable to them.

Table 5.9. Q^2 values to estimate the predictive relevance of the model

	SSO	SSE	Q^2 (=1-SSE/SSO)
CE	306	256.21	0.163
CP	306	240.29	0.215
***CA**	306	306	
EM	306	175.82	0.425
IP	306	184.91	0.396
***RA**	306	306	
TR	306	289.03	0.055

*Coping Appraisal and Risk Appraisal are second-order formative constructs; the Q^2 is not applicable.

The predictive relevance of the model provides evidence for the assumed functional relationships between individual, community, and institutional efforts driving intentions to prepare in a recovery context. Besides, the Stone-Geisser's $Q^{2,}$ PLS software provides the model fit criteria. The model fit criteria are provided below (Table 5.10).

Table 5.10. Model Fit results

	Saturated Model	Estimated Model
SRMR	0	0.161
d_ULS	0	0.729
d_G	0	0.122
Chi-Square		169.888
NFI	1	0.74

*(bootstrapping, 5000 sub-samples two-tailed tests at 0.05 alpha).

However, these criteria are in their very early stage of research and not fully understood (e.g., the critical threshold values) (http://www.smartpls.de/documentation/fit). "Unlike CB-SEM, PLS-SEM does not optimize a unique global scalar function. The disadvantage of PLS-SEM is a lack of global scalar function and the lack of global goodness-of-fit measures. When using PLS-SEM, it is essential to recognise that the term fit has different meanings in the contexts of CB-SEM and PLS-SEM (Chin, 2010). Fit statistics for CB-SEM are derived from the discrepancy between the empirical and the model-implied (theoretical) covariance matrix, whereas PLS-SEM focuses on the discrepancy between the

observed (in the case of manifest variables) or approximated (in the case of latent variables) values of the dependent variables and the values predicted by the model in question (Hair et al., 2012). However Tenenhaus, Amato and Esposito Vinzi (2004) proposed a global goodness-of-fit measure for PLS-SEM, research shows that the measure is unsuitable for identifying misspecified models (Henseler & Sarstedt, 2013). As a result, researchers using PLS-SEM rely on measures indicating the model's predictive capabilities to judge the model's quality.

However recently Henseler et al. (2016) have provided a guideline to assess overall model fit criteria in an explanatory research setting. They further argued that the PLS path model evaluation criteria should depend on the researcher's objectives. If the objective of the researcher is model predicting, testing or comparing, then there is no need to evaluate and report overall GOF criteria.

The hypotheses H1 (a and b): a direct relationship between risk appraisal and coping appraisal and intention to prepare was established. Similarly, the significance of the path coefficients proved the hypotheses H2 (a,b,c,d), H3 (a,b) and H4(a,b) (Figure 5.6). However, a full mediation analysis is necessary to evaluate the contribution of each construct representing the community and institutional efforts in the model.

5.8. Mediation Analysis

Mediation analysis is testing the role of intermediate variable linking the independent variable and the dependent variable (Hair et al., 2016, p. 228) The test involves identifying the effect of mediator on the causal link between the independent variable and dependent variable. There are different methods for testing mediating effects such as the casual method Baron and Kenny (1986) and Sobel test. Sobel test is used as a supplementary test with Baron and Kenny method (Lowry & Gaskin, 2014). Sobel test assumes a normal distribution of indirect effects. However, the sampling distribution of indirect effect may be asymmetric (Bollen & Stine, 1990;

Hayes, 2009) and PLS-SEM does not require the data to be normally distributed (Hair et al., 2016).

An alternative to these approaches is bootstrapping (Hair et al., 2016; Lowry & Gaskin, 2014). This is a non-parametric re-sampling technique that does not impose the normal distribution rules to sample distribution (Hair et al., 2016; Lowry & Gaskin, 2014). In PLS, the bootstrapping procedure draws several subsamples (e.g. 5000) with replacement from the original dataset (Hair et al., 2016). Bootstrapping performs well compared to other methods of mediation tests (MacKinnon, Lockwood, Hoffman, West & Sheets, 2002).

Identifying mediator, constructs is vital to conduct mediation analysis. The model hypotheses outline the mediators and their relationships with the independent constructs, and dependent constructs in the model. In Chapter Three, the hypothesised relationships that show the mediating roles of the constructs between the independent constructs and dependent constructs are presented in Table 5.11.

Table 5.11. Model hypotheses assessing mediation analysis

Identifier	Hypothesis
H1	Risk appraisal (RA) and coping appraisal (CA) promotes intention to prepare (IP)
H1a	Risk appraisal (RA) has a direct relationship with the intention to prepare (IP)
H1b	Coping appraisal (CA) has a direct relationship with the intention to prepare (IP)
H5	Community participation (CP) and collective efficacy (CE) mediate risk appraisal (RA) and coping appraisal (CA) to empowerment (EM)
H5a	Community participation (CP) mediates risk appraisal (RA) to empowerment (EM)
H5b	Community participation (CP) mediates coping appraisal (CA) to empowerment (EM)
H5c	Collective efficacy (CE) mediates risk appraisal (RA) to empowerment (EM)
H5d	Collective efficacy (CE) mediates coping appraisal (CA) to empowerment (EM)
H6	Empowerment (EM) mediates community participation (CP) and collective efficacy (CE) to trust (TR)
H6a	Empowerment (EM) mediates risk appraisal (RA) via community participation (CP) to trust (TR)

H6b	Empowerment (EM) mediates coping appraisal (CA) via community participation (CP) to trust (TR)
H6c	Empowerment (EM) mediates risk appraisal (RA) via collective efficacy (CE) to trust (TR)
H6d	Empowerment (EM) mediates coping appraisal (CA) collective efficacy (CE) to trust (TR)
H7	Trust (TR) mediates individual and community efforts to intention to prepare (IP)
H7a	Trust (TR) mediates risk appraisal (RA) via community participation (CP) and empowerment(EM) to intention to prepare (IP)
H7b	Trust (TR) mediates risk appraisal (RA) via collective efficacy (CE) and empowerment (EM) to intention to prepare (IP)
H7c	Trust (TR) mediates coping appraisal (CA) via community participation (CP) and empowerment (EM) to intention to prepare (IP)
H7d	Trust (TR) mediates coping appraisal (CA) via collective efficacy (CE) and empowerment (EM) to intention to prepare (IP)

Mediation analysis is conducted following the procedures outlined in the decision tree guideline for mediation analysis by Zhao, Lynch and Chen (2010) They provided a decision tree method to analyse the mediation effects of constructs in complex models.

Step 1: The first step to mediation analysis is identifying the significance of indirect effects. For assessing the significance, indirect bootstrapping results were used to assess the mediation effects of the constructs. The results of the total indirect effects and specific indirect effects for the hypothesised relationships are significant except for the path H6c (Table 5.12 and 5.13).

Table 5.12. Summary of mediating effects tests

	(H1+H7) Total effect		H1 Direct effect		H7 Total indirect effects	
	Coefficient	t-values	Coefficient	t-values	Coefficient	t-values
RA->IP	0.350	6.793***	0.300	5.698***	0.050	3.281**
CA->IP	0.307	5.739***	0.265	4.562***	0.042	2.983**

****p<0.001&**p<0.01 based on two tailed test; t(0.05, 4999)=1.64791345, t(0.01, 4999)=2.585711627, t(0.001, 4999)=3.310124157.*

Step 2: The second step is to assess the significance of the direct effect. The direct effects for risk appraisal (RA) and coping appraisal (CA) to the intention to prepare (IP) are also significant (Table 5.12). The presence of significant direct and

indirect effects implies partial mediation. That means community participation (CP) and collective efficacy (CE) through empowerment (EM) and trust (TR) partially mediate risk appraisal (RA) and coping appraisal (CA) to intention to prepare (IP).

Table 5.13. Summary of specific indirect mediating effects.

Paths	Point estimate	t-scores	95% confidence intervals	
H5. The indirect effect of RA and CA via CP and CE on EM				
H5a:RA -> CP -> EM	0.11	3.870***	0.058	0.17
H5b: CA -> CP -> EM	0.059	2.148*	0.009	0.117
H5c: RA -> CE -> EM	0.069	2.853**	0.028	0.125
H5d: CA -> CE -> EM	0.078	3.391***	0.04	0.132
H6. The indirect effect of RA &CA via CE, CP & EM on TR				
H6a: RA -> CP -> EM -> TR	0.029	3.028**	0.014	0.052
H6b: CA -> CP -> EM -> TR	0.016	1.921*	0.003	0.035
H6c: RA -> CE -> EM -> TR	0.018	2.512*	0.007	0.037
H6d: CA -> CE -> EM -> TR	0.021	2.852**	0.01	0.039
H7. The indirect effect of RA &CA via CE, CP, EM & TR on IP				
H7a: RA -> CP -> EM -> TR -> IP	0.004	2.200*	0.002	0.01
H7b: RA -> CE -> EM -> TR -> IP	0.003	1.964*	0.001	0.007
H7c: CA -> CP -> EM -> TR -> IP	0.002	1.590^{ns}	0	0.007
H7d: CA -> CE -> EM -> TR -> IP	0.003	2.028*	0.001	0.008

*Note: ***p<0.001, **p<0.01, *p<0.05 and ns(non-significant)based on two tailed test; t(0.05, 4999)=1.64791345, t(0.01, 4999)=2.585711627, t(0.001, 4999)=3.310124157.*

Step 3: The final step is identifying the type of mediation by assessing the signs of path coefficients. The mediation results show positive signs for direct effect, total effect, total indirect effects, and specific indirect effect (Table 5.12 and 5.13). This type of mediation is called complementary mediation.

5.8.8. Multi-Group Analysis

Furthermore, to test the moderating influence of age and gender on the model variables and relationships a multi-group analysis was conducted. The multi-group analysis (MGA) to identify the mean difference between male and female respondents was conducted using MGA function in Smart PLS 3.2.7. There is a parametric and Welch-Satterthwaite test inbuilt within MGA function. These two tests provide t-values and p-values. The parametric test is more a restrictive and powerful method (Chin & Dibbern, 2010). This was used to assess the difference between male and female.

Table 5.14. Multi-group comparison test results for gender

Relationship	Paths (Female)	Paths (Male)	Difference (Male-Female)	t-Parametric	t-Welch	p-values
CA -> CE	0.213	0.237	0.023	0.193	0.194	0.847
CA -> CP	0.054	0.114	0.06	0.514	0.518	0.606
CA -> IP	0.269	0.273	0.005	0.041	0.04	0.968
CE -> CP	0.474	0.305	0.168	1.53	1.627	0.106
CE -> EM	0.305	0.307	0.003	0.023	0.022	0.982
CP -> EM	0.415	0.461	0.047	0.432	0.418	0.677
EM -> IP	0.307	0.144	0.163	1.505	1.502	0.135
EM -> TR	0.24	0.234	0.006	0.055	0.054	0.957
RA -> CE	0.353	0.151	0.202	1.458	1.539	0.126
RA -> CP	0.302	0.261	0.04	0.347	0.353	0.724
RA -> IP	0.159	0.351	0.192	1.788	1.691	0.093
TR -> IP	0.22	0.093	0.126	1.437	1.431	0.155

Table 5.15 Multigroup comparison test results for age groups

a. Age group 3(over 60years) to age group 1(between 20-40)

Relationship	Paths Agegp3	Path Agegp1	Difference (Agegp3-Agegp1)	t-Parametric	t-Welch	p-values
CE -> CP	0.226	0.321	0.037	0.224	0.196	0.845
CP -> EM	0.471	0.447	0.032	0.176	0.151	0.881
RA -> IP	0.368	0.225	0.002	0.012	0.013	0.990
CE -> EM	0.469	0.237	0.096	0.533	0.484	0.631
EM -> IP	0.107	0.164	0.232	1.306	1.576	0.121
RA -> CE	0.172	0.245	0.023	0.149	0.176	0.861
CA -> CE	0.310	0.273	0.058	0.356	0.355	0.724
TR -> IP	-0.007	0.178	0.190	1.212	1.213	0.231
CA -> IP	0.366	0.368	0.073	0.368	0.308	0.759
CA -> CP	0.180	0.148	0.129	0.754	0.733	0.467
RA -> CP	0.427	0.298	0.143	0.913	0.900	0.373
EM -> TR	0.208	0.398	0.185	1.388	1.448	0.154

b. Age group 3(over 60years) to age group 2 (between 40-60)

Relationship	Paths Agegp3	Paths Agegp2	Difference (Agegp3-Agegp2)	t-Parametric	t-Welch	p-values
CE -> CP	0.226	0.495	0.129	0.797	0.677	0.502
CP -> EM	0.471	0.425	0.100	0.517	0.463	0.646
RA -> IP	0.368	0.387	0.255	1.400	1.566	0.123
CE -> EM	0.469	0.276	0.269	1.775	1.410	0.165
EM -> IP	0.107	0.217	0.193	1.101	1.274	0.208
RA -> CE	0.172	0.196	0.046	0.299	0.338	0.737
CA -> CE	0.310	0.182	0.111	0.660	0.662	0.511

TR -> IP	-0.007	0.160	0.138	0.854	0.855	0.397
CA -> IP	0.366	0.112	0.024	0.127	0.101	0.920
CA -> CP	0.180	0.080	0.349	2.027	1.953	0.057
RA -> CP	0.427	0.078	0.019	0.116	0.115	0.909
EM -> TR	0.208	0.070	0.167	1.079	1.203	0.234

This study involves a complex model with the first order and second order composites. It was not feasible to assess moderating effecting using product indicator approach. The model consisted of seven constructs. Of them, two were second-order formative constructs. MGA was conducted to evaluate the group differences in the data by gender and age. MGA in SMartPLS 3.2.7 version provides results for MGA, t-parametric and Welch-Satterwait test. Although parametric tests are more restrictive, they are considered robust, and the results of the parametric and Welch test were compared and presented in Table 5.14 (gender) and Table 5.15 a and b(Age). The results showed that there was no significant difference between groups, indicating that there was no moderation of gender and age.

5.9. Discussion

This study developed and tested a model of earthquake hazard preparedness during a disaster recovery phase in Nepal. The findings confirm the role of model variables in the decision-making process of earthquake hazard preparedness in a post-disaster recovery context. The model predicts that people's decision to, or not to, prepare commences with a personal appraisal of risk and coping options available, and then progresses through the community and institutional phases. A full mediation analysis was carried out to evaluate the general hypothesis that community and institutional factors influence individual cognition to earthquake hazard decision-making. The analysis supports the idea that individual cognition (risk appraisal and

coping appraisal) and social contextual factors interact to increase the likelihood of preparing in a post-disaster scenario, like that in Nepal.

4.1.1. Individual phase

At the individual phase, individual cognition was measured using PMT variables. PMT assumes that people exhibit protective behavioural intentions when they directly experience a hazard or threat, as they can neither avoid nor take precautionary measures (Maddux et al., 1982). The strength of the relationship between risk appraisal (RA) to intention prepare (IP), and coping appraisal (CA) to intention to prepare (IP), reveals that the decision to prepare for an earthquake hazard begins when people accept the personal risk of an earthquake hazard, and evaluate their coping abilities to reduce the perceived risk while they are recovering from the impacts of deadly earthquake. Personalising the risk and coping capabilities to reduce perceived risk offers a way of measuring the extent to which people are motivated to prepare themselves and their households against the consequences of an earthquake. However, this process is further influenced by the social context within which people interact. The social context is represented by the community and institutional efforts.

5.9.9. Community phase: Social influence in the community

The individual to community interaction proceeds following the individual cognitive phase. The direct and significant relationship between individual cognitive variables (risk appraisal and coping appraisal) to community factors shows the evidence of individual-to-community interaction. The analyses depicted that people's personal beliefs (risk appraisal and coping appraisal) have a direct and significant association with community participation and collective efficacy with a variance of 16.8% and 22.4% respectively. This implies that in a highly uncertain situation people actively seek information from significant others to reduce the uncertainty (Lion et al., 2002). They interact with their family, neighbourhood, local groups, networks, and community, who share similar values and interest, to receive guidance about what to

do; and for both validating and developing their thoughts and beliefs. In this way, people deal with their unique circumstances by co-constructing their social understanding and imposing meaning on their situation (Blumer, 1986).

The relationship between community participation in collective efficacy (β values of 0.380 at $p < 0.001$) reflects the direct role played by the communities in Nepali society to manage the consequences of the earthquake. The relationship between variables community participation and collective efficacy identify the cultural attributes of mutual social obligations and cooperation that underpin community (neighbourhood) involvement in local issues in Nepal. In a collectivistic society, people are interdependent to their in-group, family, clan, tribe, community, and state and shared norms and values influence their behaviour (Hofstede, 2011; Markus & Kitayama, 1991; Triandis & Suh, 2002). Social relationships are an important aspect of people's lives, and the strength of social bonding is a function of social proximity (Hui & Triandis, 1986; Power, Schoenherr & Samson, 2010). In Dhading, families rescued their relatives from the rubble, as well as essential supplies and utilities. Extended family and relatives from other parts of the country supported those affected by providing financial support and additional resources (Field discussion, May 2016). Mutual obligation towards the community was demonstrated through the community response: conducting rescue operations, such as pulling dead bodies from the rubble; clearing away debris; building temporary shelters, and arranging necessary supplies with the available local resources (field discussion, May 2016). This trend was observed in other affected districts of Nepal such as Sindhupalchock, Dolakha and Lalitpur (Paul, Acharya & Ghimire, 2017). Although a relationship between collective efficacy and community variables shows signs of collectivistic culture, the scope of this research is limited to identifying factors of community preparedness. Therefore further qualitative research that explores the relationship between people's preparedness and sociocultural beliefs, norms and values are deemed necessary for articulating the culturally specific responses that underpinned the implicit community response towards

a disaster and its consequences. It will also be vital to explore whether and how the experience of the earthquake has been encapsulated in the social and cultural lives of Nepali people.

5.9.10. Institutional phase: Community-agency interaction

Affected households not only engaged themselves collectively to assuage the needs and challenges that they faced during the recovery period; they also collaborated and negotiated with disaster risk management agencies and other concerned stakeholders involved in response and recovery. The direct link between community participation (CP) and collective efficacy (CE) to empowerment (EM) reveals the strength of community capabilities and collective efforts to encounter the recovery needs and challenges in Dhading, Nepal. This finding supports previous research confirming the role of people as collectives in the response-recovery process as they bear the recurrent challenges earthquakes pose in most parts of the world (Mulligan et al., 2012; Nakagawa & Shaw, 2004; Paton et al., 2014; Paton & Tang, 2008). However, collective efforts may not be sufficient to cope with and adapt to the emerging situation after a devastating earthquake. Communities seek governmental and other external support to reduce their uncertainty and recover from the impact of the disaster (Mulligan et al., 2012; Paton et al., 2014; Shaw & Goda, 2004; Shaw & Sinha, 2003).

In Dhading, communities were exposed to multiple challenges, such as the loss of lives and property, disruptions to essential services, a shortage of safe housing structures, and much more (Goda et al., 2015; Sanderson & Ramalingam, 2015). The collective efforts to overcome these issues were inadequate (Goda et al., 2015; Paton et al., 2014; Shaw & Sinha, 2003). Consequently, communities voiced their demands through the Ward Citizen Forum to local government to resolve issues that they had encountered during their recovery. However, they received a limited amount of financial

support and resources from the government (Paul et al., 2017). A gap between government service delivery and community expectations was evident.

Another institutional factor that mediates the relationship between empowerment and intention is trust. Trust explained weak (6.7%) variance although the relationship of trust to intention was significant in the model. The current gaps between the expectations of communities and government service provision explain the low variance of trust. Trust represents communities' level of familiarity with disaster-related information and general trust developed due to the complementary relationship between relevant agencies and communities in the usual context. Ambiguity persisted in communities due to new challenges when responding in the recovery period (Goda et al., 2015; Nepal Government, 2015). Communities turned towards the public institutions for assistance, based on the general trust communities have with them in Nepal around 59% of trust in public institutions (Jamil & Askvik, 2013). However, more work is needed to explore the relationship between these variables further.

5.10. Conclusion

People cope with and adapt to infrequent and complex earthquake hazards. Preparing before a potential disaster influences people's ability to cope with and adapt to the impact of the hazards. Preparation involves assessing people's own risk and coping mechanisms at the individual level, followed by interactions with community and DRM agencies in a given social context.

This study proposes and tests the utility of an earthquake hazard preparedness model in a developing country context, during a post-disaster recovery period where the disaster impacts are high, and the consequent need for preparedness is also high. The integrated theory of PMT and CET shows promise as a research strategy for investigating behavioural and social aspects of preparation for an earthquake hazard in Nepal. Disaster Risk Management policies and strategies must consider the role of individual behaviour and social context when designing and implementing public

education programmes about earthquake hazards in Nepal. Considering social context and individual behaviour would enable DRM agencies to better articulate people's information needs and effectively facilitate the preparedness process at both individual and community levels.

This research proposes and tests a method of preparedness that integrates PMT and CET to explore intention to prepare for an earthquake hazard in Nepal. This research indicates that the fusion of these theories permits a better understanding of the behavioural and social aspect, rather than applying them separately. Researchers investigating hazard preparedness may consider integrating theoretical perspectives from differing domains as it serves to deepen research knowledge in the area. The model tested is specific to earthquake hazard preparedness in Nepal, but researchers might consider testing it for all hazard applicability in Nepal and across different cultures.

Chapter 6: Social Factors Influencing Earthquake Hazard Preparedness during Disaster Recovery

6.1. Introduction

In this chapter, a qualitative component is introduced to achieve the second goal of the research: to explore how people's lived experience of a devastating earthquake hazard and their social context informs the preparedness process.

Having to co-exist with their environment, people constantly adjust their abilities to adapt to the environment by reflecting on the environmental cues and then comparing their decisions and behaviour relative to their experience (Chapter Two, Section 2.2). Similarly, in the event of an earthquake, people cope with the disruptions and adapt to the changing environment; while responding and recovering from the impacts of the earthquake, they use abilities developed in a pre-event context (Norris et al., 2008). In this process, people might endorse the use of these capabilities to respond and recover in the post-event.

Researching when people are responding and recovering from the impact of a deadly earthquake offers an opportunity to uncover the struggles people had, what supported or restricted the recovery process, and what is required to better prepare for a future event. The in-situ data captured in the post-disaster recovery setting informs and contributes to the strength of the building back better concept and future preparedness theory development (Chapter Two, Section 2.6).

The quantitative assessment of this study supported the role of social contextual variables, such as community participation, collective efficacy, empowerment and trust, in influencing decision making during the recovery period. While identifying how factors such as participation and collective efficacy influenced preparedness decisions, the model analyses did not shed light on how people

participate, whether different kinds of participation affect decision making in different ways, and how collective efficacy is developed and used. Therefore, qualitative research is deemed necessary to expand on the research for assessing how people's lived experience of a devastating earthquake informs the reasoning process underlying preparedness for future events.

This chapter comprises the process of data analysis and development of thematic codes from the raw interview data, using open and axial coding as applied in grounded theory. The findings (codes obtained from the analysis) are related to the quantitative model of earthquake hazard preparedness (Chapter Five). Relating the qualitative findings with the selected quantitative model keeps the qualitative findings consistent with thus achieves internal consistency (Denzin & Lincoln, 2011). It also allows a compare and contrast of both outcomes (quantitative and qualitative) and illuminates additional information generated from the qualitative data. In the next section, the data processing steps adopted to analyse the interview data are discussed.

6.2. Information about the interviewees

Altogether eleven participants were interviewed from 11 June – 22 June 2017 in Jeewanpur and Chainpur VDCs, Dhading district, Nepal. The principal researcher visited the households of the interviewees, conducted the interview and recorded in Nepali (the native language of the interviewees and the principal researcher). The demographic details of the interview participants are presented in Table 6.1.

Table 6.1. Interviewees number, gender, and duration of interview

S.N.	Name*	Gender	Age	Address	Interviewee	Date	Start time	End time
1	Interviewee 1	Male	40	Dhunibesi -4	1	11-Jun-17	5:00 PM	5:40 PM
2	Interviewee 2	Male	26	Dhunibesi -4	2	11-Jun-17	6:00 PM	6:45 PM
3	Interviewee 3	Male	48	Dhunibesi -4	3	12-Jun-17	10:00 AM	11:00 AM
4	Interviewee 4	Female	34	Dhunibesi -4	4	12-Jun-17	12:30 PM	1:30 PM
5	Interviewee 5	Female	31	Dhunibesi -4	5	13-Jun-17	10:00 AM	11:00 AM
6	Interviewee 6	Female	35	Dhunibesi -4	6	13-Jun-17	2:00 PM	3:00 PM
7	Interviewee 7	Female	55	Dhunibesi -4	7	18-Jun-17	1:00 PM	2:00 PM
8	Interviewee 8	Female	34	Chainpur	8	19-Jun-17	10:00 AM	11:00 AM
9	Interviewee 9	Male	28	Dhunibesi -4	9	19-Jun-17	10:00 AM	11:00 AM
10	Interviewee 10	Male	48	Chainpur	10	21-Jun-17	9:00 AM	10:00 AM
11	Interviewee 11	Male	50	Chainpur	11	22-Jun-17	9:00 AM	10:00 AM

The principal researcher followed different steps to the process of oral interview data.

6.3. Data Processing

All the interviews were conducted and recorded in Nepali, the language of the respondents, on a tape-recorder. The data was prepared in three steps before coding (Figure 6.1).

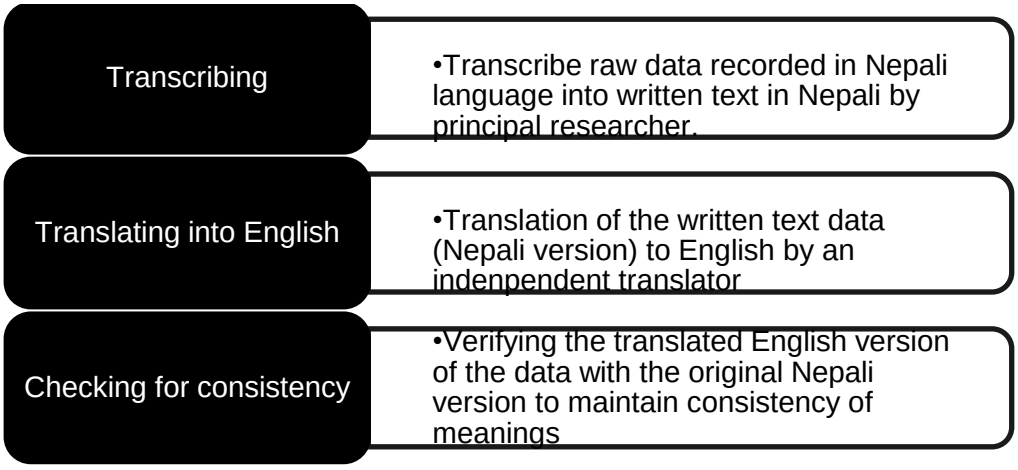

Figure 6.1. Steps of data preparing before coding.

6.3.1. Data transcription

Data transcription is the process of carefully examining the data through careful and repeated listening and watching (Bryman, 2016). Data transcription is the first step in data analysis (Bryman, 2016). This process enables the researcher to familiarise with the content and meaning of the data (content of the interview). Data transcription takes a long time (Bryman, 2016).

The raw oral data were transcribed into written text (Nepali) by the principal researcher (Figure 6.1). This process was necessary to understand the data better and code the data efficiently.

6.3.2. Data translation

Conducting qualitative research non-English speaking population and presenting the findings in English has its implications. Language is the primary medium for understanding the voice of the interview participants and the related findings (Boutain, 1999). The translated version of the text may vary in meaning by word choice, sentence length, and construction (Boutain, 1999; Bryman, 2016). The process of gaining a comparable meaning is achieved by a researcher proficient in both English and the original language in which the data is collected (Brislin, 1970). The most common and highly recommended method is back translation. Back translation is translating the target language (e.g. English) to back to the source language (e.g. Nepali) (Brislin, 1970; Candell & Hulin, 1986).

An independent translator was hired to translate all the raw interview data into the English language. The principal researcher verified the translated version of the interview data and applied corrections for maintaining the consistency of the meanings as close as possible to the original Nepali version. Data coding started after transcribing and translating the data.

6.3.3. Data Coding

Data coding is a crucial aspect of data analysis in qualitative research. A code is a short phrase or word assigned for a portion of a language-based or visual data (Bryman, 2016). The data for coding can consist of interview transcripts, field notes, journal, artefacts, and participant observation data. Coding is done to record the description of the data and later to identify themes (Bryman, 2016).

Means-End Chain theory (MEC) asserts that while coding, the data should be categorised into attributes, consequences, and values, and then the constituent parts of each category should be identified (Reynolds & Gutman, 1988). Open coding allows analysing each word, sentence, a paragraph of the text data to extract the meaning of the information, while axial coding reassembles the constituent parts of the data generated from open coding into new categories and relationships (Charmaz, 2011).

In this study, transcribed text interview data were coded to expose the thoughts and meanings of the information interview participants disclosed about the response and recovery efforts. The open and axial coding process is elaborated using an example of collective coping (main code and theme).

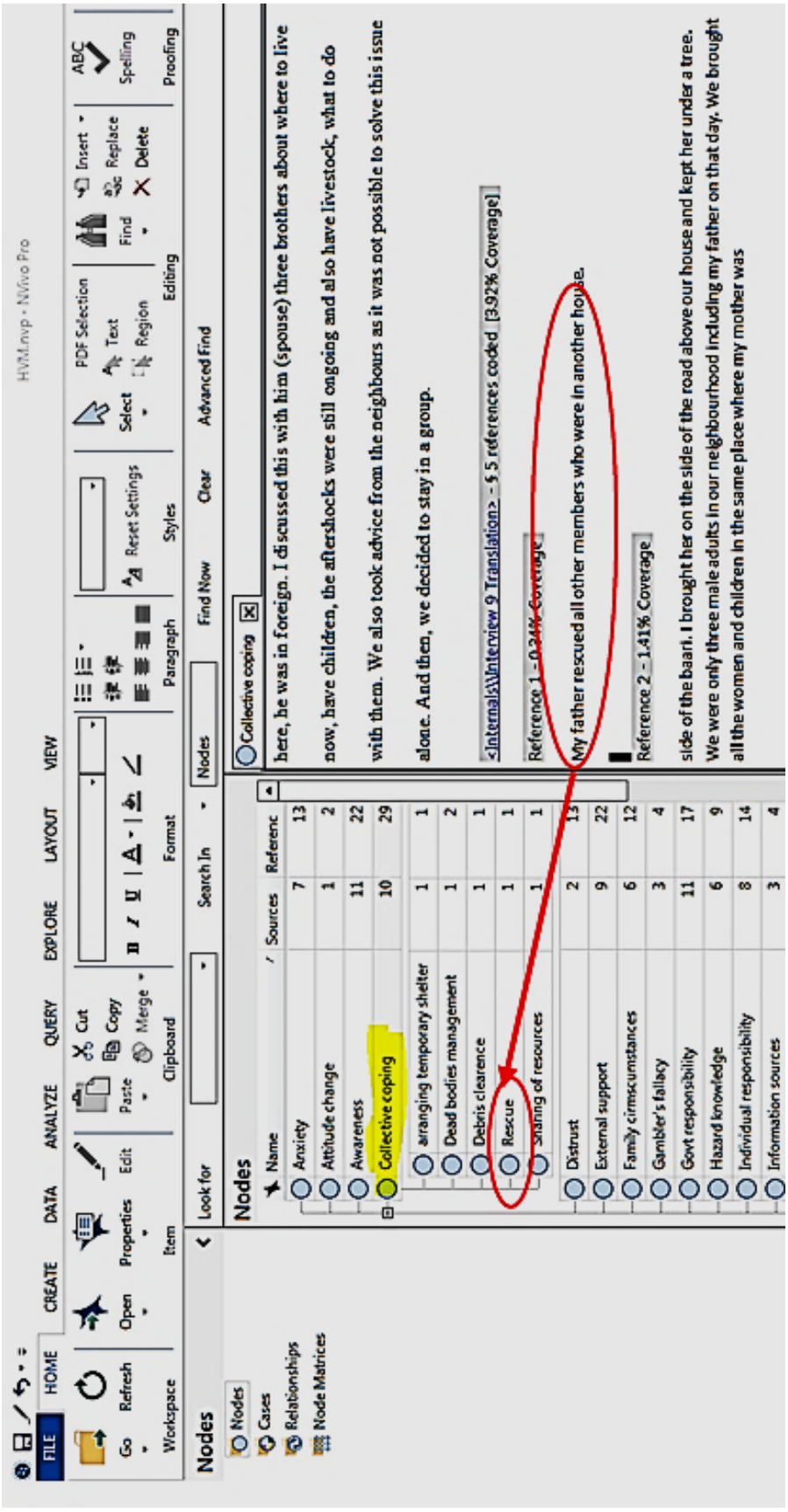

Figure 6.2. Open coding process in Nvivo

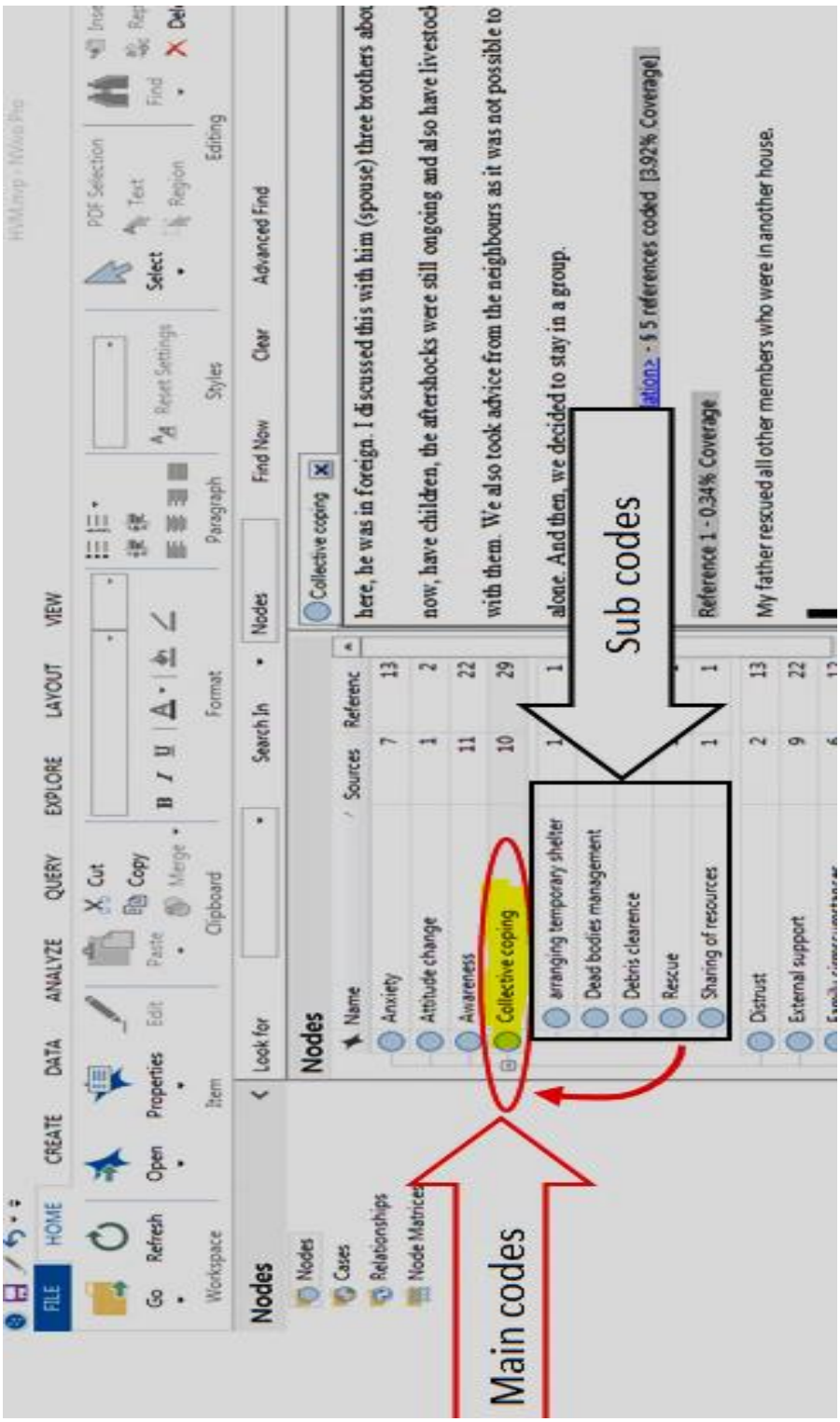

Figure 6.3. Axial coding process to condense sub-codes into codes

Open coding

In Figure 6.2, the sentence ‘‘*my father rescued all other members who were in another house”* (red circled) is coded under rescue sub-code (red circled and an arrow pointing from the sentence to the sub-code). In this way, each sentence, paragraph and observation contained in the text was analysed and assigned a category that represented the meaning. A total of all 110 sub-codes were identified from the interview data following the same process (Appendix C).

Before, condensing the sub-codes into codes, the original version and the translated version of the data were coded separately. The principal researcher analysed and coded the Nepali version of the text data manually. Again, the primary research coded the English version of the raw data in NVivo version 11. Then, she compared the sub-codes obtained from the original version of the text data to sub-codes obtained from the English version and applied corrections for maintaining consistency.

Axial coding

In axial coding, new categories and relationships are reconstructed using the sub-codes or constituent parts of the data generated while open coding (Charmaz, 2011). As shown in Figure 6.3, the sub-codes: arranging temporary shelter, management of the deceased, debris clearance, rescue, and sharing of resources (food, water) are recoded under collective coping (code). The 110 sub-codes were condensed into 27 codes using axial coding process (Figure 6.4).

6.4. Credibility, dependability, and confirmability of qualitative data

Qualitative data is checked for its interpretive rigour using validity criteria suggested by (Lincoln & Guba, 1985). Triangulation was used to achieve the credibility of the findings. Triangulation is one of the popular methods for assessing the credibility

of the qualitative data (Creswell & Miller, 2000). Triangulation refers to a procedure for identifying converging meanings from multiple sources of data and perspectives (Creswell & Miller, 2000; Lincoln & Guba, 1985). A standard way to generate corroborating evidence from multiple sources is combining qualitative and quantitative data (Creswell & Miller, 2000). It allows findings arising from the data to keep in context and thus achieve internal consistency of the findings (Denzin & Lincoln, 2011; Lincoln & Guba, 1985). Dependability and confirmability are other criteria to evaluate the reliability of qualitative data (Lincoln & Guba, 1985). In this study, the interpretation of the qualitative findings relating to the quantitative findings enabled a data convergence.

Similarly, to ensure the dependability of the data, the primary researcher compared the codes obtained from manual coding in Nepali language and coding in Nvivo 11, with the English version translated by an independent translator. The primary researcher sorted out the standard codes and removed the overlapping areas. Furthermore, discussion of the data analysis process and the outcomes with a supervision panel ensured the confirmability of the data.

6.5. Linking Qualitative Findings to the Earthquake Hazard Preparedness Model

The earthquake hazard preparedness model illustrates that people make decisions regarding earthquake hazard preparedness at the individual, community, and institutional level during recovery (Figure 5.10 Chapter Five). When an individual faces an earthquake hazard, the process of interpreting the experienced risk begins at the individual level, where people acknowledge the risk and assess the coping options available (Maddux & Rogers, 1983; Rogers, 1983). Furthermore, this process progresses to the community and institutional levels as people are normative decision makers and look for options to mitigate the risk (Ajzen, 1991; McIvor & Paton, 2007; Paton & Jang, 2016). Identifying the codes and themes that emerge at the individual level, community level, and institutional level are vital to gain an understanding of the

convergence of the data from quantitative and qualitative findings. It is also vital to assess the factors that provide a further understanding of the processes of earthquake hazard decision making. Some of the factors that evolved from the interview data are summarised in Figure 6.4.

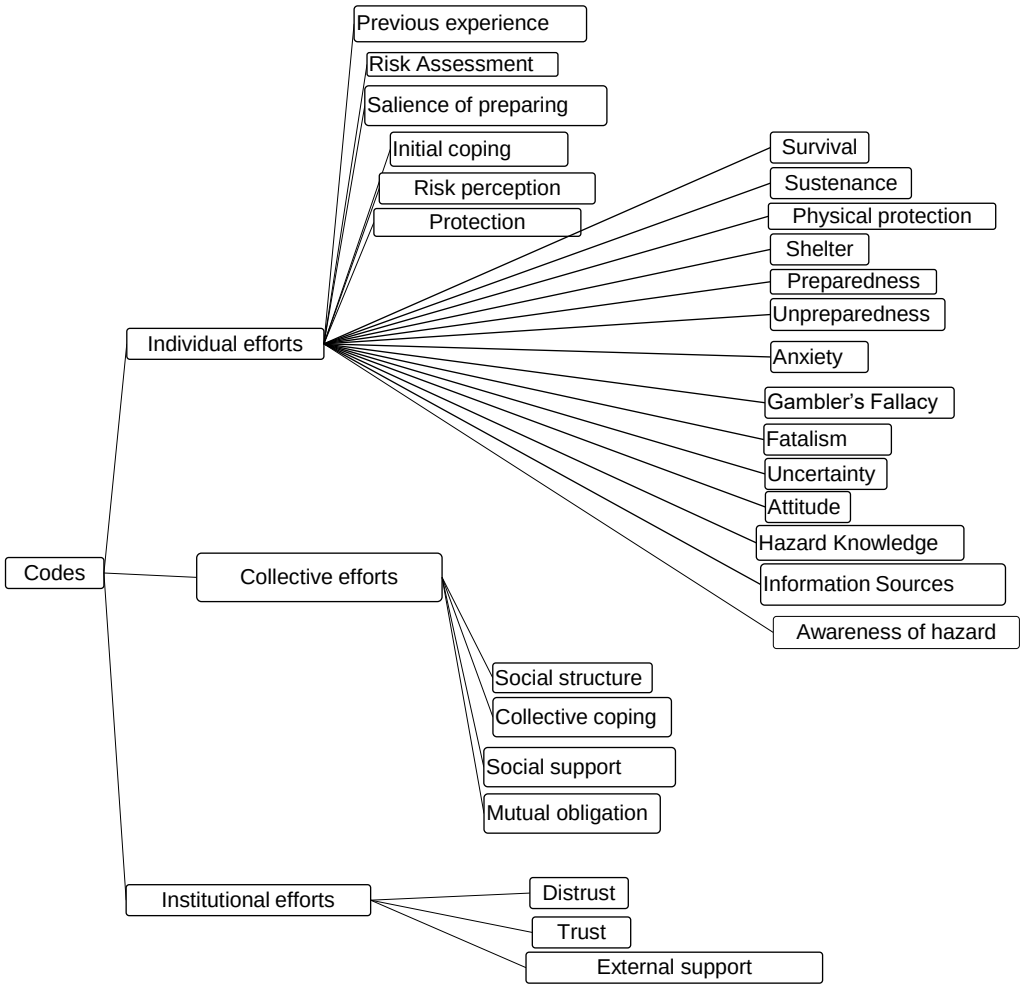

Figure 6.4. Summary of codes grouped into individual, collective and institutional efforts.

6.6. Individual Efforts

At the individual phase, the earthquake hazard preparedness model measures people's risk appraisal of the earthquake risk that prompts their coping strategies (coping appraisal) and further motivates them to prepare (Chapter Five). Since the participants have lived the experience of the earthquake, their experience influences

the risk perception and coping process. The risk perception and initial coping codes correspond to the elements of the model. Several codes were identified at the individual level from the qualitative data that influenced the individual risk perception and coping process. Factors such as protection and survival were identified, reflecting people's beliefs about why preparing is important for them in the post-disaster recovery. All the codes that emerged at the individual level are discussed. However, a detail analysis of the relationships between codes is conducted in Chapter Seven. The presentation of codes begins with previous experience as previous experience stimulates risk perception and initial coping.

6.6.1. Previous experience

People rely on direct and indirect sources of information to assess their risk to a potential hazard and their adaptive strategies (Becker et al., 2012, 2013). Indirect sources are the information available from media, e.g. radio, television, reading materials, e.g. leaflets, poster, pamphlets, awareness programs, conferences, workshops. The direct personal exposure to the consequences of an earthquake is the direct experience (Becker et al., 2012; Lindell & Perry, 2000). The interview data revealed the direct experience of all the respondents to the devastating Nepal earthquake in 2015. An account of the participants demonstrates direct personal experience (Table 6.1).

Table 6.2**.** Participants quotes on the lived experience of an earthquake hazard

"Everyone's houses shattered; there were dead bodies of livestock underneath the broken houses. There was no proper space to live (Participant 1)."
"During the earthquake, I was at home; I mean here. I ran to the open space. Children were down the road. Once the earthquake shaking became less only then the search for children began (Participant 8)."
"I was on my bed, watching TV; it started shaking, and a tin sheet fell and cut my shoulder. In the meantime, I went out of the house, turned around and saw all the houses falling. All the houses collapsed and turned into debris and dust. After a while, I went close to the house and realised that I am alive (Participant 9)."

"We thought it might be a small quake that uses to occur sometime. We stayed inside for a couple of seconds; everything was trembling. After a while, we went out. The houses started to fall apart. The top of our house also fell. If the whole house had collapsed, we would not be alive including the priests. My daughter in law got injured" (Participant 7)."

The interview data shows that respondents have experienced injury to themselves and family members, loss of livestock, and damage to their property following the devastating earthquake. These findings are consistent with research reporting the direct experience resulting from the amount of loss and damage (Heller et al., 2005; Russell et al., 1995). Previous research has highlighted that direct experience influences the preparedness process in some ways, including an increase in risk perception and stimulation of coping abilities assessment (Becker et al., 2017; Dooley et al., 1992; Rüstemli & Karanci, 1999).

6.6.2. Risk perception

Risk perception is another code that emerged from the data analysis. Perceived risk is acknowledging that there is an imminent risk of an earthquake (Maddux & Rogers, 1983; Rogers, 1983). People develop their risk perception of a hazard from direct experience and indirect experience of hazards (Becker et al., 2017). The interview data revealed the perceived risk of earthquake accrued from the direct experience of the severity of impacts and frequent aftershocks. The participants displayed an understanding of the severity of an earthquake by the keywords "*trembling",* or *"shaking',* while "*shattered houses", "dust", "debris",* and *"dead bodies"* represented earthquake impacts (Table 6.1). They reported that they felt several aftershocks following the earthquake, and landslips that made their residential area uninhabitable. Risk acknowledgement compelled people toward initial coping.

6.6.3. Initial coping

Coping is the assessment of the abilities (knowledge, skills, and resources) required for coping with the risk of an earthquake hazard (Duval & Mulilis, 1999;

Rogers, 1983). The initial coping is the ability of an individual to respond to the inevitable threat (Lazarus, 1966; Rogers, 1983).

The participants (7 and 9) expressed how their experience of earthquake consequences resulted in initial coping as:

"we stayed inside for a couple of seconds; everything was trembling. After a while, we went out (participant 7)." "It started shaking, and a tin sheet fell and cut my shoulder. In the meantime, I went out of the house, turned around and saw all the houses falling (participant 9)."

The interview data reveals a flight to open space as an initial coping strategy for the earthquake consequences. As per the model of preparedness, personalising risk and available coping options lead to preparedness. The qualitative findings revealed that protection, physical protection, survival, and sustenance influenced the realisation of the risk and initial coping process. Moreover, some other factors also contributed to preparedness, beyond risk personalisation and coping.

6.6.4. The salience of preparing and protection

Preparing for any potential natural hazard threat is to attain safety goals. The goal of protection can be achieved when people realise the importance of preparedness (Becker et al., 2013). People might realise the importance of preparing that adopting protective measures would increase their safety through their experiences (Bagozzi, Bergami & Leone, 2003b; Paton & McClure, 2013).

In this study, the interview participants acknowledged that their experience of the earthquake consequences instigated the need for preparing to protect them better, their family members, and their property. The participants were asked about the importance of preparing for an earthquake hazard. An example of an interview with one of the participants is presented:

Interviewer: "How would you rate the importance of preparing for an earthquake hazard on a scale of one to ten; if one is of low importance and ten is high importance?"

Participant: "It is important. I would rank it as most important because being prepared is better than doing nothing."

Interviewer: "Why?"

Participant: "If we think what to do, where to go and stay, how to do before the event then it will be more comfortable for us when it comes (earthquake occurs)."

Interviewer: "Why is it more comfortable?"

Participant: "We do not have time to think when the event occurs. It does not come by giving a warning. Many people were injured and killed last time. Preparing will help to prevent the damage and loss that might occur."

Interviewer: "Why preventing damage is important?"

Participant: "Protect us."

Interviewer: "what does protect us mean?"

Participant: "If I am safe only then I can save others. Everybody wants to save his or her own life." Prevent the damage and to be safe. Protect ourselves, livestock and property."

All the eleven interview participants considered preparing as an essential task for protecting themselves, their family, and their property from the earthquake consequences. So protection is one of the goals driving preparedness in a post-disaster recovery context. Similar to protection, physical protection, shelter, survival, and sustenance were also identified from the data analysis.

6.6.5. Physical protection and shelter

Physical protection refers to the dwelling facilities required to protect people and their valuable resources during and following an earthquake hazard (Lindell & Prater, 2000; Russell et al., 1995).

Interview respondent (2) expressed his views about the need for physical protection as "Housing is a primary thing at the moment. Physical protection is important; not possible to live like this forever (live in the shelter)."

The direct impact of earthquake resulted in the loss of residential buildings and infrastructure. The lack of structural readiness measures forced people to live in temporary shelters and thus reduced their level of survivability and sense of physical protection, offered by a home. Securing housing structure and household items are one of the preparedness categories (Paton & McClure, 2013). However, all the interview participants experienced the damage of fragile residential buildings and infrastructure during the earthquake. As a result, the households have to face extra survival demands (e.g. food, water, sanitation) and have to reside in a temporary shelter.

6.6.6. Survival and sustenance

The interview participants mentioned that they recovered food grains from the debris. They were asked why recovering food grains from the debris was important. Participants expressed their views (Table 6.2).

Table 6.3. Participants' quotes about survival and sustenance

"Buying foodstuff is difficult. A cost is involved in producing food grains. I wanted to extract it slowly so that I can use it. Usually, we store food for the summer season. At this time (summer) we are busy farming. We do not have alternative income from vegetables, and we cannot go to seasonal jobs in Kathmandu during this time (summer) of the year (participant 1)."
"During summer, we are engaged in agriculture. We use the saved produce from the winter during the cropping time of the year. This is a practice for a long time here. In the case of those households who have more than enough food produce, they store to sustain throughout the year and next year also. This also helps to sustain during the food deficit years or bad years due

to crop failure that may result from drought, wind, and flood or to survive during the unforeseen events such as this last earthquake (Participant 9).''

They responded that the extraction of food grains from the debris was essential to maintain a regular supply of food during the recovery period. The earthquakes occurred in April and May (spring) in Nepal. Most of the recovery work was initiated in summer when the crop cultivation (e.g. rice, maize, millet) begins. During this season, households are typically engaged in agriculture, which is one of the primary sources of food supply. Households use the stored food grain to sustain themselves during food deficit periods, and this is a part of the regular lifestyle. The effects of the earthquake buried the stored food grain in the debris, so households attempted to recover the food grain to maintain a regular supply of food to sustain their families during the recovery period, and continue to engage in the crop production. Storing food produce is a traditional inbuilt system to cope with food deficit periods (Prindle, 1979). This strategy enabled communities to cope with the earthquake disaster and is a vital aspect of preparedness. Securing survival items including food and water is a primary aspect of the preparedness strategy. If securing food is an inbuilt system of a society, it facilitates the process of recovery.

Besides the safety beliefs governing people's coping response to certain earthquake risk, other factors also influenced people risk perception, coping, and preparedness in a post-disaster context. The factors that promoted the individual risk perception coping, and preparedness relationships are discussed in the following sections.

6.6.7. Anxiety

The direct experience of a hazard influences people's emotion and feelings (Becker et al., 2012). Among these emotions and feelings, anxiety and fear emerged from the data analysis. Participants 1 and 4 described their emotions and feelings as:

"There was fear of more earthquakes. People were scared. Women and children were crying due to fear and anxiety (Participant 1). I am afraid and feel that it can come anytime (Participant 4)."

These quotes from the interview participants illustrated the fear and anxiety of earthquake event as fearful, scary, frightening, and threatening. The fear and anxiety resulted in the insecurity of being in their houses which led the process of initial coping (escape to open space).

6.6.8. Hazard knowledge

The knowledge relating to a natural hazard refers to the nature of the hazard and its consequences (Becker et al., 2013; Lindell & Whitney, 2000). The interview data revealed hazard knowledge relating to the nature of the earthquake hazard, the consequences resulting from the interaction of earthquake, the fragility of residential buildings, and the effects of secondary hazard (landslip). Participants (10 and 2) stated:

"A natural disaster (earthquake) does not come by informing us. It happens suddenly (Participant 10); and recent event (the earthquake 2015) has taught us that it was the infrastructure we have built had caused the damage and casualties, not the earthquake itself. When rebuilding the new housing structures, we need to consider constructing earthquake resistant infrastructures. We also need to consider the land aspect and slope while constructing houses and for the cattle sheds also. In steep areas, the land collapses (Participant 2)."

Besides acknowledging the impacts of the hazard, people also identified housing structural integrity and land use planning as essential aspects for preparing for potential future events.

6.6.9. Awareness of hazard

Awareness is the degree to which people "think and talk" about a hazard and its impacts (Paton & McClure, 2013, p. 103). The interview data revealed people

interacting (thinking and talking) with their family members and neighbours. Participant (5) stated that she interacts with her family members and neighbours:

"We talk about how and where to go when it (earthquake) happens. I have asked children to stay in open place both while there are at school and home also. There is an open space in the right of our resident, so I have asked all family members to be there if something happens again. We discuss this (earthquake and how to respond during the earthquake) with our neighbours also (Participant 5)."

The interview data shows that respondents interacted with their family members and neighbours to figure out possible preparedness strategies for a potential future event. This finding is evident because direct experience prompts thinking and talking about a hazard and related preparedness strategies (Becker et al., 2017; Paton & McClure, 2013). The necessity to prepare arises if people realise the importance of the hazard and the need to preparing for a hazard arises from the interaction among family members, neighbours, and community members (Paton & McClure, 2013). Regular interaction between significant others (family, friends, neighbours) reinforces the value in forming and sustaining risk beliefs (Paton et al., 2005). In addition to creating an awareness of hazards, the experience of the impacts and coping processes facilitates changes in their attitudes.

6.6.10. Attitude change

Changing people's attitude and beliefs for motivating them to adopt natural hazard preparedness is the primary goal of the various disaster risk reduction strategies and outreach interventions (Johnston et al., 2013; Paton & McClure, 2013). People are likely to form and sustain their attitude and beliefs about an issue based on positive and negative outcomes of a behaviour or action influenced by their experience (Doll & Ajzen, 1992).

In this study, the participant has lived experience of a devastating earthquake (negative consequences) influenced their attitude toward preparing. An account of the participant views on the experience of change in attitude about preparation included:

"The event that has occurred last year has changed people's attitude to some extent. People constructing the houses are following the building codes whether it may be a concrete or wooden house. They are not bothered only by getting a grant from the government. They are concerned with how to construct resilient houses. It can be observed in the village. Also, people have also realised that they need extra materials such as tents, big water tanks (participant 11)."

The data shows that severe loss and damage from the earthquake created extra demand for secured housing or earthquake resilient housing in the affected communities. The importance of housing needs that people encountered following the earthquake stimulated change in their beliefs regarding preparedness among affected households.

From the above discussion, factors such as previous experience, risk perception, hazard knowledge, hazard awareness, and anxiety promote people's risk belief formation and contribute to preparedness. However, people may also develop beliefs and attitudes that hinder preparedness (Paton & McClure, 2013; Solberg et al., 2010). Some of the factors hindering preparedness, identified from the interview data, are presented in the next section.

6.6.11. Information sources

People gather information from different sources to reduce the uncertainty of an earthquake hazard (Becker et al., 2012). During the interview, participants discussed the information about earthquake hazard risk and precautionary measures that used to be broadcasted on media, including radio and television. They also reflected that

messages regarding earthquake hazard safety were inappropriate in the context of the study sites. Participant 8 expressed his views as:

"I have heard about earthquake precaution message on the radio. It uses to provide information: earthquake might come anytime; if it happens, one needs to protect him or her by hiding under the bed, standing on the side of the door and if possible to escape, go to open places. During the earthquake, some of the children went under the table and lost their lives (Participant 8)."

This indicates flaws in risk communication strategy and message delivery. The generic message regarding the earthquake risk and precautions ''drop, cover, and hold'' were delivered without considering the housing infrastructure fragility, resulting in the loss of lives. As a result, people question the credibility of the message provided by concerned agencies and do not take heed. Uncertainty arose from other aspects besides the information sources in a post-disaster recovery setting.

6.6.12. Uncertainty

Uncertainty related to earthquake hazard preparedness arises for different reasons. Uncertainty about a risk arises from the information sources (media and experts) provide to the public about a potential risk (Eiser et al., 2012). Experts also use their judgements to interpret the estimated risk that involves some level of uncertainty (Paton & McClure, 2013). Furthermore, ordinary citizens do not take information at face value but make judgements about its sources and interpretation (Slovic et al., 2004; Slovic & Weber, 2002). Also, uncertainty arises from the lack of knowledge and information on how and what to do during the recovery phase (Paton & McClure, 2013).

Interview participants 10 and 8 illustrated the uncertainty that they faced in the aftermath of the earthquake as:

"We went to a hotel for shelter and food during the crisis/earthquake. However, there was no space. It was damaged. We did not know where to go for safety. There was uncertainty about what to do? I guess this was the same for all the affected people in the

district and maybe we do not know much about it (earthquake) (Participant 10).'' ''However, it is essential to know whether this place and the house are safe or not (Participant 8).''

The interview data reflects the uncertainty about the response as people did not know what to do following a disaster. Uncertainty about the coping process hinders response and recovery: it also prevents preparedness for future events (Paton et al., 2014). Besides uncertainty, interview participants also demonstrated beliefs such as Gambler's Fallacy and fatalism.

6.6.13. Gambler's Fallacy

Gambler's Fallacy is the assumption that the recently occurred earthquake event would not happen for many years (Barron & Leider, 2010). In this study, interview participants reflected Gambler's Fallacy.

''At present, there are several discussions ongoing. I hear that the chance of a big earthquake in Nepal is one in 80 years. There are fewer chances of happening bigger events than this. The earthquake timeline shows that big events occur around once in 100 years, so there is no chance of another big event recently. This big earthquake also did not break down our house; if an event bigger than this happens only when there is the possibility of causing damage to the house (Participant 10).'' ''It (earthquake) may not occur again. I heard that a big earthquake occurred in the 90s also. After so many years this is another event. So it may not happen soon. There could be smaller events (Participant 7).''

The interview participants' experience of earthquake resulted in Gambler's Fallacy. People interpreted the risk posed by the unusual circumstances that emerged in the aftermath of the earthquake disaster, and identified strategies to reduce the uncertainty associated with it. However, people determine risk reduction strategies through their direct and indirect experiences, which are influenced by their judgemental biases (Slovic et al., 1979). Biases such as normalisation bias, unrealistic optimism,

gambler's fallacy, and fatalism could lead to miscalculation of risk that may result in unpreparedness (Paton & McClure, 2013).

6.6.14. Fatalism

When people experience an earthquake hazard, they not only demonstrate behavioural intentions to prepare, but they might also show the beliefs of fatalism (Paton & McClure, 2013). Fatalism refers to the conception that an earthquake and its consequences are beyond people's control and so they can do nothing to affect their risk of earthquake hazards (McClure, Walkey & Allen, 1999). Participant 8 elicited a fatalistic attitude as:

''If it (earthquake) happens, it happens, it is not under our control. One of my aunties said maybe this is our fate/luck (lekha). If fate is to die, then we will die (participant 8).''

This indicates that the direct experience of a severe earthquake hazard could explain fatalistic beliefs in people. The interview participant attributed the consequences of the earthquake to luck and disregarded the idea that damage and loss caused by an earthquake could be controlled. People with fatalistic beliefs attribute the impact of hazards on the nature of an earthquake, instead of building designs and other factors that increase exposure and vulnerability (Solberg et al., 2010). In addition to this, risk assessment of secondary hazards also influenced people's beliefs about preparedness.

6.6.15. Risk assessment

Risk assessment refers to the impacts of secondary hazards including landslides that interview participants experienced following the earthquake. An account of the interview participants views on secondary hazard risk assessment and its impacts are presented in Table 6.3.

Table 6.4. Interview participants' quotes about risk assessment

"We had a strong house built before this quake. What to do, it was under no one's control. A huge landslip has formed above the road that passes through the village down. This has an impact on our residential area also. We cannot use that house at present (Participant 1)."

"We are residing in a hilly area where heavy rainfalls in the rainy season. Our place (residential area) has slipped due to the recent earthquake. During the monsoon, flood and landslides might occur. However, we are not getting any support from outside. You can see a big trench formed just below the road; this happened due to the earthquake (Participant 3)."

Interview participants reported that landslides occurred due to the earthquakes. The landslides around their residential area made them vulnerable to floods and landslides that might occur during the monsoon (Table 6.3). The increased risk due to the secondary hazard prevented them from reconstructing their houses, making the residential location vulnerable. Consequently, they were demotivated to prepare (Section 6.4.16).

6.6.16. Unpreparedness

Unpreparedness or not preparing or unwilling to prepare are the outcomes of the decisions people made after experiencing the earthquake impacts and while coping with new needs and challenges. Participants were asked to what level of preparedness do they have or are they planning for. In response to this question, participant 9 provided an account of his thoughts as:

"Definitely, there is some level of preparation. However, issues are affecting this process. In our neighbourhood, there are other reasons for being not able to prepare for housing. Some have a financial constraint; some do not have the human resources to contribute when constructing the house. Moreover, it is expensive. Some could not receive the subsidy government is providing; some are waiting for the subsidy. Some conditions need to be met for getting a subsidy. Those who can and who have an urgency to construct, such as a household with a large family, children are grown and are in an age of marriage. If they have to marry their children, then housing is a priority.

Those who can afford to build the house are constructing it. While those household with family members are outside or do not have adult members (excluding old and children) are reluctant to construct the house and are still living in temporary houses/shelter (participant 9)."

From the above discussion, it is clear that people's decision to not prepare is influenced by personal circumstances and available subsidies from the government. As discussed above, factors such as uncertainty, information sources, gambler's fallacy, and fatalism prevented people from preparing.

6.6.17. Preparedness

Preparing at the household level is enhancing the capacity of the household to respond and recover from earthquake impacts (Chapter Two, Sections 2.3 and 2.4). During the interview, participants were asked what level of preparedness do they have or are they planning for. Participants' responses are recorded in Table 6.4.

Table 6.5. Participants' quotes about preparedness

"I am planning to build a new house during winter. In summer, we are busy in farming (paddy and maize cultivation and vegetable farming). Later on in winter, I am planning to build an RCC house (participant 1)."
"Household preparing means less damage and less damage means few people are moving to temporary shelters. It reduces the costs of reconstruction during post-event (participant 10)."
"If an earthquake occurs in near future this stuff (basic supplies of food, water, and medicine) is required to survive. If we have the required supplies and materials with us, we do not need to rely on others. In the village storing food is a general trend. People have subsistence farming. They produce for themselves mostly. Saving food crop for next year is common in our village. It is also used in critical times as was used during the earthquake (participant 11)."

Interview participants reflected that they are planning to rebuild their houses and arrange the basic supplies required to survive through a future crisis. However, as introduced above, factors such as hazard knowledge, hazard awareness, previous experience, attitude change, and anxiety influenced the preparedness process in the recovery phase.

As discussed above, people's experience of earthquake risk led to initial coping and motivation to prepare. However, several factors influenced the decision to prepare or not during recovery at the individual phase. The earthquake hazard decision-making process is social constructed (Chapter Two, Section 2.2., and Chapter Three). Previous research asserts that community and institutional processes influence household response and recovery in the post-disaster scenario (Chapter Three, Section 3.2). In Nepal, affected households might reflect community and institutional influence while responding and recovering from the impact of the earthquake. Therefore, community and institutional influence at the household level, during recovery, may further influence the preparedness decisions. Therefore, an analysis of community and institutional influence is vital to understand the preparedness process during post-disaster recovery better.

As illustrated in the earthquake hazard preparedness model (Chapter Five, Figure 5.4), the community phase is the first stage in which the influence of the social context on the individual decision making begins. In the following section, codes representing community efforts are discussed.

6.7. Collective Efforts

According to the model of earthquake hazard preparedness, people interact with significant others (family, neighbours, and community) to reduce uncertainty, and give meaning to the unusual social environment during recovery (Adhikari, Paton, Johnston, Prasanna & McColl, 2018). The process of interaction between an individual and a community is represented by community participation and collective efficacy in

the model. Qualitative findings have revealed processes and factors contributing to collective efforts. The presence of community participation and collective efficacy as collective efforts and other distinct elements in the analysis are discussed.

6.7.1. Collective coping and mutual obligation

Cognitive theories, such as PMT, discuss the individual's coping process, but not the collective dimensions of coping. When a natural disaster occurs, the impact spreads over a geographic location, and the communities living in the affected region suffer the consequences. In that context, people might operate collectively to respond and recover from the impact of disasters (Schwarz, 2014b). In Dhading, an increased uncertainty following the earthquake forced people to rely on family and community members to cope with and adapt to the impact of the earthquake. An account of the interview participants' description of collective coping is provided in Table 6.5.

Table 6.6. Collective coping and participants quotes

"After the houses fell apart, we thought it is essential to check people trapped in debris. We went to the village to ensure that if anyone is trapped in the debris. We then started to look for livestock. We took it out one of our cattle trapped in the shed. *Moreover, my father was sleeping in the house during that event; we also rescued him. On that day, we stayed outside on the ground. We lived together: I mean three to four families lived together in a shelter (Participant 2)."*
"After it (the earthquake) slowed down, we rescued people and livestock that were alive. One of our neighbour's father was beneath his house debris. Still, remember his hands hanging out of the debris. My daughter was also trapped. All the neighbours joined us, and we rescued them. Once the rescue was over, we then checked for the dead. It took almost three days to take out the dead bodies of animals and chicken and bury them in the pit. They were buried in a pit to prevent the epidemics that may occur due to decomposition of dead bodies (Participant 3)."
"At that time we had some processed rice in stock. We could use that rice for feeding ourselves and neighbours during the earthquake. We (12 households) shared that food. We stayed in one place, all of us on the road, as it is the open space here. We had to stay together as we did not have space to live (Participant 4)."
"We could not stay in the house. We brought all the stuff we could extract from home and put in that shed. We (my family and neighbours) made a temporary shed close to the road, and we stayed there for 5/6 days. All of the households were living on the road at that time. There were

three shelters on the road for this part of the village only. Around 20-25 shared the food we had. After 5-6 days all the foodstuff was somehow extracted. They also recovered the dead bodies and buried (Participant 7).''

''We were only three male adults in our neighbourhood including my father on that day. We brought all the women and children in the same place (Participant 9).''

The above views of interview participants reflect the notion that communities operated collectively, through the response to early recovery phases, following the disaster. Community members were involved in the search and rescue of the community members, arrangement of temporary shelter, and necessary supplies, e.g. food, water, debris, and clearance of the deceased. The collective effort also extended to recover stored food grains and valuable items from the debris. The community participation was evident in a collective coping process that was derived from a sense of mutual obligation, implicit in Nepali society.

In order to explore further why the affected communities carried out collective coping, the interview participants were asked ''why did they undertake collective coping?''

The participants responded that collective coping was a social obligation to their community, implicit in Nepali culture. Participants 11 and 6 express their views on why they performed collective efforts as:

''In the village when something critical happens to an individual people often help each other. Giving hands to others in need is usual here. In addition, the destruction from the quake was a common issue faced by the village. It was a mutual obligation to clear up the debris and make it better for a living (Participant 11).'' ''During the crisis working collectively was a way of being together. It was also a part of the mutual obligation to help each other in such a time (Participant 6).''

The affected households worked together as a community to address the issues that they encountered during response and early recovery. The participants acknowledged that their mutual obligation, implicit in the collectivistic nature of

Nepalese society, determined collective efforts for response and recovery. In a collectivistic culture, individuals are firmly bonded with their in-groups, ascribed by birth, emotional dependence, and shared duties and obligation (Hui & Triandis, 1986; Markus & Kitayama, 1991; Oyserman, Coon & Kemmelmeier, 2002). Individuals are entities in a social unit or group and are responsible for fulfilling the mutual obligation towards their group. The shared fate, goals and values derive from the social unit (Markus & Kitayama, 1991; Oyserman et al., 2002).

During the recovery phase, communities may engage their groups, networks, or other organisations to facilitate recovery processes, besides participating in collective coping. In the reconstruction period, the pre-existing or evolving social structures might facilitate affected community members to access resources and benefits from the social structures (Aldrich, 2011; Mulligan et al., 2012; Schwarz, 2014b; Shaw & Goda, 2004; Shaw & Sinha, 2003). An analysis of the social structures reveals the community competence, and social context is, therefore, essential to evaluate its influence on the post-disaster recovery.

6.7.2. Social structure

Many networks and organisations exist and operate in the study sites, and those networks and organisations that the interview participants mentioned for seeking social support are presented (Table 6.6). These organisations are categorised into natural resource-based organisations; saving and credits groups; cooperatives; local government; NGO, I/NGOs, and networks. These organisations existed in the study sites before the disaster and were functional to fulfil the specific needs and demands of the community in a typical situation (Table 6.6).

Table 6.7. Organisation types, names and their primary roles in a pre-disaster setting

Organisation types	Roles in pre-disaster
Natural resource-based organisations	
Integrated Pest Management group (Agriculture)	Farmers group to promote pest management using the organic substance and reduce the use of pesticides. The District Agriculture Office supports it. They promote integrated pest management for reducing the use of insecticides and pesticides in the vegetables and fruits. These groups are

	connected directly with the district agriculture office (DAO) that provides technical support and resources to implement the activities related to integrated pest management (IPM) in the district.
Community Forest User Group	Community Forest User Groups (CFUG) are autonomous groups that are registered in the department of forest and can operate independently for managing the public forest registered and handed over to group by the department of forest to protect, maintain and use. Community Forest User Groups (CFUGs) are linked directly to district forest office (DFO) for approval of CFUGs and monitoring of the programs that the CFUGs undertake in their forests to manage and utilise the forest products.
Water User Committee	Registered committee or network of community members living in a geographic location and concerned stakeholders for smooth maintenance of the drinking water services in that location. Water user committee (WUC) is a network of community members living in a geographic location and concerned stakeholders for smooth maintenance of the drinking water services in that location. WUC is linked with Village Council and FOCUS Nepal and indirectly associated with the Fund Board. WUC received the fund to execute drinking water program in Chainpur from Fund Board. FOCUS Nepal collaborated with WUC and Fund Board for this program.
Saving and credit groups	
Women's group	Women are organised into groups by VDC for awareness of health and hygiene, maternal health care training and adult literacy among women. In the study sites, FOCUS Nepal and HEIFER International have also formed women's group to implement the smallholders' goat and dairy improvement program. Women groups are associated with cooperatives. These groups can register as shareholders and purchase shares from the cooperative. Affiliation to cooperative allows group members to access loans without any collateral. These groups also promote savings and credit schemes for women members and regulate soft loan among group members. In addition, the group members serve as a self-help community by providing mutual support to each other during a difficult time. In Jeewanpur, women's groups have direct formal ties with VDC, Sana Kisan cooperative, and Lumanti Nepal while women's groups have an indirect relationship with GIZ and HEIFER international. Women's groups are financially and technically supported through FOCUS Nepal and Lumawanti Nepal for goat and dairy promotion by HEIFER International.
International non-governmental organisations (INGOs)	
HEIFER International Nepal	HEIFER International Nepal works in 30 districts of Nepal including Dhading for Strengthening Smallholder's Enterprises of Livestock Value Chain for Poverty Reduction and Economic Growth in Nepal (SLVC). Program delivery strategy: Partnership with NGOs (FOCUS Nepal in Dhading) and organising households through women's saving and credit groups (HEIFER International Nepal, 2016).
GIZ Nepal	Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ) implements projects mainly on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ) collaborates with Government of Nepal and concerned stakeholders to promote development programs in Nepal. The focus area is sustainable development, trade promotion and economic growth, earthquake recovery in Nepal (GIZ, 2017).
Local non-governmental organisations (NGOs)	
FOCUS Nepal	Forum for Community Upliftment System (FOCUS) Nepal, is an NGO based in Dhading district, the central region of Nepal and. The objectives of the organisation are community development and livelihood improvement through improved livestock and dairy. Collaborates with local government, communities and I/NGOs to identify development issues, e.g. drinking water

	and facilitates to put forward the community needs to the concerned stakeholders for facilitating the development activities in the district.
Lumanti Support Group for Shelter	NGO based in Kathmandu, working across all regions of Nepal. The main aim of this organisation is to reduce urban poverty through the improvement of housing and socio-economic conductions of the poor people living in urban areas. It works in community disaster risk reduction and community resilience.
Cooperatives	
Sana Kisan Sahakari Sanstha	Sana Kishan Sahakari Sanstha (Small farmers cooperative) owned and managed by small farmers for regulating saving, credits and insurance in agriculture.
Local government	
Village Council	Regulate development activities in the village under its jurisdiction. It is the smallest government unit to plan, implement, and monitor government-sponsored programmes. Also, it also monitors and regulates the development activities of other organisations, e.g. NGOs, INGOs, and communities in the village. Village Development Committee (VDC) before, now the Village Council.
Network	
WFC(Ward Citizen Forum)	Ward Citizen's Forum (WCF): WCF is a network representing all the political parties in the VDC acting as a watchdog in the VDC for ensuring quality development in the designated wards. WFC was created to ensure the representation of the public in the local government in the absence of local election for last 20 years. There are nine wards (smallest administrative unit) in a VDC. Representatives representing each ward is chosen and designated as a ward coordinator to monitor the development activities in the district. WCF constitutes representatives from each ward (smallest administrative unit) of the VDC. It played a role in planning, articulating the needs and demands of the ward to local government (VDC) via planning and allocation of resources. As district government use to allocate budget to VDC based on their plans and VDC has to regulate it to the respective wards. A representative; ward coordinators played the role to ensure the allocation of the resources to their respective wards.

Sources: Interview data, June 2017

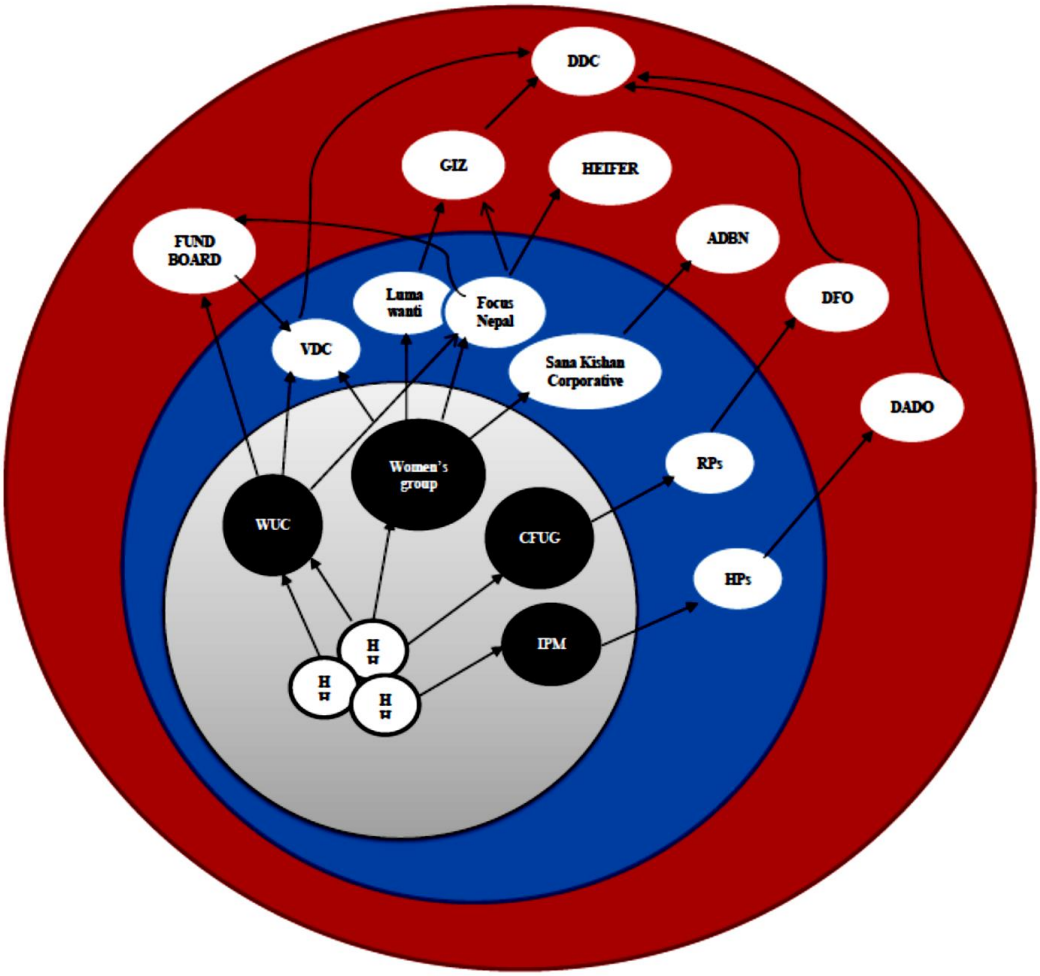

Figure 6.5. The relationship between different organisations and communities in Dhading.

Figure 6.5 shows three layers of the social structures existing before the disaster in the study sites. The first layer (grey colour) includes households and women's groups and natural resource base thematic groups. Households organise into community-based organisations (e.g. women's groups, water user committee, forest user group) to serve the basic needs such as health, sanitation, drinking water, and forest resources (timber, firewood, grazing land) of the community. In the second layer (blue colour) community-based organisations, local government branch (e.g. Range Post, Village Council), Sana Kishan cooperative, and NGOs (FOCUS Nepal and Lumanti Nepal) collaborate among themselves and with communities to address the contemporary issues of communities. In the third layer (red colour) local government

agencies and international donors including INGOs facilitate communities to address their issues, via local level government branches, NGOs, and CBOs.

While attempting to address their everyday demands and challenges, households organise themselves into collectives (CBOs, groups), and coordinate and collaborate with institutions working for the common interest of the households and communities (Figure 6.5). In Dhading, the Village Development Committee (VDC), local government agencies, and NGOs collaborated to facilitate CBOs and groups establishment for the smooth implementation of the development activities in the communities. The collaborative efforts have nurtured an intracommunity and community-agency relationship. However, the quality of this relationship determines the future collaboration and communication between community and agencies.

Unlike everyday issues, devastating earthquakes are unusual (Jordan et al., 2011). Communities rarely have the chance to interact with an extreme event and develop their understanding of such events (Paton & McClure, 2013). Consequently, communities have to draw on their everyday experiences and resources while dealing with such unusual situations (Paton, Jang, et al., 2015; Paton & McClure, 2013).

In Dhading, after the response subsided, early recovery activities and community activities resumed. Communities resumed their group activities to access resources and benefits readily available in the group. The activation of the groups ensured their participation in community activities, which helped to facilitate recovery. The revival of the group functions also enabled members of the community to access social support as mutual help and financial resources, which is discussed in the next section.

6.7.3. Social support

Social support is the interaction within the community members that serve as informal insurance with the availability of assistance (Norris et al., 2008). Social support is the help or support provided by the groups and community to the community

members. Interview participants expressed that CBOs and groups started to operate again after a few months. In Dhading, households or community members derived mutual help and soft loans from their groups (Table 6.7).

Table 6.8. Support derived from groups and participants quotes

Social support type	*Participants quotes*
Transportation of raw materials	*We provide manual labour, e.g. help each other to bring sand and stones from the river to the construction sites but not monetary help (Participant6).* *My group members volunteered to bring sand and stone from the river to the house for constructing the house (Participant 5).*
Household chores and farming	*We also help each other, e.g. if someone is sick, we support for household and agriculture work (Participant 6).* *We have a system to support if somebody is sick. For example, if a women member gives birth to a child, then she cannot work so we help her to carry out her household and agriculture tasks (Participant 5).* *Women's groups have established a trend to support each other mutually. During the earthquake also they supported each other for clearing debris and helping in farming (maize cultivation) (participant 11).*
Cash and kind donation	*In one of our members family in Kewalpur, we raised a fund of NRs 50 from each member and donated to her as cash support as her daughter died in the quake (Participant 6).* *One of our members lost her daughter and mother in law in the earthquake. In one of our meeting, we decided to support her, and we collected donations from the group members and supported her (Participant 8).*
Soft loan	*Women members can access soft loan money which supports them to pay children's school fees, buy medicine (Participant 8).*

Women's groups function as mutual support and cooperation and extended their services during the recovery period (Table 6.7). The social bonding in the form of women's groups enhanced the household capacity to recover. Group membership allowed households to access readily available human labour and financial resources within their group. Social bonding also limited access to and use of resources held by the group to the group only. It is important to note that group efficacy accrued from their experience of everyday issues enabled them to cope during the recovery. Besides the social support households and communities also accessed resources from the local government and development agencies.

6.8. Institutional Efforts

Communities which included women's groups had collaborations and formal linkages with government and other organisations, particularly development aid

agencies and cooperatives before a disaster (section 6.5). The pre-existing linkage enabled communities to access benefits and resources from these social structures. The organisations not only provided relief to the communities but they also had to their resume their programmes a few months after the disaster.

6.8.1. External support

The collaboration between different social structures and communities offered a conducive environment for access resources for reconstruction and recovery from the impacts of the disaster. The benefits and resources derived from different organisations are discussed in the next section.

Access to loans

The communities and women groups registered as shareholders with Sana Kisan Shahakari (small farmer's cooperative) were able to access a loan of NRs 100,000 (the US $1000). Participant 5 mentions:

"We can withdraw around NRs 100,000 from the cooperative (Sana Kisan) without putting anything collateral. 4/5 members have taken a loan, for constructing a house, and social activities such as the marriage of children, sending children abroad."

The affiliation of women's groups as shareholders of Sana Kishan increased access to the financial resources from external sources (from cooperatives-Sana Kisan) that contributed to cope with the challenge of rebuilding housing facilities during the recovery period. Further communities and women's groups' relationship with NGOs and INGOs also allowed them to access relief and other resources during the disaster.

Support from other organisations

Collaboration between women's groups, FOCUS Nepal, and Lumanti linked them indirectly with the HEIFER International and GIZ to resume development activities that were ongoing before the disaster (Table 6.6). This collaborative effort contributed

to households as they could receive the financial support to restart their goat keeping programme initiated by HEIFER international and FOCUS Nepal in the recovery period (Table 6.8).

The GIZ, in collaboration with Lumanti Nepal, distributed CGI sheets for constructing housing and relief materials, e.g. tents, blankets in the Jeewanpur VDC. Heifer International collaborated with FOCUS Nepal to deliver relief materials both cash and kind to the affected communities in the Chainpur VDC (Table 6.8). In Jeewanpur, the VDC worked through local women's groups. FOCUS Nepal, in coordination with WCF, VDC, HEIFER International, and community members organised and executed the relief support program. Also, CWIN and Action Nepal also provided some relief support to the communities (Table 6.8). Despite this, HEIFER International also supported the distribution of NRs 15000 (the US $150) cash to those households who lost their livestock by reintroducing their livestock again. Collaboration between FOCUS Nepal, Fund Board, VDC, and the water user committee facilitated the drinking water management in the post-disaster context This collaboration already existed, and a water management scheme was underway.

Table 6.9. Summary of relief and other support

Organisation name	*Support type*	*Items*	*Respondents reporting*
GIZ in collaboration with Lumawanti VDC and WFC	*Relief support* *Building material*	*Food, tents, blankets* *CGI sheets*	*Participant 2, 6, 1,7, 8* *Participant 6, 8, 9*
HEIFER International in collaboration with FOCUS Nepal, VDC, WCF	*Relief material* *Other support* *Cash*	*Blankets, tents* *Livestock (goat),* *Fodder seedlings* *NRs 15000/household*	*Participant 5, 7, 8,* *Participant 8,* *Participant 11, 10*
CWIN	*Material support*	*CGI sheets*	*Participant 11, 10*
Action Nepal	*Material support*	*Grain Seeds*	*Participant 11, 10*

Additionally, households also received external support from the central government and various organisations to facilitate the process of response and recovery following the disaster.

Central government support

During and following the disaster, the central government was actively involved in assisting the public. The capacity of the local government was overstretched or exceeded its limit to support the public. In Dhading, Nepal central government played a role in providing essential supplies, e.g. medicines, to the public or affected communities (Goda et al., 2015; Nepal Government, 2015). The support provided to the communities from the central government is summarised in Figure 6.6.

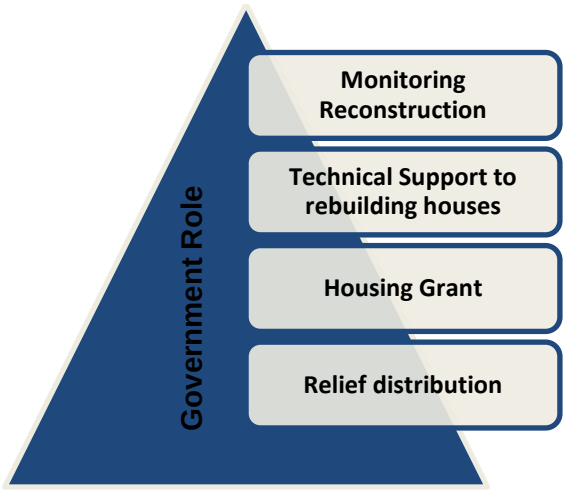

Figure 6.6. Role of central government in response and recovery in Dhading district

The central government also played a role to assess the needs of housing facilities through damage and loss assessment in the respective districts and villages through local government (VDC) in coordination with WCF (Ward citizen's forum). Technical staffs from DDC were engaged in loss and damage assessments and needs assessments in the communities (Nepal Government, 2015). The WCF members acted as a point for verifying the damage and needs of the households reported to the technical team (who were engaged in the survey). Affected households reported their loss of property, including livestock and any casualties, to the technical team. The WFC

members and neighbours verified the records in the field. The report was presented in the VDC. Furthermore, these demands were forwarded to the district government and further to the central government. Central government provided affected households to rebuild their houses a grant of NRs 50000 (the US $ 500) in the first instalment (Table 6.9).

Table 6.10. Central government support and participants quotes

Support	*Participants' quotes*
Basic supplies	*''After the quake there a small emergency health camp set up in the bazaar (market centre) that was operated under the command of Nepal army by Nepal Government. They provided us with medicines, sanitary stuff, e.g. detail, soaps for washing hands (Participant 9).''*
Damage and Needs Assessment	*''VDC in coordination with WFC facilitated technician and engineers from the district government to assess the damage and consequences of the earthquake in their respective wards. It provided information about the casualties, injured; damage caused and showed technicians the damaged areas and houses to assess the amount of damage. For example no of deaths, injured people, number of damaged houses and the status of the houses, the status of drinking water sources. WFC helped to collect information about damage and needs assessment to the VDC and concerned stakeholders (Participant 9).''*
Grant for housing reconstruction	*''Recently we received only NRs 50000 relief if we have received this grant during November (Mangsir) we might have done something. We cannot build a house with only 50000. For making a comfortable mud house also, it costs around NRs 800000-900000. Concrete Reinforced houses are better. This type of house would cost at least NRs 2000000. At present some of the people are constructing their houses while others are not able to do as they do not have enough money to construct it (Participant 1). We can renovate the house with that NRs 50000 and stay here.''* *''We obtained NRs 50000, and we had NRs 50000 cash, so we spent NRs 100000 for renovation (Participant 4).''*
Technical support	*At present VDC has sent engineers to evaluate the instructions people are following to construct the house before they provide the relief grant to build the house. People are using trained technicians helping to construct robust infrastructure (Participant 5).*

The provision of relief and other support from central government, local government, international aid agencies, NGOs, networks, and CBOs provided an empowering environment for communities and households to access resources for response and recovery efforts following the disaster. Moreover, the abilities of communities and households, and the process of service provision in the social structures resulted in trust and distrust.

6.8.2. Trust

The provision of social support within the community, and external sources, such as the entitlement to central government housing grants and technical support, promoted household integrity in those who were able to access these benefits (Table 6.7, 6. 8, 6. 9). This process further enhanced the persisting level of trust between the households and the government. Respondents 4 and 5 describe the sense of trust as:

‘‘They (VDC/local government) are the right unit to enforce the building codes and regulatory mechanisms. For example, at present VDC has sent engineers to evaluate the instructions people are following to construct the house before they provide the relief grant to build the house (Participant 5)."

Moreover, ‘‘For constructing the house, we are seeking advice from the VDC engineer and technicians (Participant 4).’’

The level of ongoing trust between community members and concerned agencies enhanced the current behaviour and actions. Enhanced levels of trust form a basis for future transactions and communications between the community and concerned agencies. Trust is developed from previous relationships and transactions between the concerned stakeholders (Paton, 2008; Paton & McClure, 2013).

6.8.3. Distrust

In contrast, the opportunity to access resources or benefits from the groups was limited to group membership, which prevented some of the households from accessing

the benefits from the groups. Similarly, the process needs assessment could not ensure the representation of all the affected households in the needs assessment report. Some of the households were excluded during the needs assessment survey. The conflicting interest of the WFC ward representative and the household and property ownership led to their exclusion. A father owns the house and property of his extended family, although the sons are living in a separate house. All the houses owned by the father are recorded as a loss of one household.

Participants 1 and 9 illustrate their experience of distrust as:

"In the victim's list, we are seven brothers, but we were recorded as one family. We were separately living with our parents for the last 19/20 years. We were recorded as one family as we did not have a legal division of property and ownership of the house (Participant 1)."

"In those wards (smallest administrative unit) where the WFC coordinator and people had a good relationship, they insisted on registering the single joint family house also as multiple houses. While in wards where the coordinators were neutral, the households who did not have property papers were excluded in the registration. The grant from the central government to renovate the house has been provided to most of the households. Only those were left out those who do were in a joint family and have made the claims that they live separately. In our neighbourhood twelve households who did not receive the grant, they have received other supports (Participant 9)."

The process created a sense of alienation in those households who were not entitled to the social support both in group and external sources, like a government grant, due to either lack of membership or exclusion from entitlement as a result of property ownership issues: this resulted in distrust. The illustration of distrust in the government is expressed by respondent 1and 3 as:

"VDC is not reporting or publishing who has received the grant which has not received from the public. All the people have suffered so all should get the support

(Participant 1)" "We do not get any information what is happening. We have not received any advice about how to prepare from VDC either (Participant 3)."

This indicates that lack of entitlement to housing grants and the limited communication between the VDC and the community members resulted in a feeling of alienation. Although trust results from the quality of prior relationships and communications between two parties (Mayer et al., 1995; Paton & McClure, 2013), the current transactions of behaviour and actions could result in trust and distrust.

6.9. Chapter summary

The findings of the qualitative analysis reveal the decision-making process regarding earthquake hazard preparedness, response, and recovery efforts of people at individual, community, and institutional level during the post-disaster recovery context. Multiple factors at the individual, community, and institutional level contributed to deciding to prepare or not for a potential future event.

At the individual level, the experience of the earthquake risk prompted initial coping. Factors affecting safety goals, protection, survival, physical protection, and sustenance influenced the response and recovery efforts; and influenced the motivation to prepare for a future event. Furthermore, factors such as hazard knowledge, hazard awareness, anxiety, and change in attitude influenced the relationship between recovery and preparedness. In contrast, people also developed beliefs such as fatalism, Gambler's Fallacy, and uncertainty, which hindered people from engaging with recovery and preparedness.

At the community level collective coping a new factor was evident implicitly associated with the Nepali socio-cultural context. Social support generated from the social structures (groups, networks) facilitated response and recovery in addition to collective coping. Collective coping and mutual reciprocation help among group members and are reflected in community participation. The ability of groups and

networks to resume their activities and continue to function during the recovery period reflects the collective efficacy or community competence. The communities, groups, and networks not only resumed their activities, but they also coordinated with the external organisations they were collaborating and involved with for conducting developing activities before a disaster.

At the institutional level, the pre-existing linkage between different social structures (communities, groups, committees, NGOs, INGOs, local government) resumed following the disaster and offered an empowering setting for households and communities to better access resources for response and recovery. However, the provisions and process of accessing resources enabled some households to benefit from the resources while preventing others from accessing the same: this resulted in trust and distrust, respectively.

The findings provide valuable insights into the people's reasoning process for responding to and recovering from the impacts of the earthquake disaster. The data also showed that interplay of multiple factors contributes to deciding whether to prepare or not for an earthquake hazard. However, the current analysis does not explicitly reveal the relationships between these factors and the reasoning process behind the decisions. Therefore, a systematic analysis of people's reasoning process behind the decisions is conducted in Chapter Seven.

Chapter 7: Earthquake Hazard Preparedness Decision-making Analysis using Means-End Chain Theory

7.1. Introduction

This chapter discusses the relationships of the elements (codes) identified in Chapter Six. It provides a bridge between the qualitative data in Chapter Six and theory to understand the preparedness-recovery relationship better. The quantitative model of earthquake hazard preparedness explains that people at risk must accept that they are at risk and choose the best coping option available when deciding to prepare (Chapter Five). Deciding to prepare is the desired outcome for attaining increased safety value. However, people tend to consider the immediate outcome ‘’preparedness’’ although ‘’safety’’ from disasters is a desired goal for preparing, to reduce the risk of a hazard. The safety goal is implicit in the model. Moreover, earthquake hazard decision making is a social process discourse in the community, and the institutional arena influences the intentionality to prepare, which in turn affects the consequences and underlying safety goals (Paton & McClure, 2013).

The qualitative component of the research introduced in Chapter Six extends the findings of the model by revealing the critical features of the social context influencing response and recovery in Nepal. The findings provided insight into the reasoning process underpinning people’s decisions for responding to and recovering from the impacts of earthquake hazard. The findings also highlighted that multiple factors contribute to deciding whether to prepare or not in a recovery setting. The analysis revealed the underlying social structural factors implicit to socio-cultural characteristics of Nepali society, such as mutual obligation and survival, as contributing

to collective efforts. However, the analysis does not explicitly expose the relationship between the social contextual factors, or the reasoning process underlying the decisions people make when adapting to the recovery context. Therefore, a closer examination of the post-disaster recovery context that influences people's decisions to respond and recover is vital.

The present chapter builds on the qualitative findings of Chapter Six, to identify the association between people's behaviour (attribute), consequences of the behaviour (consequences), and their safety goals (values) are explored using Means-End Chain (MEC) Theory. This systematic analysis further strengthens understanding of the critical role of social context governing people's behaviour that informs the recovery and preparedness relationship and thus the concept of building back better. It is essential to capture the features of the post-disaster recovery to provide content for discourse on natural hazard issues and inform future cognitive theory development in natural hazards.

In this chapter, Section 5.2 covers data analysis process. Section 5.3 presents the findings of the data analysis using MEC, and the last section covers the discussion.

7.2. Data Analysis Process

The MEC theory identifies the association between the attributes (behaviour and actions), consequences of attributes (outcomes of behaviour and actions) values (end goals) of people (Bagozzi & Warshaw, 1992; Gutman, 1982). It assumes that people perform actions/behaviours with the expectation of getting a desired outcome/consequence (Gutman, 1982). Attributes are the behaviours demonstrated as actions by the survivors (of earthquakes), or people associated with services, resources, and assistance, based on their experience (Gutman, 1982; Reynolds & Gutman, 1988). Consequences are the outcomes accrued from the behaviour or actions of people. These outcomes are the benefits of acting to reach the desired goal (Gutman, 1982). The desired outcomes are argued to be driven by the end goals or

values people inherit from socio-cultural practices (Pieters et al., 1995; Woodside, 2004). However, the principles or values may vary by the socio-cultural values of the society (Oyserman et al., 2002). The values are argued to be in the subconscious mind of the people, and thus people may not be aware of these values while making decisions (Bagozzi et al., 2003a). As a result, people consider consequences when choosing actions (Bagozzi et al., 2003a; Woodside, 2004).

The MEC theory is used to analyse linkages between each code from the qualitative interview data (Chapter Six). In this chapter, the codes are called elements based on the MEC terminology, which refers to codes as elements. The exploratory analysis, using open and axial coding, provided twenty-seven main codes or elements (Chapter Six). The axial coding process provided an idea of the relationship between the codes. However, it is essential to identify the relationships of each element to another, in order to explicitly explore the mediating effects of social contextual factors on people's decisions to respond and recover. Therefore, the raw data of each interview participant was re-analysed again following the step outlined in Figure 7.1.

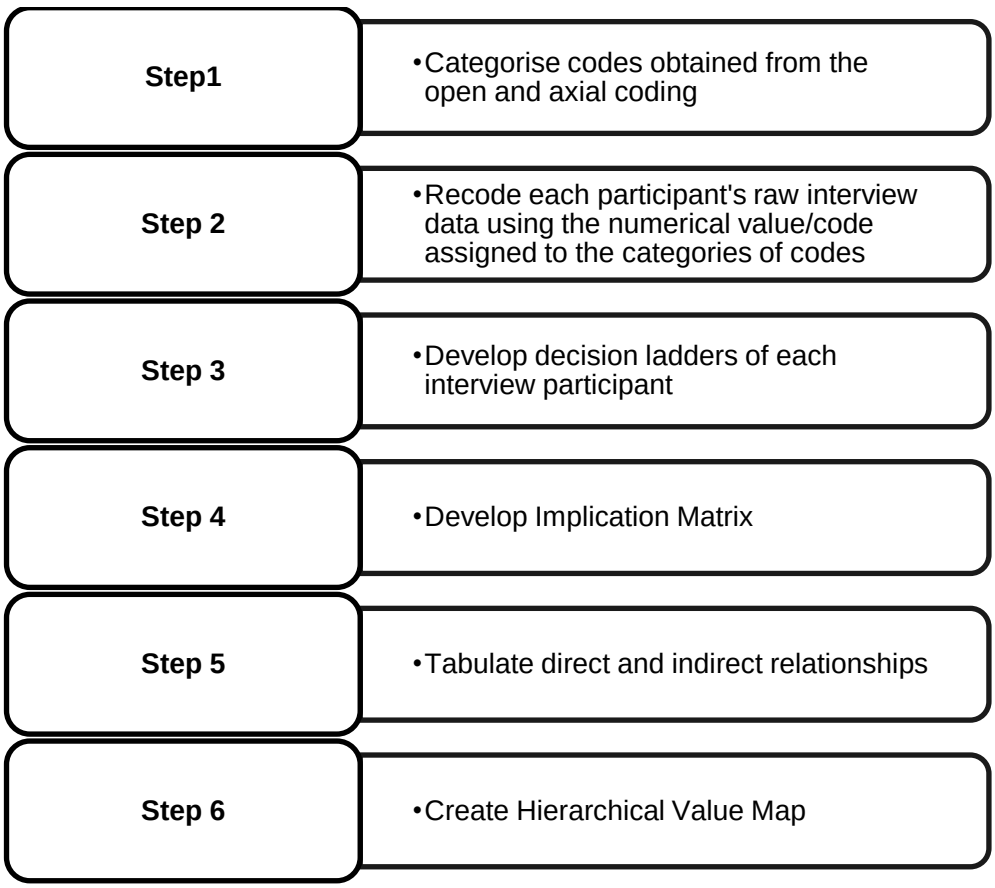

Figure 7.1. Data process steps for developing hierarchical value mapping.

Step 1: Categorise codes obtained from open and axial coding

The same data sample used for the qualitative analysis in Chapter Six is the data source for this analysis. According to the MEC, the 27 codes or elements generated from the open and axial coding were categorised into an attribute (A), consequence (C) and value (V) for assessing the linkage between values, consequences and behaviour/actions. After assigning the elements to A-C-V groups, each element was assigned a number to further re-code the individual interview data as illustrated in Figure 7.2.

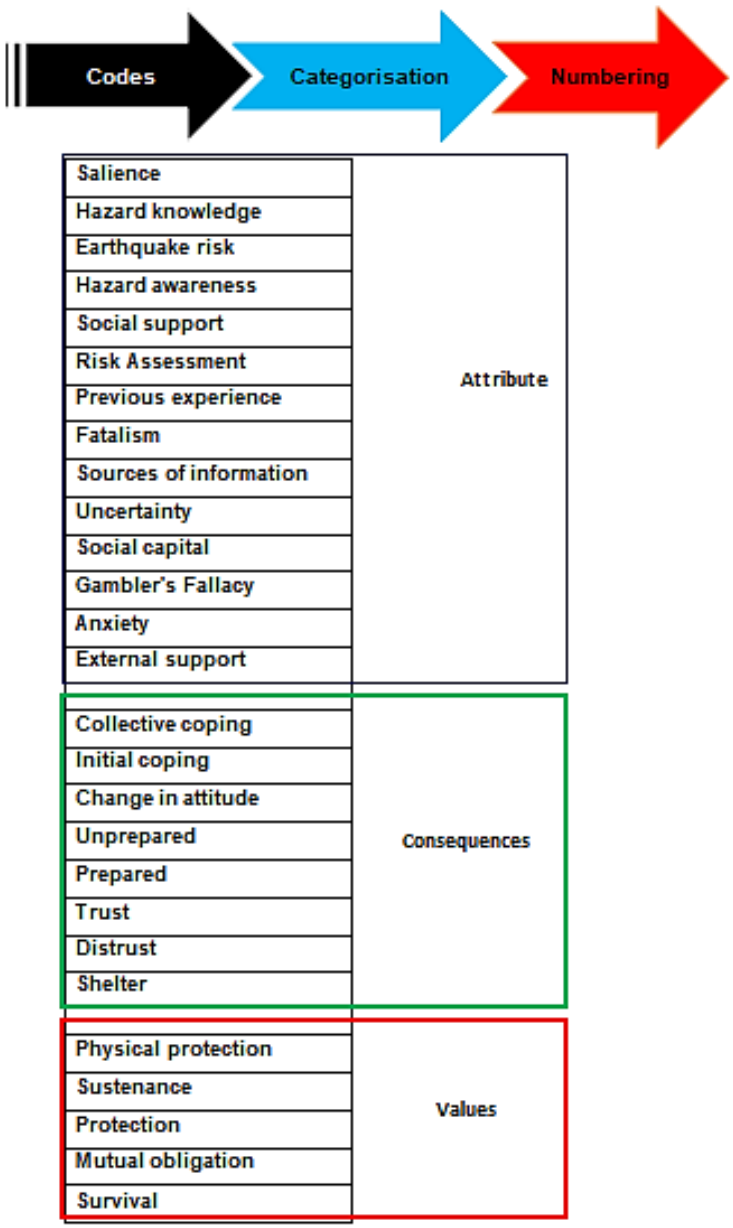

Figure 7.2. Code categorisation into attributes, consequences and values.

Step 2: Recoding each participant's interview data

Each interview participant's raw data was re-coded again, using the number assigned to each element, to extract the linkage between elements: values, consequences and attributes. For example, collective coping is the code representing the consequence (C) and has been assigned number 15. In Figure 7.3, the raw data "*my father rescued all other members who were in another house*" is coded under sub-code rescue and then that sub-code is coded under the code collective coping. So the

sentence is assigned numeric code 15. All the raw interview data was re-coded into an attribute, value, and consequences categories, following the same process as given in Figure 7.3.The re-coded raw data for each participant in appendix C.

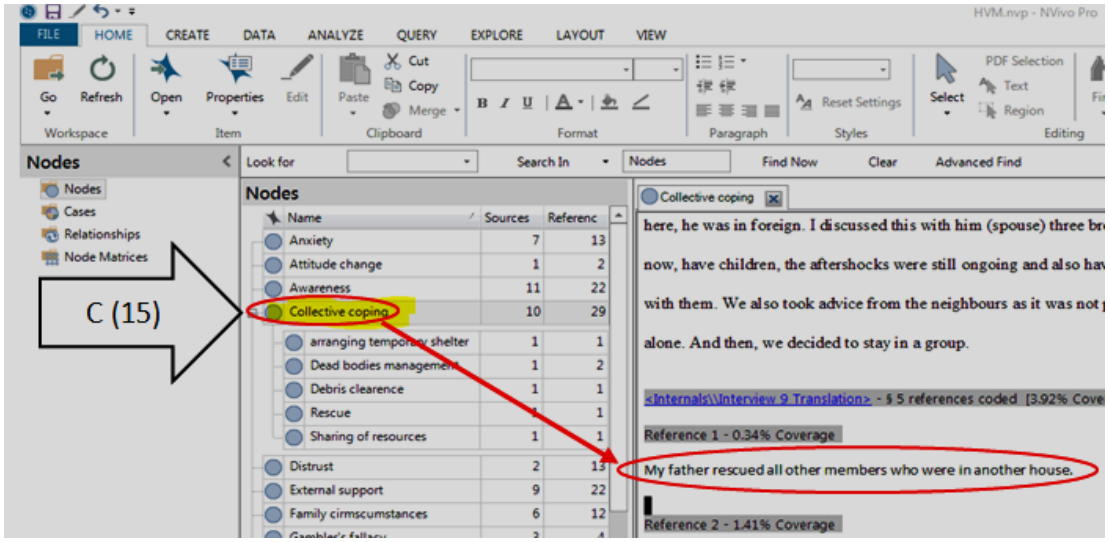

Figure 7.3. The process of re-coding raw data into attribute, values and consequences.

Step 3: Develop decision ladders for each interview participants

The ladder is the relationship between individual elements (Gutman, 1982). After re-coding the raw data, ladders representing the decision-making process of each interviewee's data were constructed (Appendix C). As shown in Figure 7.4, a sequence of reasoning process for arriving at a decision was established to develop a ladder of collective coping. Interview participant 3 expressed his experience of earthquake consequences (assigned numeric code 3) that lead to the rescue process (rescue is a collective coping-allocated numeric code 15). After further inquiry regarding why rescue was essential, he stated that rescue was a part of mutual obligation (which is allocated numeric code 26).

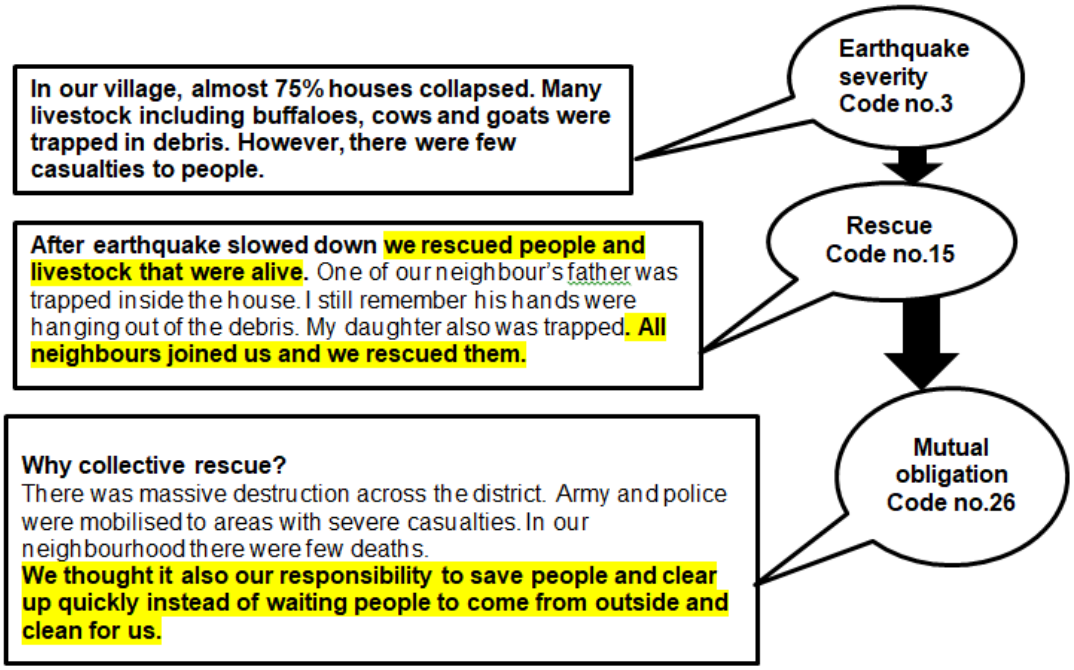

Figure 7.4. Data coding and laddering process.

Each interview data yielded multiple ladders. Data from 11 interviews yielded 91 reasoning ladders. The number of ladders in each interview ranged from seven to 10 ladders. Within each of these individual data sets, the number of elements contained within a ladder ranged from two to five. All the ladders of individual participants were tabulated in an implication matrix (Appendix C).

Step 4: Developing implication matrix

An implication matrix is a square table displaying the number of times each element leads to each other element (Gutman, 1982; Reynolds & Gutman, 1988). An implication matrix was constructed for assessing the frequency of relationships from the individual raw data ladders (Appendix C). All 27 elements were cross-tabulated to display the number of times each element leads to another element. A summary of each row and column was calculated to identify the frequencies of direct and indirect relationships. Estamiting the frequency of relationship requires counting the elements present in each ladder. However, the question arises whether to count each mention of the relationship among elements that an individual respondent makes or to count a

relation only once for each respondent. As suggested by Gutman (1982) the relationship was counted once in a ladder. An implication matrix provides a direct and indirect relationship between elements.

Step 5: Tabulate direct and indirect relationships

A summary of all the direct and indirect relationships was drawn from the implication matrix (Table 7.1). The direct relationship is the linkage between two elements without a mediator in between while the indirect relationship is the association of one element to another element through a mediating element (Bagozzi et al., 2003a; Gutman, 1982). For example, collective coping leads (arrows emerge from collective coping) to other elements 12 times directly and to other elements indirectly five times. Similarly, other elements lead 24 times directly and 15 times indirectly to collective coping (Table 7.1).

Table 7.1. Summary of direct and indirect relationships

	Elements	To another element Direct: Indirect	From another element Direct: Indirect
Values	Survival	0:00	5:05
	Protection	0:00	15:11
	Mutual obligation	0:00	7:06
	Sustenance	7:00	12.13
	Physical protection	4:00	5:02
Consequences	Shelter	3:00	8.06
	Distrust	0:0	6:06
	Trust	2:01	5:06
	Prepared	8:03	10:12
	Unprepared	3:02	6:04
	Collective coping	12:05	24:15
	Initial coping	8:05	7:02
Attributes	External support	10.02	13:02
	Social support	8:03	7:00
	Change in attitude	3:01	2:00
	Gambler's Fallacy	1:00	2:01
	Social structure	15.15	1:00
	Uncertainty	2:00	2:00
	Fatalism	0:00	0:00
	Risk Assessment	5:03	5:01
	Awareness	12:08	4:01
	Anxiety	4:01	4:00
	Risk perception	28:16	18:01
	Previous experience	16:12	0:00
	Source of information	3:02	0:00
	Hazard knowledge	6:04	4:00
	Salience	13:11	0:00

Step 6: Hierarchical Value Mapping

Hierarchical Value Map (HVM) is a graphical representation of the cognitive structure of interview participants (Gutman, 1982; Pieters et al., 1995). It extends MEC by providing an ability to represent the data in a loop. It provides a structural component ordered in a sequence of behaviour or attributes, consequences, and values to qualitative data (Reynolds & Gutman, 1988). The HVM reveals the reasoning process that people follow to make individual decisions. As discussed in step 3, ladders, generated from the reasoning process an individual follows to reach a decision, represent some aspects of cognitive structure specific to that individual. The cognitive structures are interrelated sets of relationships, obtained by integrating all the cognitive ladders of eleven interview participants (Pieters et al., 1995; Reynolds & Gutman, 1988). The implication matrix represents all the cognitive structural categories resulting from the coding process. The non-empty cells of the implication matrix show the link between cognitive categories (Appendix C). The implication matrix consists of many non-zero cells; in this case, in a 27x27 implication matrix; there are 729 cells, and out of them, 120 cells are active (non-zero cells). It is essential to identify the essential links between the elements represented in these cells by using the cut-off point (Gutman, 1982; Pieters et al., 1995). It may not be feasible to plot all the relationship in the HVM. Using all the possible relationships produces a cluttered map (Gutman, 1982). The cut-off value gives the minimum cell entry in the implication matrix required for representing a relationship in the map. Pieters et al. (1995) suggested estimating a concentration index: the percentage of links in a given implication matrix that are retained at a given cut-off value divided by the percentage of cells in the implication matrix retained (Pieters et al., 1995).

Table 7.2. Cut-off value estimation

Cut-off point	Number of active cells	The proportion of active cell to the total number of cells	The proportion of active cells to total cells mentioned at least once	Number of active linkages	Number of active linkages as a proportion of all linkages
Direct relationships					
1	120	0.17	1.00	174	1.00
2	39	0.06	0.33	129	0.74
3	23	0.03	0.19	101	0.58
Indirect relationships					
1	55	0.08	1.00	94	1.00
2	22	0.03	0.40	60	.64
3	10	0.01	0.18	38	0.40

Note: total number cells in 27x27 matrix= 729, total cells =702 excluding diagonal cells

According to Pieters et al. (1995), there two principles for selecting a cut-off point. First, plotting all the linkages for a cut-off point and identifying an elbow in the graph. The second is to compare the percentage of active cells to the percentage of the connections and choose the cut-off point to represent the most significant number of connections. As shown in Table 7.2, the percentage of active cells (column 4) to the percentage of linkages (column 6) was compared for drawing the HVM. The cut-off point 2 contains 74% of the linkages (column 6) with 33% of active cells for direct relationships while 40% of active cells retain 64% of the relationships for indirect relationships. Therefore, cut-off point 2 was used to draw intended HVM for this study, which is the outcome of the Means-End Chain Analysis and findings depicted in a graphical map (Figure 7.5).

The hierarchical value map (Figure 7.5) comprises attributes, consequences and values related to response and recovery efforts that households underwent after the 2015 Nepal earthquake and households' decisions to prepare for future earthquake events informed by their experience of the response and recovery efforts. Furthermore, it also shows the community and institutional process that influenced household response and recovery, and thus households' decisions to prepare for future events.

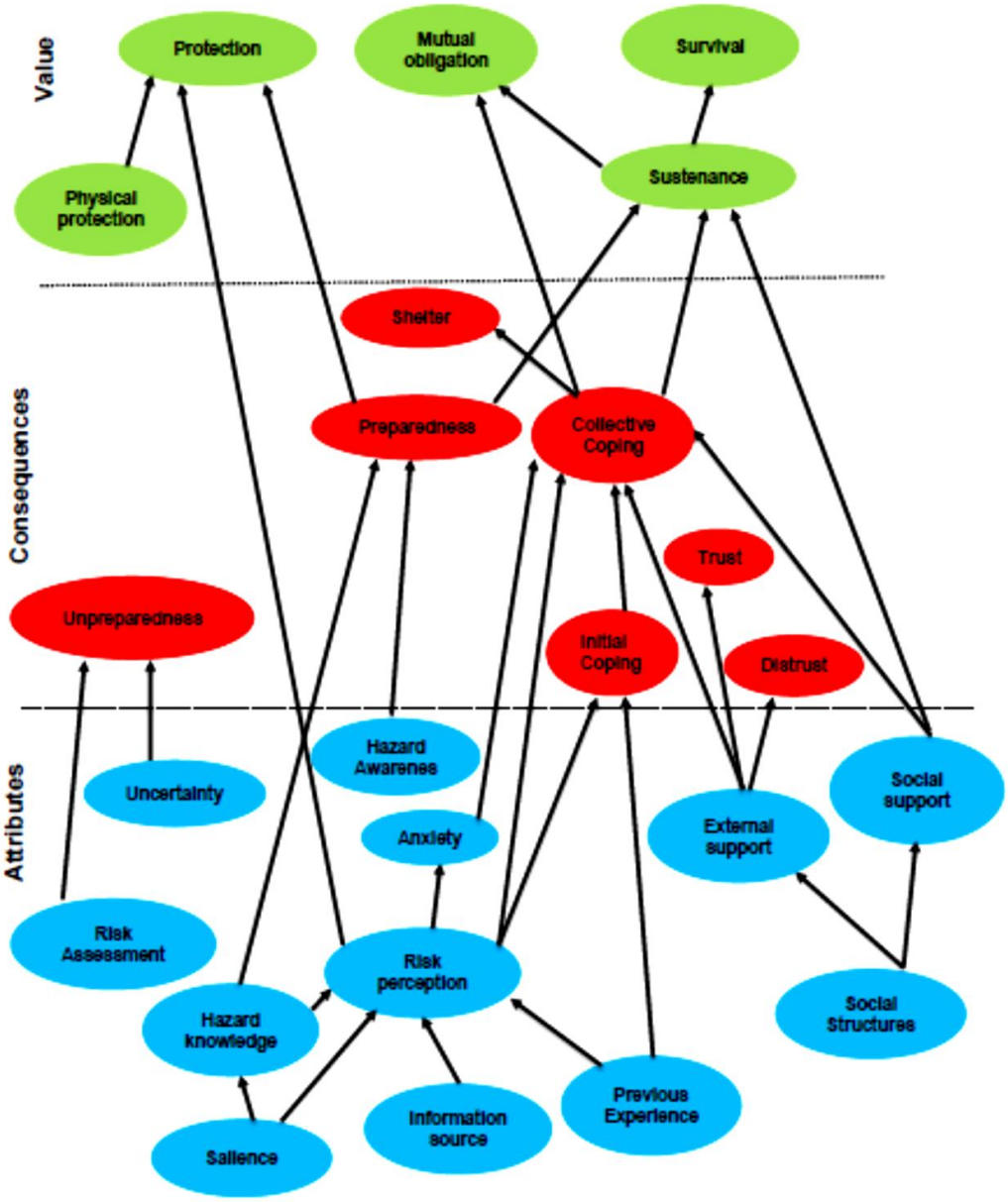

Figure 7.5. Hierarchical Value Map of earthquake hazard decision.

7.3. Findings

The HVM provides insights into the cognitive structure of an individual's decision making and enables the research to conclude the underlying motivation behind the specific decision and behaviour (Pieters et al., 1995; Reynolds & Gutman, 1988). In an HVM, each path is considered as a representation of the interview participant's MECs which implies the correlation of motivational aspect and the

relevance of behaviour. Data analysis resulted in attributes, consequences, and values (Table 7.1). The attributes, consequences and values are interpreted using the HVM (Figure 7.5), and summary of direct and indirect relationships (Table 7.1) in the following sections.

7.4. Attributes

In earthquake hazard decision making, attributes refer to behaviour demonstrated as actions of people related to decisions for responding and recovering from the impacts of the earthquake (Reynolds & Gutman, 1988). The behaviour or actions of people may be tangible and intangible. For example, fixing the house, securing furniture, and storing food are tangible actions; while hazard knowledge and awareness, risk perception, and the previous experience of hazards are abstract behaviours. Previous experience, the importance of preparing, hazard knowledge, earthquake risk, hazard awareness, risk assessment, anxiety, fatalism, information sources, uncertainty, social capital Gambler's Fallacy, anxiety, change in attitude, social support, and external support, are all identified as attributes.

7.4.1. Previous experience

Previous experience is an essential element in the HVM with 16 direct and 12 indirect relationships emerging from it and leading to earthquake risk and initial coping (Table 7.1). The relationship between previous experience and earthquake risk explains the critical value of direct previous experience to better understand the severity of consequences (loss and damage), the probability of threats (aftershocks), and initiate initial coping to protect themselves (initial coping discussed in 7.5.1). Furthermore, an increase in understanding of consequences of earthquakes allows respondents to make realistic inferences about the risk of a potential event. Prior experience allows people to adjust their judgements regarding earthquake hazard (Slovic et al., 1979). Previous experience leads to an increase in respondents'

perception of risk (Heller et al., 2005; Helweg-Larsen, 1999; Russell et al., 1995). However, an increase in perception of risk may not culminate into preparedness (Johnston et al., 1999).

7.4.2. Hazard knowledge

Hazard knowledge is another element represented in the HVM (Figure 7.5) that mediates the relationship between earthquake risk and its importance. The mediating relationship demonstrates the role of hazard knowledge in making risk judgements. As discussed in Chapter Six (Section 6.6.5) hazard knowledge derives from the experience of earthquake consequences, which further allowed people to realise the imminence of earthquake, but also contributed to their acknowledgement of the need for secure housing structures to protect them from future events. Hazard knowledge is an essential factor to motivate people to prepare (Lindell & Whitney, 2000).

7.4.3. Information sources

Information source is another attribute connecting to risk perception (Figure 8.5). The linkage from information sources to risk perception reflects the role of information sources in shaping people's risk perception during recovery. People rely on different information sources to estimate their risk (Becker et al., 2012; Kirschenbaum et al., 2017). The respondents relied on direct and indirect sources of information to estimate risk. Before the 2015 Nepal earthquake, the respondent accessed information about what to do in case of an earthquake on radio and television (Chapter Six, section 6.6.8). The general information of the safety delivered through radio and television (e.g. drop, cover, hold) proved useless due to structural fragility. It claimed the lives of children and people who followed the safety information and stayed inside houses or went under the table for protecting themselves (Chapter Six, section 6.6.8).

People gather information from different sources to reduce the uncertainty of an earthquake hazard. Generally, they filter the information before using it. However, it is also necessary to consider the relevance of the information for a given context. The

general information on earthquake safety ‘drop, cover, hold’ is a global message delivered in all parts of the world. However, the practice of drop, cover, and hold in a fragile structure could not reduce the risk of the earthquake, and instead threatened the lives of people.

7.4.4. Salience

Salience, in this context, is the importance of preparing and is an essential element in the HVM (Figure 7.5). Arrows emerging from salience to other elements are 13 direct and 11 indirect relationships (Table 7.1). Salience is linked to hazard knowledge and risk perception directly. The interview participants appreciated the usefulness of preparing that derives from the experience of the earthquake consequences (Chapter Six, section 6.6.13). The direct experience of loss and damage from an earthquake has set forth the salience of earthquake issues and thus provided an impetus to prepare. Previous research supports this finding (Heller et al., 2005; Mileti & O'Brien, 1992; Russell et al., 1995).

7.4.5. Risk perception

Risk perception is the element with the highest direct and indirect relationships emerging from it to other elements (Table 7.1). In the HVM loop arrows emerge from risk perception to another element directly 28 times and indirectly 16 times while arrows from other elements to earthquake risk converge 18 times directly and one time indirectly.

In the HVM risk perception emerges from the previous experience, information sources, salience and hazard knowledge (Figure 7.5). The direct experience of the consequences and aftershocks that the respondents felt following the 2015 Nepal earthquake led people to realise the imminence of the earthquake risk (Chapter Six, Section 6.6.2). The experience also allowed people to identify the relevance of information sources, and acknowledge the need for preparedness (salience of preparedness) about their perception of risk (discussed in the above sections).

Risk perception leads to anxiety, initial coping, collective coping and protection. The relationship between risk perception and these elements is discussed in the following sections.

7.4.6. Anxiety

Anxiety is another element in the HVM (Figure 8.5). The anxiety element represents emotions and feelings people may demonstrate when they experience an earthquake event (Paton & McClure, 2013). It emerges from risk perception and connects to the collective coping (Figure 7.5). The arrow emerging from risk perception to anxiety highlights emotion and feelings of people resulting from the loss and damage (consequences) and aftershocks (Chapter 6, section 6.6.3). Furthermore, anxiety arising from the experience of consequences and aftershocks leads to collective coping. The degree of feelings and emotions or concerns about an earthquake risk facilitates risk acknowledgement and is a determinant of preparedness (Dooley et al., 1992; Rogers, 1975; Russell et al., 1995; Rüstemli & Karanci, 1999). However, people also need to realise their efficacy to reduce threat (Mulilis et al., 1990; Mulilis & Duval, 1995; Mulilis & Lippa, 1990). If people perceive that they can reduce the risk, then they would approach for an adaptive response (Duval & Mulilis, 1999; Mulilis et al., 1990; Paton & McClure, 2013).

7.4.7. Hazard awareness

Hazard awareness or awareness of the hazard consequences is one of the elements in the HVM (Figure 7.5). Hazard awareness is linked directly with preparedness. The direct experience of the consequences of the hazard has provided the respondents with an opportunity to personalise the risk and reflect on the preparedness options available ‘‘thinking and talking’’ about taking precautions in case of another event’’ with their family members and the neighbourhood (Chapter Six, Section 6.6.6). Respondents’ awareness of the hazard risk and preparatory measures at their disposal contribute to preparedness (Lindell & Perry, 2012). The ‘thinking and

talking' process initiated in families and neighbourhoods allows people to realise that earthquake hazard risk is a critical issue for them, and thus motivate people to adopt protective behaviour (Dalton et al., 2001; Paton et al., 2005). However, translating awareness to preparedness is contingent on the resources available to adopt preparation, and the ability and willingness to adjustment adoption (Lindell & Whitney, 2000; Mulilis et al., 1990).

7.4.8. Risk assessment

Risk assessment in this analysis refers to the assessment of the risk of secondary hazard. In the HVM arrows emerge from risk assessment five times directly and three times indirectly towards other elements. Similarly, arrows also converge five times directly and only once indirectly to risk assessment from other elements (Figure 7.5). The previous experience of earthquake hazard, the salience of preparing, and hazard knowledge contributed to the assessment of secondary hazards. However, the linkage between these elements and risk assessment is not evident in the HVM as they did not reach the cut-off threshold.

Following the earthquake consequences, issues of landslip prevalent in the study sites rendered residential area inappropriate for a living (Chapter Six, Section 6.4.7). Landslip hazards that occurred following the earthquake influenced the risk perception and preparedness of people. Additionally, people encountered uncertainties that might have prevented them from preparing.

7.4.9. Uncertainty

Uncertainty is another element in the HVM (Figure 7.5). An arrow from uncertainty emerging towards unpreparedness indicates that uncertainty posed by the direct exposure of earthquake consequences leads to unpreparedness. The earthquake risk that the respondents were exposed to create uncertainty about what to do and how to respond (Chapter Six, Section 6.6.9). The linkage between earthquake

risk and uncertainty is not shown in the HVM as it could not research the cut-off value threshold of 2.

In natural hazards, uncertainty arises from the nature of a hazard (low earthquake frequency but high impacts), people's construal of hazard behaviour (intensity, the severity of loss and damage), and the judgements they make by their interpretation of risk (Paton & McClure, 2013). In this analysis, uncertainty arose from a lack of knowledge of what to do to respond. People's uncertainty was also influenced by social processes, as people turn to others to interpret the risk and impose the meaning on the context (Blumer, 1986).

7.4.10. Social structure

Social structure is an element representing the formal and informal organisations and institutions and their quality of relationships before the earthquake disaster. Social structures such as natural resource-based organisations; women's groups, NGOs, Heifer International, GIZ, and Chainpur Water User Committee and Ward Citizen's Forum (WFC) were present in the study sites before the disaster and were functional to fulfil the specific needs and demands of the community in a typical situation (Chapter Six, Section 6.7.2).

The HVM depicts two arrows emerging from the social structure and converging to social support and external support (Figure 7.5). These social structures provided social support and external support to the affected communities.

7.4.11. Social support

In the HVM arrows emerge from social structure to social support while arrows from social support lead to collective coping and sustenance. Social support is the help or support (resource, moral support, physical support) provided by the groups and community to their members (Chapter Six, section 6.6.3). After the response subsided, early recovery and community activities resumed. The revival of the group functions enabled community members to access mutual reciprocal help in the reconstruction of

houses, farming, soft loans, and meeting places for sharing of issues among the group members (Chapter Six, Section 6.6.3) in Dhading. Social support derived from the groups and networks facilitated community and household recovery. However, the ability of households to access social support was determined by their prior affiliation to the group and network membership.

7.4.12. External support

Communities and households had collaborations and formal linkages with local government, development aid agencies, NGOs, networks and cooperatives before a disaster in Dhading (Chapter Six, Section 6.7.1). Development aid agencies (HEIFER and GIZ) provided the affected communities within their programme areas immediate relief. They also restored their development programmes after a few months of the disaster. The restoration of the development activities in the affected communities, by the development aid agencies, promoted an emerging empowering setting. Restoration of community development activities encouraged other community groups, such as women's groups, to return to routine work and foster development programmes in their communities. Similarly, community groups were able to access loans from cooperatives for reconstruction.

Another source of external support that the communities relied on was housing grants from the central government for the reconstruction of private houses. However, the provisions and process of accessing resources enabled some households to benefit from the resources, while preventing others from accessing the same. The inconsistency in housing grant allocations to the housheolds resulted in trust and distrust (Chapter Six, Section 6.7.1).

7.5. Consequences

Consequences are the outcomes accrued from the behaviour of people. These outcomes are the benefits of acting to reach the desired goal (Gutman, 1982; Rokeach,

1973). In natural hazards, people expect to perform specific actions for attaining safety goals. Initial coping, collective coping, preparedness, unpreparedness, shelter, physical protection, trust, and distrust are the consequences people opted for achieving by performing behaviour described above.

7.5.1. Initial coping

Initial coping emerges from previous experience and risk perception and leads to collective coping in the HVM (Figure7.5). The arrows leading from previous experience and risk perception towards initial coping reflects the respondent's reaction to the lived experience of risk. Coping is the ability of people to recognise the stress or threat, and cope with it (Folkman, 2013; Lazarus & Folkman, 1984; Rogers, 1975). When people face a hazard, and they cannot take precautions nor avoid the risk, they have to cope with it instead (Maddux & Rogers, 1983). In this study, the personal efforts of respondents to ‘‘flee and evacuate to a safe place’’ (Chapter Six, Section 6.5.2) was inadequate to meet the further demands and challenges such as shelter, food as a result people turned towards their significant others for collective coping.

7.5.2. Collective coping

Collective coping emerges directly from risk perception, initial coping, and external support in the HVM (Figure 7.5). The relationship between initial coping and collective coping indicates that when the uncertainty increases, the initial coping may be inadequate and could trigger collective coping. People interacted with their family, neighbours, and community to cope with the impacts of earthquakes (loss of family members, housing, property, and livelihood options) during the response and recovery phase. Households and communities collectively conducted search and rescue of family and neighbours. They also rescued livestock, recovered food from debris, and managed debris and dead bodies (Chapter 6, section 6.6.1). The mutual obligation implicit to the collectivistic nature of Nepalese society derived collective efforts for response and recovery in Dhading. In a collectivistic culture, individuals are firmly

bonded with their in-groups ascribed by birth, emotional dependence, shared duties, and obligation (Hui & Triandis, 1986). Individuals, entities in a social unit or group, are responsible for fulfilling the mutual responsibility towards their group (Markus & Kitayama, 1991; Oyserman et al., 2002).

The linkage between external support and collective coping reflects the role of direct external support, accessible from the social structure, such as central government and international aid agencies, for facilitating collective coping (Chapter Six, section 6.7.1). However, coping is provisional to the resources required to minimise the risk, and the efficacy beliefs of the people (Duval & Mulilis, 1999; Mulilis & Duval, 1995). If people realise that their resources and capacities are less than the required resources to solve the issue, they are less likely to cope (Mulilis et al., 1990; Mulilis & Lippa, 1990).

7.5.3. Preparedness

Preparedness, or motivation to prepare, emerges directly from hazard awareness (Figure 7.5). Preparedness is an outcome of the interaction of hazard awareness, hazard knowledge, risk perception, anxiety, and attitude change resulting from the direct experience of the consequences of earthquakes (Chapter 6.5.16). Furthermore, the preparedness decisions of a household or an individual are mediated by collective coping and social and external support, accessible to households while responding and recovering from the impact of the disaster. However, the experience of earthquakes also interacts with uncertainty and the risk of secondary hazards that resulted in Unpreparedness.

7.5.4. Unpreparedness

Unpreparedness is another element that emerges from the uncertainty and risk assessment in the HVM (Figure 7.5). After experiencing the impacts of the earthquake, some households decided not to prepare for the future potential event due to the added risk of a landslip in their residential location and uncertainty about how to respond to

the impacts. Furthermore, households' decision whether to prepare or not was contingent on their circumstances, location of their residential land in the landslip, inability to allocate their private resources to reconstruct the houses and the extent of any government grant they were able to access.

Derailment of government grants for supporting the earthquake resilient housing forced respondents to continue to live in temporary shelters, which they constructed during the response period as temporary physical protection. Those community members who were unable to allocate their private resources to rebuild the houses preferred temporary shelter: they thought that the shelter would not kill them if an event occurred in the future. Due to the loss of the residential units, people were unable to take precautionary measures required for reducing the risk of earthquake hazard.

7.5.5. Trust and distrust

Trust and distrust are two critical elements represented in the HVM, and that emerge from the external support (Figure 7.5). Social structures prevailing in the Dhading, Nepal before the 2015 disaster offered an opportunity for the affected communities to develop social and external support, from in-group and external sources, like INGOs and government, in the aftermath of the disaster (Chapter Six, section 6.7.2 and 6.7.3). Social bonding (affiliations with women's groups, membership in Water User Committee) allowed access to in-group benefits. However, access to resources and benefits from external sources, like central government grants, depended on prior communications and the quality of trust. Quantitative analysis of trust revealed the presence of low trust between government agencies and the community in Dhading Nepal (Adhikari et al., 2018). However, the quality of trust could be enhanced or diminished, based on the current behaviour and actions of community and concerned agencies during the response, recovery, and reconstruction phase (Aldrich, 2011; Paton et al., 2014). Access to mutual help, soft loans, housing grants,

and technical support promoted recovery in those households who were able to access these benefits. In contrast, inaccessibility to social support (both in group and external sources) due to the lack of group memberships, lack of property ownership, and conflict of interest between households and the concerned agencies, led to alienation and distrust in Dhading, Nepal.

7.5.6. Shelter

The shelter is an element that emerges from collective coping in the HVM (Figure 7.5). It is a consequence accrued from the lack of sense of physical protection that resulted from the loss of houses. The damage of houses added the extra burden of food, water, sanitation, and shelter.

During the response and recovery, temporary shelters served as a substitute for housing facilities for physical protection in Dhading (Chapter 6 section 6.5.5). They also served the longer-term needs of ensuring an alternate place for evacuation. Additionally, shelters served as a residence for those respondents who could not afford to rebuild their homes due to an inability to access benefits and grants for housing reconstruction. However, long-term residence in temporary shelters is likely to increase the vulnerability of those people who could not afford to rebuild their houses.

7.6. Values

Values are the endpoints of the cognitive structure represented in an HVM. Values or end goals are the motivations of an individual for performing an action or behaviour (Pieters et al., 1995). These values are acquired from culture, society and its institutions and personality through interaction (Schwartz, 2006).

The interview data reveals that people opted for achieving goals of protection, mutual obligation, survival, physical protection, and sustenance Protection and survival are terminal values, while mutual obligation and sustenance are instrumental values.

7.6.1. Protection

Protection is the ultimate end of the respondents reflected in the HVM. This goal emerges from the preparedness, physical protection, and earthquake risk directly. The experience of the consequences of the earthquake creates a situation where respondents are compelled to react to protect themselves. Earthquake risk and previous experience also enforce the motivation to adopt behavioural protections, as they cannot avoid the risk or prepare (discussed above). The sense of lack of physical protection also reinforces the importance of protecting themselves, their families, and property from potential future events. Preparing for future events also contributed to the goal of protection (Chapter Six, 6.5.4).

7.6.2. Physical protection

Physical protection is an element in the HVM that emerges from the risk perception (Figure 7.5). Residents of Dhading (Jeewanpur and Chainpur) lost their houses as the residential buildings were too weak to withstand the earthquake vibration and shaking. The previous experiences of earthquake risk developed a need for earthquake resilient houses for physical protection. A sense of physical protection is vital to achieving the safety value. The sense of physical protection is an essential aspect in earthquake preparedness as it allows people to secure their housing facilities or a space that can protect people from the effects of the earthquake. Strengthening household integrity is a significant aspect in reducing earthquake effects, while also ensuring the contents of the household are secured. Insecure household contents could also cause severe injury and damage (Lindell & Prater, 2003). The demand for physical protection raised due to fragile housing was marked in the 2011 Christchurch earthquake in New Zealand (Paton et al., 2014), 2004 Indian Ocean tsunami in India (Aldrich, 2011), and the 2011 earthquake in Haiti (Olshansky & Etienne, 2011). Housing integrity is an important aspect to be considered when designing and delivering preparedness strategies.

7.6.3. Survival and sustenance

Survival and sustenance are two values represented in the HVM (Figure 7.5). Collective coping leads to sustenance directly and indirectly to survival. Survival is the ultimate goal for sustenance and collective coping. Affected communities recovered food grains from the debris to extract the preserved food grains (collective coping) and self-sustainment throughout the response and recovery period (sustenance). Storing food produce was an important strategy to cope with the disastrous consequences, and is a vital aspect of preparedness. Preserving food grains is a traditional inbuilt system that enabled communities to cope with the disaster in Dhading, Nepal (Chapter Six, section 6.5.6).

7.6.4. Mutual obligation

Mutual obligation is a terminal value emerging from collective copping in the HVM (Figure 7.5). In Dhading Nepal, communities realised earthquake impacts in their village as a shared issue of community and made them available to the service of the community to solve that problem considering the problem solving as their social obligation. Mutual obligation is a factor inherent to collectivistic culture. A similar scenario was observed in Indonesia following the 2004 Indian Ocean tsunami (Schwarz, 2014b; von Vacano, 2014). In a collectivistic society, individuals are socially bonded with their in-groups ascribed by birth, emotional dependence, shared duties, and obligation (Hui & Triandis, 1986). Individuals are entities in a social unit or group and are responsible for fulfilling the mutual obligation towards their group. The shared fate, goals and values derive from the social unit (Markus & Kitayama, 1991; Oyserman et al., 2002).

7.7. Discussion

The hierarchical value map (Figure 7.5) reveals people displayed different attributes that is behaviour and actions while responding and recovering from the

impact of the Nepal earthquake in 2015. The actions and behaviour of people led them to two distinct consequences: preparedness and unpreparedness (Figure 7.5). The unpreparedness resulted from the uncertainty as to what to do, the impact of secondary hazards, and dispositional beliefs such as fatalism and gambler's fallacy (Chapter Six, section 6.5.13 and 6.5.14)). Previous experience, hazard awareness, hazard knowledge, anxiety, and risk perception influenced preparedness.

The previous experience of the loss and damage accrued from the earthquake allowed people to realise the imminence of the earthquake risk and the importance of preparing. Furthermore, the experience of this earthquake enabled people to develop an understanding of the hazard knowledge, awareness of the hazard, anxiety, gambler's fallacy, fatalism, and uncertainty. These factors influenced the relationship between risk perception and preparedness. This finding supports previous research asserting that previous experience increases risk perception, and further prompts the motivation to prepare (Becker et al., 2017; Dooley et al., 1992; Heller et al., 2005; Helweg-Larsen, 1999; Lindell & Prater, 2002; Rogers, 1983; Russell et al., 1995). However, the direct experience might result in an increased risk perception; it may not culminate into preparedness. As Johnston et al. (1999) described, the experience of volcanic hazards had limited impact on reducing the level of preparedness among a population. People exposed to volcanic hazards thought that they had coped with the event adequately, and would be able to cope with future events. Therefore, the decision of whether to prepare or not is dependent on the extent of the experience.

The social support and external support derived from the social structures influenced the decision regarding preparedness in Nepal. The linkage from social structures to social support and external support depicts the role of social structures (networks, groups, NGOs, INGOs, local government) to facilitate the recovery process (Figure 7.5). In the Dhading district, development activities were underway involving communities, Community-based organisation (e.g. women's groups) networks, NGOs, INGOs, and local government before the disaster (Chapter Six, section 6.6.2). These

institutions had developed formal and informal linkages among them to implement development activities such as drinking water management; improved livestock breeding, integrated pest management, and health and sanitation programmes (Chapter Six, section 6.6.2). The persisting relationships among these social structures offered an empowering setting for the communities to derive the social support and external support from within the groups and external sources.

The affected households accessed mutual reciprocal help and soft loans from their CBOs. For example, households affiliated with women's groups provided mutual support to each other. Similarly, they also benefited from the soft loan available from their group (Chapter Six). However, households not associated with CBOs could not access the benefits from the CBOs. Besides in group social support, households and communities had relationships with other stakeholders.

Households and communities accessed the external support from local government, FOCUS Nepal, HEIFER International, Lumanti, Sanakishaan cooperatives. For example, women's groups collaborating with FOCUS Nepal and HEIFER International to implement livestock breeding programmes benefitted from the financial resources provided. Similarly, community groups were able to access loans from cooperatives for private house reconstruction. However, some households not affiliated with CBOs could not directly benefit from the resources available for developmental programmes. Consequently, there was a sense of alienation in some households. Similarly, access to central government housing grants resulted in alienation that further fostered trust and distrust.

Affected communities had access to central government housing grants. However, there was a delay in direct support from the government regarding housing reconstruction. Despite this, an inconsistency in loss and damage registration prevented some of the households from accessing the grants. The process of grant acquisition alienated some of the households, which resulted in distrust. On the other hand, some of the households registered in the needs assessment report were able to

access the grant of NRs 50,000 (US$500) provided by central government, which facilitated the rebuild of private houses. The process that facilitated household recovery enhanced trust between the community and government.

The socio-cultural values influenced the consequences and behaviour of people to respond and recover in a post-disaster context. The relationship between mutual obligation and collective coping reflected the role of social value in influencing coping behaviour (Figure 7.5). Community members interacted with each other to impose shared meaning on the emerging situation following the disaster. They undertook search and rescue operation, shelter and necessary supplies arrangement, and deceased and debris removal as a mutual obligation. Mutual obligation is a characteristic of the collectivistic nature of Nepali society. In a collectivistic culture, an individual is an entity contributing to the common goals of the community, and shared goals might override individual goals (Markus & Kitayama, 1991; Triandis & Suh, 2002). This characteristic provides an impetus for people to perceive a problem experienced over a location as a shared issue, and thus they are morally obliged to address the issue collectively (Lyons, Mickelson, Sullivan & Coyne, 1998; Schwarz, 2014b).

The association between survival, sustenance, and collective coping reveals a specific tradition of Nepali society, developed to maintain a sustainable supply of food. Through sustenance, a sense of survival links back to collective coping. Sustenance is an instrumental or mediating, value o between the terminal or end state value (survival), and the coping behaviour. In the study sites, the affected households recovered food grain to meet the immediate need of food supply in the community and stored the remaining food grains for the upcoming farming season. In Nepal, many households and communities still practice farming for subsistence (Pain, Ojha & Adhikari, 2014; Schroeder, 1985), and storing and exchanging food grains among community members for sustaining in critical times is characteristic of Nepali society (Prindle, 1979).

In summary, when responding and recovering from the impacts of an earthquake, people showed risk and preparedness beliefs and behaviour. The behaviour of people resulted in two distinct outcomes: preparedness and unpreparedness. Collective efforts and institutional efforts influenced the behaviour of the people and the outcomes of their actions. Furthermore, the socio-cultural values inherent to the Nepali society governed outcomes of the behaviours of people.

Chapter 8: Discussion and Conclusion

8.1. Introduction

This study aimed to explore the influence of the social context on earthquake hazard preparedness at household level in a post-disaster recovery setting, bridging the existing research gap on population preparedness in developing countries with marginal communities. This chapter presents the discussion of the research findings from the questionnaire survey and semi-structured interviews (Chapters Five, Six, and Seven) in its first section. The discussion section begins with a synthesis of the quantitative and qualitative outcomes, providing a clear picture of earthquake hazard preparedness and recovery efforts in Nepal. The subsequent sections of the chapter explain the relationship between these findings and that of prior research, highlighting theoretical and practical implications, and the limitations of the findings, suggesting future potential research in earthquake hazard preparedness and recovery.

8.2. Synthesis of Quantitative and Qualitative Findings

A quantitative model that captures the preparedness process people pursue when they experience severe earthquake hazard was developed by integrating Protection Motivation Theory (PMT) and Community Engagement Theory (CET). The empirical data collected from Dhading, Nepal, following the devastating earthquake in 2015, provided empirical validity to the model. The predictive model of earthquake hazard preparedness passed the statistical rigour and all criteria for validity.

Furthermore, a qualitative study expanded findings. The qualitative findings expanded the quantitative findings by linking the model parameters to the end goals (values) and the consequences of the behaviour of people (Chapter Seven, Figure 7.5). The quantitative and qualitative findings showed some convergence. The findings

of the study provided valuable insights into the earthquake hazard preparedness and recovery within the Nepali social and cultural environment.

8.2.1. Influence of socio-cultural values on preparedness and recovery

The socio-cultural values inherent to the collectivistic nature of Nepali society influenced individual, community, and institutional efforts for earthquake hazard preparedness in a post-disaster recovery setting (Chapter Seven, Figure 7.5). The relationship between mutual obligation and collective coping highlights the role of social value in influencing coping behaviour (Chapter Seven, Figure 7.5). Mutual obligation is a characteristic of the collectivistic nature of Nepali society in which an individual contributes to the shared goals of the community (Markus & Kitayama, 1991; Triandis & Suh, 2002). This characteristic enforced affected populations to collectively engage together to address the demands and challenges posed by the earthquake. The direct experience of the earthquake impact, which shook the whole central regions and parts of Nepal, brought the affected communities together for collective coping. The collective efforts to search and rescue, debris and deceased management, temporary shelter arrangement, and social protection without external support, implied community self-reliance and collective efficacy: a model variable in the quantitative model (Chapter Five, Figure 5.6). However, a community is made up of households. Households might have differential capacities to cope and represent different social positions and power relationships, not only within the community but also among external sources (Arlikatti & Andrew, 2011; Bolin, 1994; Drabek & Boggs, 1968). The power relationship, social positions, and resources available in households and communities could moderate collective coping when recovering from the impact of a deadly earthquake. Therefore, considering the community and societal influence on households is critical to understanding household preparedness, which is the topic of discussion in Sections

8.2.2 and 8.2.3. Furthermore, elements such as survival and sustenance reflected socio-cultural values ingrained in the traditional practices of Nepal.

The association between survival, sustenance and collective coping reveals a specific tradition of Nepali society developed for maintaining a sustainable supply of food (Chapter Seven, Figure 7.5). In developing countries like Nepal, where food security is a challenge, retaining survival food items, a basic preparedness strategy, is critical. In Dhading, Nepal, a lack of housing integrity resulted in the loss of food grains due to the earthquake. As a result, households had to extract the stored food grains from the debris (Chapter Six, Section 6.7.1). The structural integrity of private houses plays a vital role in ensuring survival preparedness. In the study sites, the earthquake-affected households used the recovered food to meet the immediate need of food supply in the community and stored the remaining food grains for the upcoming farming season. This section presented the socio-cultural values associated with the consequences and behaviour of people in a post-disaster recovery setting in Nepal. In the next section, the influence of institutional efforts on household recovery is discussed.

8.2.2. Influence of institutional collaborations on preparedness and recovery

In the quantitative model of earthquake hazard preparedness (Chapter Five, Figure 5.6), the variable empowerment represents the relationship between community and disaster risk management (DRM) agencies, and other relevant groups engaged in the DRM sector. The quantitative findings demonstrated an empowering setting for collaboration between community and DRM agencies in Nepal. The qualitative findings confirm the quantitative findings by examining social and external support, derived from the social structures (DRM agencies), and their relationships before a disaster (Chapter Seven, Figure 7.5).

The linkage between social structures, social support, and external support depicts the role of social structures (networks, groups, NGOs, INGOs, local government) in facilitating a recovery process (Chapter Seven, Figure 7.5). In the Dhading district, development activities were underway involving communities, CBOs, networks, NGOs, INGOs and local government before the disaster (Chapter Six). These institutions had developed formal and informal linkages among them to implement development activities, such as drinking water management, improved livestock breeding, integrated pest management, and health and sanitation programmes (Chapter Six, Section 6.6.2, Table 6.6). The persisting relationships among these social structures offered an opportunity for the communities to derive social support and external support from within the groups and external sources during the disaster.

Following the disaster, GIZ Nepal and HEIFER International provided relief to the affected households in the Dhading district. These institutions further extended their financial assistance to the members of the women's groups to reinitiate their development programme in collaboration with women's groups and partner NGOs. For example, membership in a women's group allowed households to access the NRs 15000 (US$150) from Heifer International Nepal via FOCUS Nepal (Chapter Six, Sections 6.7.1). The continued coordination and collaboration between INGOs, NGOs, and community groups to restore the programmes ensured household participation in the groups and further promoted new, empowering settings.

Another source of empowerment was the collaboration between communities, local government, and central government to assess damage and loss, and provide grants for reconstruction (Chapter Six, Section 6.7.1). The central government made provisions for a housing reconstruction grant to rebuild private residential buildings. However, the quantitative analysis revealed a low trust between government agencies and the community in Dhading, Nepal (Adhikari et al., 2018). The level of persisting

trust between the community members and government agencies affected the recovery efforts.

The external and social support available from their groups, cooperative, INGOs, and government enabled some households to reconstruct earthquake resilient housing, and thus enhance the current level of trust. For example, a loan from the Sana Kishaan Cooperative, the in-group support (mutual help), and government grants facilitated the reconstruction of housing, ensuring physical protection and enhancing trust.

In contrast, inaccessibility of external support due to, lack of property ownership and conflict of interest between households and the concerned agencies lead to alienation and distrust. An inconsistency in loss and damage registration prevented some of the households from accessing the grants. The national political transition derailed the process of establishing the national reconstruction authority (NRA). Consequently, there was a delay in grant disbursement, which resulted in frustration and increased the distrust people already had in the government service.

8.2.3. Influence of collective efforts on preparedness and recovery

Collective efforts derive from collective efficacy and community participation in the quantitative model (Chapter Five, Figure 5.6). Qualitative findings confirmed the role of collective efforts for response and recovery in Nepal (Chapter Six and Seven). Community participation occurred at different stages of the recovery process. Earthquake-affected households members participated in collective coping: search and rescue operations, arranging temporary shelter and food supplies, dead and debris clearance, and food recovery (Chapter Six, Section 6.6.1). Household members were involved in community-based groups (e.g. women's groups), and networks (water user committee) to access social support (tangible and intangible resources and assistance). For example, after the earthquake, women's groups started to meet

regularly again and made decisions to regulate their group fund and resources (Chapter Six). The group membership permitted households to access soft loans and mutual reciprocal help available within the group. Also, the groups served as a platform for interaction and sharing of feelings and emotions among members. Furthermore, households participated in the needs assessment survey to inform the loss and damage they have experienced from the earthquake.

The group efficacy developed before the disaster enabled group members to resume their group activities and access the resources available in the groups. In this process, they also participated in the meetings and supported each other with mutual help which again is a condition for rebuilding collective efficacy.

8.2.4. Individual efforts on preparedness and recovery

In this study, the quantitative model shows that people's risk appraisal and coping appraisal results in preparedness (Chapter Five, Figure 5.6). The qualitative findings revealed multiple factors contributing to and hindering preparedness during recovery (Chapter Seven, Figure 7.5). Factors such as awareness of hazard consequences, hazard knowledge, attitude change, anxiety resulting from the experience of impacts, and salience of preparedness, recognised by the consequences of the hazards, promoted preparedness. In contrast, factors such as uncertainty about how to respond, personal circumstances and the inability to allocate resources, impacts of secondary hazards, gamblers fallacy, and fatalism prevented preparedness.

8.3. Relating the Findings to Prior Research

The findings of this study provide new insights into earthquake hazard preparedness and recovery in the context of Nepal. This study proposed a model of earthquake hazard preparedness and empirically validated using the data collected in a post-disaster recovery context from Nepal. The model comprises individual, community and institutional factors predicting preparedness in a recovery setting.

In this study, at the individual level, people's risk beliefs, such as the imminence and inevitability of the impact, resulted in coping and, therefore, preparedness. Self-efficacy; a component of coping appraisal was evidenced in the preparedness-recovery of earthquake hazards in Taiwan and New Zealand (Paton, Jang, et al., 2015; Paton et al., 2014). However, risk appraisal was not evident. However, risk appraisal is an important factor when considering hazard preparedness (Floyd et al., 2000; Milne et al., 2002; Rogers, 1983). People must realise the inevitability of risk in order to search for available coping options (Becker et al., 2013; Floyd et al., 2000; Milne et al., 2002; Rogers, 1983). Furthermore, the qualitative findings of this study provided evidence of factors such as hazard knowledge, hazard awareness, the salience of preparing, and anxiety promoted preparedness, while Gambler's Fallacy, fatalism, and uncertainty prevented motivation to prepare in a recovery context. Therefore, further research is required to explore the preparedness-recovery relationship, and the factors influencing preparedness.

In this study, community participation was evident in collective coping (rescue, debris clearance), social support (mutual help, attending group meetings) and involvement in needs assessment surveys. Similarly, collective efficacy was reflected in the group and networks, which allowed their members to harness the benefits and resources available in the group and networks, while the external linkage (INGO, NGO, community collaboration) permitted them to access the external sources required to fulfil their immediate need of housing reconstruction. Involvement of community members in collective coping, social support, community groups, networks and needs assessment survey provided an interactive environment to forge new collective efficacy. Previous research has shown community participation and collective efficacy as collective efforts in the post-disaster recovery (Mulligan et al., 2012; Schwarz, 2014a; Shaw & Goda, 2004; Shaw & Sinha, 2003; von Vacano, 2014). Paton and colleagues, in their study of preparedness-recovery, identified community participation in the process of helping other members in the communities and the process of

engagement with other community members in the early recovery (e.g. debris clearance, social support) (Paton, Jang, et al., 2015; Paton et al., 2014).

In this study, as discussed in the findings synthesis, the prevailing collaboration between local government, development aid agencies (e.g. GIZ, HEIFER International), NGOs (FOCUS Nepal), networks, cooperatives and community-based groups (women's groups) provided a conducive environment to access resources for response and recovery in Dhading, Nepal. However, increased access to government grants, social support, and loans from cooperatives facilitated household recovery, and thus enhanced trust. On the other hand, inaccessibility to social support and external resources marginalised some of the households, which lead to a sense of alienation and distrust. Similarly, as Paton and colleagues identified, community-agency collaboration could lead to both empowering and disempowering environments during recovery (Paton, Jang, et al., 2015; Paton et al., 2014). Furthermore, the research provided evidence of the community and collaboration with DRM agencies and concerned stakeholders as being critical to response and recovery in post-disaster contexts (Aldrich, 2011; Ganapati, 2014; Joakim & Wismer, 2015; Mulligan et al., 2012; Mulligan & Nadarajah, 2011; Shaw & Goda, 2004).

8.4. Theoretical Implications

The quantitative model of earthquake hazard preparedness, empirically validated using the in-situ data collected during the post-disaster recovery settings of the 2015 Nepal earthquake, serves as a reference point to develop disaster preparedness and recovery theory. The model variables identified to capture the real-time data, reflecting the experiences of people to respond and recover. The in-situ data provided people's retrospective evaluation of what they had to contend with and what they need to do for future intentions to prepare.

Researching disaster preparedness (intention to prepare) during recovery offered an opportunity to develop an understanding of people's direct experiences of

the earthquake disaster and their coping abilities in a complicated situation. It informed people's motivation to prepare for the future event as their direct experience of the event stimulates behavioural intention to prepare. Prior experience of a hazard event also promotes the preparedness needs for active coping in the future.

Furthermore, the findings provide new insights that the pre-existing community competence and community-agency relationship were critical to promoting the intention to prepare in the post-disaster scenario for earthquake hazards (Chapter 5). During the earthquake disasters, family, friends, relatives, neighbours, and broader community commonly carry out initial search and rescue efforts, before the formal rescue operations led by government and international agencies (Mulligan & Nadarajah, 2011; Shaw & Goda, 2004; Shaw & Sinha, 2003; von Vacano, 2014). However, communities collective efforts to tackle the emerging demands and challenges may become inadequate for responding to and recovering from the impact of the hazards (Han & Waugh, 2017; Sanderson et al., 2014). Consequently, communities seek external assistance from government and international aid agencies to respond and recover effectively (Ganapati, 2014; Ghafory-Ashtiany & Hosseini, 2008; Waugh & William, 2017). Additionally, the qualitative finding revealed a new community factor i.e. collective coping. However, further testing the model variables in different countries cross-culturally would provide evidence of the utility of the model variables in a post-disaster context.

This research indicates that the integration of PMT and CET theories, rather than using each separately, facilitates a better understanding of the behavioural and social aspect in DRR. Researchers investigating hazard preparedness may consider integrating theoretical perspectives from differing domains as it serves to deepen research knowledge in preparedness modelling. The model tested is specific to earthquake hazard preparedness and recovery in Nepal. Researchers may consider testing it for all hazard applicability in Nepal, and across different countries and cultures.

8.5. Practical implications

Developing and sustaining risk beliefs in people to encourage preparedness is critical in post-event settings (Paton & Jang, 2016; Paton et al., 2014; Paton & McClure, 2013). People intend to prepare only when they realise the relevance of risk they are exposed (Chapters Five and Seven). In the qualitative model, the salience of the hazard, and the relevance of preparing for it culminates from the direct experience of the earthquake impacts and severity of the consequences and aftershocks (Chapter Seven). The recentness effect allows sustaining the salience of preparing for the imminent risk of an earthquake hazard. As a result, people considered the need for securing structural integrity (physical protection) as one of the prime needs for future safety (Chapter Seven). People tend to focus on current priorities, and thus salience decreases as the experience and memories fade (Paton & McClure, 2013). People prioritise the attitudes they hold towards behaviours and actions by the recentness of the behaviour and their needs (Ajzen, 1991). In such a situation, sustaining beliefs regarding the salience of hazard and the relevance of preparing in communities is a challenge for DRM agencies. Disaster risk communication strategy should integrate interactive programmes that allow people to acknowledge the risk regularly.

The findings of the present study have provided new insights into community and agency relationships for preparedness during post-disaster recovery. This has implications for risk communication strategy design and delivery for earthquake hazard mitigation. The collaborative efforts between the government, other agencies and communities, which evolved to address recovery demands and challenges encountered in post-disaster, provides lessons for disaster management (Chapter Six). It also underlines the importance of community-agency relationship for preparedness and recovery. It argues for close coordination and collaboration to establish a direct link between DRM agencies and communities in a post-recovery context.

The findings of this study revealed two distinct outcomes resulting from the interaction of personal, community and societal efforts during recovery. These

outcomes are preparedness and unpreparedness (not preparing) (Chapters Six and Seven). These outcomes have a significant effect on risk communication and outreach programme. The unpreparedness resulted from uncertainty over to what to do, as well as dispositional beliefs such as fatalism and Gambler's Fallacy (Chapters Six and Seven). DRM agencies have the role of designing strategies that can motivate people through interactive programs to better prepare. The strategy could include processes to convince people of the earthquake-related consequences from weak infrastructure and unsecured household items. People can control the damage and loss that accrues from building designs by increasing the strength of the infrastructures and securing the household items.

In contrast, to facilitate preparedness further in those sections of the population already motivated to prepare, DRM agencies need to identify the level of preparedness of communities at present. The level of preparedness of communities affects their perceptions of the risk, and their capabilities to cope (Martin et al., 2007; Paton & McClure, 2013). DRM agencies need to deploy strategies to identify the stages of preparedness people are at and apply different strategies to facilitate progress towards comprehensive preparedness.

The qualitative findings reflected trust and distrust as two distinct factors resulting from the community-agency transactions during recovery (Chapter Seven, Figure 7.5). The recognition of trust and distrust as two distinct reasoning processes requires two separate strategies to deliver risk information. DRM agencies need to provide information about risk and coping process to adapt to the consequences of a risk. The first step could be responding to the factors or processes leading to distrust. DRM agencies need to engage themselves as facilitators in communities simultaneously. Working closely with communities to facilitate collective efforts for preparing encourages an enabling environment, developing a bond between communities and agencies that could serve as a leverage point to encourage trust-building.

Both quantitative and qualitative findings corroborated that personal, community and societal factors contributed to motivating people to enhance their behavioural intentions to prepare for a potential future earthquake hazard. In order to promote people's behavioural intentions to prepare for an earthquake hazard, DRM agencies should conduct hazard education programmes and work closely with communities to build community competence to respond and recover from the future disaster.

8.6. Limitations

A limitation of the present study was that data was only collected at one point time (cross-sectional nature). The interview participants were interviewed at varying stages of their reasoning process in regards to preparation. Interviewees were at the beginning middle or end of their reasoning process. In other words, the present study may have been assessing risk perception in some participants while others had made their decision on the intentions of preparing and had progressed to preparing.

An outcome of this could be that some of the variables identified could have been classified as attributes, consequences or values. To provide more rigorous testing of the variables identified future research could utilise a longitudinal study. By testing at different points the long term influences of the variables of the Earthquake Hazard Preparedness Model can be examined, and whether this influence changes over time. This would also assess the extent that feedback and discussion of issues that occur between people can influence positive and negative evaluations of the efficacy of adopting protective measures. The addition of an intervention program could further assess societal influences on intentions to prepare by ensuring that the participants were at the beginning of their decision making and tested along with a linear trajectory.

Altogether eleven participants participated in the semi-structured interview. Although the number of participants was small, the sample size was enough for data saturation. In qualitative research sample size depends on the data saturation (Bryman, 2016). However, using a small sample of interviews to produce means-end

chain cognitive structure may result in loss of information provided by a single participant. Hierarchical Value Mapping (graphical representation of the means-end chain cognitive structure) are developed using cumulative information from multiple interview participants.

The interview participants volunteered to participate in the interview. As a result, there may be some bias in the sample although participants were from the same population sample who took part in the questionnaire survey. People who were more interested in the earthquake recovery and preparedness might have participated. The data might be prone to desirability bias and interviewer demand effects. However, the researcher could only interview those participants interested in taking part in the interview process. However, the results are informative and provide a foundation to develop research questions that can inform comprehensive and longitudinal studies relating to preparedness and recovery.

Intention to prepare is a proxy of actual preparedness in this study. Intention to prepare is one direct antecedent of actual behaviour. However, it is difficult to know whether one's intentions would turn into actual preparedness actions. The level of success for turning intentions to actual preparedness actions will depend not only on one's intention but also on partly non-motivational factors such as availability of important opportunities and resources that represent people's actual control over the behaviour (Ajzen, 1991). Therefore, having a relatively valid set of indicators provides a good starting point for exploring preparedness measures in Nepal and elsewhere. However, there is no validated measure of preparedness in Nepal (for pre-event research/planning). There is, as yet, no systematic research into the development and validation of preparedness measures during response/recovery periods. Especially in developing countries even if a preparedness measure was available, preparedness scores could be low because people lack the resources (e.g., money, time) to adopt measures, so intention provides better insights. The measure of intention has been validated and applied in preparedness research in New Zealand (where it was

originally developed and validated), Australia, Japan, Taiwan, Indonesia, Portugal, USA, the Netherlands – so using it makes it easier to compare your findings across studies and places (i.e., using intentions increases comparability).

8.7. Future Research

This study is a cross-sectional data even through data collection occurred in two times; it uses different methods to collect data. The objective was to expand the quantitative results of qualitative findings. However, earthquake hazard preparedness is a socially constructed process, and it may not be possible to capture processes and elements of the social environment in a cross-sectional study (Becker et al., 2012; Blumer, 1986; Paton & McClure, 2013). Therefore, a longitudinal study that captures the recovery and preparedness process could be useful to trace the dynamics that occur when communities transit from a typical situation to a post-disaster recovery setting.

The findings reflected that in conflict-affected and socio-economically fragile Nepal prevailing collaboration between development aid agencies, local government, NGOs and communities for implementing development initiatives served as a mechanism for facilitating response and recovery (Chapter Seven, Figure 7.5). This provides a clue to link local development and DRR for building back better. Linking local development and DRR for building back better during recovery requires an understanding of what is comprehensive disaster preparedness specific to developing countries. It is also critical for DRM agencies think and strategise how emerging collaborative mechanisms can be developed and sustained further, to ensure that recovery initiatives are planned and implemented in harmonisation with the local development goals.

In the findings, the relationships between concerned stakeholders and communities resulted in programme restoration. Restoring activities are a vital step to engaging communities in the recovery process. However, they do not necessarily

ensure building back better in affected communities (Birkmann & Fernando, 2008; Mulligan et al., 2012). Returning or restoring normality to pre-disaster standards recreates the vulnerabilities that existed before and exposed them to further devastation in subsequent disasters (Birkmann & Fernando, 2008; Mulligan & Nadarajah, 2011). Therefore, the focus should be on the opportunity to improve or build back better in the recovery period (Thomalla et al., 2017). However, international aid agencies advocating BBB have suffered from a lack of a shared understanding of BBB, and lack of the ability to implement projects adhering to the principles of BBB (Fan, 2013). This is because the adaptive capacities to cope with and adapt to the disaster impacts differ by social and cultural context, as does the meaning of BBB (Paton & Jang, 2016). Therefore, future research focusing on BBB, recovery, and preparedness, specific to developing countries, could make a significant contribution to DRR and resilience.

8.8. Conclusion

This section provides a summary of the outcomes of contributing to the overall aim and goals of the research. This study aimed to explore the influence of social context on earthquake hazard preparedness during post-disaster recovery in Nepal. There were two specific goals and five objectives of the research to achieve the overall aim of the research. The first and second outcomes: i) review of cognitive theories and models applied in natural hazards (Chapter Two, Section 2.5) led to ii) a conceptual model developed by integrating Protection Motivation Theory and Community Engagement Theory. iii) The third outcome was the empirical validation of the model using the questionnaire data, collected during the post-disaster recovery period of the 2015 Nepal earthquake. These three outcomes contributed towards achieving three objectives and the first goal of identifying an individual, community, and institutional factors contributing to earthquake hazard preparedness at household level during the recovery period. The empirical validity of the model parameters (community

participation, collective efficacy, empowerment and trust) provided evidence of the influence of social context on post-disaster recovery. The model variables reflected the domains of community and societal processes essential for community capacity building. The model was successful in the context, in which it was applied, and it demonstrates the potential value of a comprehensive model of preparedness, but replication of this model will further establish its validity in different contexts.

Furthermore, outcomes (fourth and fifth) of qualitative study provided evidence of the factors contributing to preparedness and the reasoning process behind the decisions people took while responding and recovering the impacts of the earthquake hazard contributed to achieving the second goal. The open and axial coding process, as discussed in Chapter Seven, identified the codes and themes from the interview data and also allowed to confirm the quantitative and qualitative data convergence. The Means-End Chain analysis and hierarchical value mapping provided the evidence that socio-cultural values govern people's response and recovery efforts and thus their decisions to prepare in a post-disaster context which contributed to expanding the scope of the research.

In developing countries prone to earthquake hazards, like Nepal, developing the capacity of people to cope with and adapt to the impact of earthquakes is vital. Community capacity building requires identifying the domains and processes reflecting community and societal processes and efforts. The model variables community participation, collective efficacy, empowerment, and trust reflect community and societal efforts and represent the post-disaster recovery context of Nepal. The model variables can serve as a useful reference for recovery and preparedness research in the future.

The findings of the present study contribute to natural hazard preparedness and recovery research. Both quantitative and qualitative findings confirm that individual, community, and societal (institutional) factors contribute to preparedness in a post-disaster recovery setting.

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Appendix A Survey Information Pack

Household questionnaire survey sheet

Participant Information Sheet

Participant Consent Form

Household Questionnaire Survey

1. Age (years) Please tick in one of the following

20 – ☐ 40

41 – ☐ 60

60 ☐ above

2. Gender Please tick in one of the following

Female ☐

Male ☐

3. Education Please tick in one of the following

Education level	Attainment
Illiterate	
Literate	
6 – 10 grade	
11-12 grade	
Undergraduate	
Graduate or above	

4. Income (Average annual income in NRs) Please tick in one of the following

   a) Under NRs. 18000

   b) NRs 18000 – NRs 50000

   c) NRs 51000 – NRs 100000

   d) NRs 100000 – NRs 200000

   e) Above NRs 200000

5. Please list the major three sources of income?

Income source types	
Agriculture, poultry, livestock	

Wage labour	
Business/enterprise-small scale	
Employed in govt services, private sector	
Industry	
Remittance	

6. Please tick in one of the following

Family details	Numbers
Number of family members	
Number of children	
Number of elderly	

7. Please tick in one of the following box to indicate the housing type you are currently residing.

House types	Tick box (√)
Stone, mud, adobe house	
Stone, mud, adobe with timber	
Mud mortar or ordinary bricks	
Cement mortar in brick masonry	
Strengthened or retrofitted for earthquake resistant brick buildings	
Strengthened good quality brick buildings in cement mortar	
Reinforced Concrete Cement building	
Mason designed Reinforced Concrete Cement building	
Tent or CGI tin and wooden house (temporary house)	

8. How long have you lived in this district ----------years.

9. Age of the residential unit you are living currently----------years

10. How long have you lived in this house ----------years.

11. Is there open space available around your house? If yes, …….

Please indicate distance from your house to the open space. ……

12. Please indicate the distance between your house and the closest road head in meters.

……

13. What is the source of drinking water at your household?

Pond	
Spring	
Tap	
Others	

14. Do you receive information about disaster risk? From which sources you receive this information?

Information sources	Tick box ( )
TV	
Radio	
Newspapers	
Discussion in neighbourhoods	
Community meetings	
Voluntary organisations/networks	
Disaster Management committee meetings	
VDC/municipality	
Other government offices	
NGOs/INGOs	

15. Regarding the earthquake occurrence, to what extent do you agree or disagree with the following statements

	Strongly agree (5)	Agree (4)	Neither agree nor disagree (3)	Disagree (2)	Strongly disagree (1)
A devastating earthquake is likely to occur in central Nepal					
A devastating earthquake can occur anytime					

16. What could be the likely impact of a major earthquake to you, your family and the place where you live? (Please rate the impact factors from 1 (not at all severe) to extremely severe (5)

	Extremely severe (5)	Severe (4)	Moderately Severe (3)	Slightly severe (2)	Not at all severe (1)
Affect me					
Affect my family					
Damage my house					

Damage my property					

17. In regards to preparing for earthquake hazards please describe the extent to which you agree or disagree to each of the following statements.

	Strongly agree (5)	Agree (4)	Neither agree nor disagree (3)	Disagree (2)	Strongly disagree (1)
Preparing for earthquake risk is a priority for my household					
Preparing is a priority agenda in our community/ neighbourhood					
My neighbours respect me as I prepare for the hazards					
Community feels proud for being able to prepare for earthquake hazard					

18. To extent to which you agree or disagree to each of the following statements while dealing with issues and problems in your everyday life.

	Strongly agree (5)	Agree (4)	Neither agree nor disagree (3)	Disagree (2)	Strongly disagree (1)
I have control over things that happen in my life					
I can solve most of the problem I have by myself					
I cannot do much to change what happens in my life					
I am responsible for important changes in my life					
There is no way I can solve some of the problems I have by myself					
Somehow problems in my life usually solve themselves					

19. To what extent each of the following supports you to prepare for an earthquake. Please describe the extent to which you agree or disagree to each of the following statements.

	Strongly agree (5)	Agree (4)	Neither agree nor disagree (3)	Disagree (2)	Strongly disagree (1)
Storing extra basic stuffs (dried food, water) in the house					
Having a working radio, torch, extra batteries					
Developing household preparedness plan					
Having first aid and rescue skills					
Participating in the community meetings					
Contacting Red Cross and VDC					

20. To what extent each of the following prevents you preparing for earthquakes? (Please rate the impact factors from 1 (not at all) to great deal (5)

	Do not prevent at all (1)	2	3 No idea	4	Great deal (5)
Cost					
Time to do them					
Skill and knowledge required					
Need cooperation with others					

21. In regards to what happens in your household and community, please describe

	Once a week or more (5)	Once a month or more (4)	A few times a year (3)	Rarely (2)	Never (1)
Think about earthquakes					
Talk about earthquake					

22. Have you experienced an earthquake? Yes (1) No (2)

23. If yes, how often have you faced earthquake events in last 10 years (the frequency of past earthquake events)?

Almost always (5)	
Sometimes (4)	
Every once in a while (3)	
Rarely (2)	
Never (1)	

24. If yes, Have you or your family experienced any injury or damage due these earthquake in the past? If yes, please indicate the damage occurred.

---

25. Please describe the extent to which you agree to disagree with each statement about your feeling in living in this community.

	Strongly agree (5)	Agree (4)	Neither agree or disagree (3)	Disagree (2)	Strongly disagree (1)
I belong in this community					
Neighbours would help me in emergency					
I feel loyal to the people in my community					
I plan to remain in this community for a number of years					
I prefer to stay/reside in this community					

26. In regard to participating with the community, please describe how often you undertake each of the following

	Strongly agree (5)	Agree (4)	Neither agree or disagree (3)	Disagree (2)	Strongly disagree (1)
I have worked with other on something to improve the community life.					
I participate in activities (feasts, fairs, rituals, ceremonies)					

organised by our community					
I have contributed food, cloths, amenities, money to local causes, charities or to others in my community					
I attend public meeting in my community					
I have been involved in volunteer activities e.g. fund raising, clean up etc)					

27. In regard to assessing your community, please describe how often you undertake each of the following

	Strongly agree (5)	Agree (4)	Neither agree nor disagree (3)	Disagree (2)	Strongly disagree (1)
When it comes to saying something in front of a group or others most people in this community will do it					
When people are needed to stand before a group of outsiders to tell them what this community needs, most people here could do it					
What a community talks about depends on what residents are interested in and what their needs are					
I often take the leadership role in my community meetings					
Community members take turn to exercise the leadership role					
People around here often express their views in the meetings					

Community perceptions of issues depend on the quality of the individuals in that community					
How people think about community problems controls what is done about those problems					
Community members collectively identify the issues and decide on the key issue to focus					

28. In regards to what in happens in the wider community, in general, to what extent do you think that:

	Always (5)	A great deal (4)	Sometimes (3)	Not very much (2)	Not at all (1)
I feel that I can influence what happens in my community					
I feel that participating in the community activities is useful					
I feel that I have contribtion to mobilise/regulate this community					
Local elected representatives seriously consider my opinions					
Local elected representatives consider opinions and needs of this					

community					
Voting in local elections influences what happens in my community					
Elected representatives try to influence community activities					

29. In regard to your general feeling of living in this community, please describe the extent to which you agree to disagree with each statement.

	Strongly agree (5)	Agree (4)	Neither agree or disagree (3)	Disagree (2)	Strongly disagree (1)
I trust our local VDC to respond to meet the needs of its residents					
I trust my community leader in my community					
I trust District Disaster Management Committee to respond the needs of my community					
I trust district government officials to respond the needs of my community					
I trust the media (newspapers, TV, radio) to report fairly					
I have					

confidence in the law to protect and maintain order in my community					

30. Please describe to what extent do you agree or disagree with the following statements regarding the specific trust to the local government responsible for emergency management.

Agency responsible for emergency management (District/local vdc level disaster management committees)	Strongly agree (5)	Agree (4)	Neither or disagree (3)	Disagree (2)	Strongly disagree (1)
They are knowledgeable about earthquake risk					
They can manage the disaster risk					
They care for members of the community					
They facilitate community members to minimize the risks for them					
They provife comprehensive information to the community					
They provide accurate information to the community					
They provide information required by the community members					
They provide clear instructions on how they will deal with a earthquake					

They are responsible for earthquake risk management					
They allocate resources for earthquake risk management					
They respect the values and culture of community members					
They always support and stand up in favour of the community					
They consider people's ideas when developing their plans					
They include the community plan as their priority					
They provide appropriate information to the community regularly					
They provide appropriate information to the community in a timely manner					

31. How often do you intend to prepare for earthquakes (please tick in the box as appropriate)

	Always (5)	Often(4)	Sometimes(3)	Rarely (2)	Never (1)
Check my level of preparedness for earthquake					
Identify areas within your home that could be affected by earthquake					

Discuss earthquake protection measures with family					
Become involved with a local group/community to discuss how to reduce damage/loss					
Seek information on earthquake hazard and risk					
Seek information on things to do to prepare					

32. Please state the membership and activities attended in following organisations

Organisations	Membership	Meetings/activities attended
Clubs		
Networks		
School/parents groups		
Community groups		

33. Please indicate the type of help received by household from relatives, community members and network to the help given to other by the household.

Helping hands	Help received by household from	Help given by household to	Remarks
Relatives			
Community members			
Networks			

34. Please indicate the average landing and borrowing of money by your household.

Average landing in NRs……

Average borrowing in NRs……

35. Does your community own a community management plan? If yes, does that plan have provisions for disaster risk management?

……..

36. Does community have an emergency management plan? ……

37. How have your community been generating the resources required to implement the plan?

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RESEARCH INFORMATION SHEET

The vulnerability of earthquake-prone communities: Case studies from Nepal

Professor David Johnston (Massey University), Dr Raj Prasanna (Massey University), Dr Sam McColl (Massey University) and Mina Adhikari (PhD Student, Massey University) would like to invite you to participate in a research project, which is being undertaken by Mina Adhikari to fulfil the requirements for a PhD degree.

The research project is being undertaken to i) identify the community vulnerability and ii) identify factors that influence household and community members to prepare for earthquake hazards. The enclosed questionnaire includes questions that help us understand population vulnerability and preparedness for earthquake hazard.

The outcomes of this research will be used by district emergency managers to enhance the effectiveness of public education programs, enhance household preparedness for an earthquake, and help ensure that these plans and activities will meet the needs of the community. Further, the outcome is intended to help similar communities in Nepal and other parts of the world.

The researcher and survey assistants will administer a questionnaire survey to collect information to a sample of 350 households in Chainpur and Jeevanpur Village Development Committees of Dhading district, Nepal. The estimated time for the survey is approximately 60 minutes. However, if the participant needs support to fill up the form then it might take up to two hours.

The researcher is bound to abide the Massey University Ethical Code of Conduct for Research to maintain the security of collected information and confidentiality of the participants. To maintain the confidentiality of participants the questionnaire and consent forms will be assigned two computer generated random codes. The participants will be coded based on the random codes. After the data is collected questionnaire/survey will be retained separately from the consent forms under the supervision of a researcher. At Massey University, the paper-based consent forms and questionnaires will be stored in a locked cabinet separately for five years and all the raw data will be destroyed at the end of this period. For protecting the data from unauthorised access, the electronic data will be stored in a password protected computer accessible to only researcher and supervisors.

A report summarising the findings of this survey will be submitted to Disaster Management Section, Ministry of Home Affairs, Nepal and local authorities responsible for the selected community in the district. In addition to, a summary of findings will be published in the local newspapers, and on the Massey University at School of Psychology web page. Should you wish any additional information regarding this study, please do not hesitate to contact any of the research team.

We would like to take this opportunity to invite you to participate in this survey. Your participation will help ensure that future earthquake mitigation programs can be targeted to meet the needs of your community and similar communities and increase community participation in the risk management programs.

Your participation in this study is entirely voluntary. You may choose to refuse to answer any question on the questionnaire. If you get uncomfortable by reading this

information sheet or at any stage of the research; please contact the organisations for health and psychological support given in the list attached to this information sheet.

We would be grateful if you could return the consent form for this study with the completed questionnaire.

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern A, Application 16/05. If you have any concerns about the conduct of this research, please contact Mr Jeremy Hubbard, Chair, Massey University Human Ethics Committee: Southern A, telephone 04 801 5799 x 63487, email humanethicsoutha@massey.ac.nz.

If you have any queries about the project please contact Mina Adhikari [redacted]; Email: m.adhikari@massey.ac.nz),

Your return of the questionnaire will be taken as indicative of your having read the information sheet and of your agreement to participate in the survey component of this study.

Please feel free to contact me should you require any further information or wish further clarification about any issue relating to this research and its objectives.

Thank you in advance for your assistance in this project.

Mina Adhikari

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Vulnerability of earthquake prone communities: Case studies from Nepal

Survey participation consent form

1. I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.
2. I understand that survey will be conducted with me to obtain an understanding of my views on earthquake vulnerability and preparedness.
3. It is my understanding that the survey will take approximately 60 minutes to complete if I am filling in the questionnaire. If I need to seek others help to fill in the questionnaire it might take up to 2 hours.
4. I agree that the information gathered for the study may be published provided that I cannot be identified as a participant.
5. I also understand that consent forms will be retained separately from the survey to ensure the confidentiality of the participant.

I agree to participate in this study under the conditions set out in the Information Sheet.

Name of participant:...……

Signature/fingerprint* of participant:…… Date:……..

*Consent form can be signed using fingerprint only if participant gives oral consent to the researcher or survey assistant.

Statement by investigator:

I have explained this project and the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation.

Name of Investigator:…… Signature ……

Date:……...

Name of Researcher: Mina Adhikari Signature ……

Date:……...

Appendix B: Structural Equation Modelling

Raw data

Table 2: Descriptive Statistics

	No.	Missing	Mean	Median	Min	Max	Standard Deviation
PP1	1	0	4.147	4	1	5	0.984
PP2	2	0	4.755	5	1	5	0.887
PS1	5	0	3.539	4	1	5	1.143
PS2	6	0	3.31	3	1	5	1.143
PS3	7	0	3.987	4	1	5	0.939
RW1	10	0	3.84	4	1	5	0.927
RW2	11	0	3.784	4	1	5	0.99
RW3	12	0	4.147	4	2	5	0.724
RW4	13	0	4.088	4	1	5	0.72
PSE1	18	0	3.873	4	1	5	0.925
PSE2	19	0	3.951	4	1	5	0.86
PSE3	20	0	2.984	3	1	5	1.089
PSE4	21	0	4.225	4	1	5	0.757
PSE5	22	0	3	3	1	5	1.117
PSE6	23	0	3.288	4	1	5	1.095
PRE1	24	0	3.536	4	1	5	1.035
PRE2	25	0	3.882	4	1	5	1.013
PRE3	26	0	3.529	4	1	5	1.067
PRE4	27	0	3.68	4	1	5	1.03
PRE5	28	0	3.373	4	1	5	1.148
PRE6	29	0	4.039	4	1	5	0.969
RC1	30	0	2.366	2	1	5	0.972
RC2	31	0	2.683	3	1	5	1.109
RC3	32	0	2.627	3	1	5	0.983
RC4	33	0	2.461	2	1	5	1.294
SC1	46	0	4.461	5	2	5	0.626
SC2	47	0	4.448	5	1	5	0.661
SC3	48	0	4.301	4	1	5	0.715
SC4	49	0	4.114	4	1	5	0.688
SC5	50	0	4.474	5	1	5	0.715
SC6	51	0	4.196	5	1	5	1.073
CI1	52	0	3.827	4	1	5	0.98
CI2	53	0	4.582	5	1	5	0.643
CI3	54	0	2.755	3	1	5	1.319
CI4	55	0	3.873	4	1	5	1.073

CI5	56	0	3.209	4	1	5	1.294
CE1	57	0	3.908	4	1	5	0.791
CE2	58	0	3.807	4	1	5	0.874
CE3	59	0	3.676	4	1	5	0.857
CE4	60	0	2.928	3	1	5	1.322
CE5	61	0	3.569	4	1	5	1.133
CE6	62	0	3.997	4	1	5	0.842
CE7	63	0	3.892	4	1	5	0.787
CE8	64	0	3.775	4	1	5	0.766
CE9	65	0	3.987	4	1	5	0.832
EM1	71	0	3.373	3	1	5	0.885
EM2	72	0	3.448	3	1	5	0.87
EM3	73	0	3.608	4	1	5	1.098
EM4	74	0	2.647	3	1	5	1.132
EM5	75	0	2.961	3	1	5	1.031
EM6	76	0	3.268	3	1	5	1.129
EM7	77	0	2.944	3	1	5	1.1
TG1	78	0	3.696	4	1	5	0.781
TG2	79	0	3.157	3	1	5	1.15
TG3	80	0	3.15	3	1	5	1.04
TG4	81	0	3.441	4	1	5	0.858
TG5	82	0	3.915	4	1	5	0.848
TG6	83	0	3.673	4	1	5	0.787
TS1	84	0	3.363	4	1	5	0.958
TS2	85	0	3.183	3	1	5	0.956
TS3	86	0	3.108	3	1	5	0.921
TS4	87	0	3.02	3	1	5	0.943
TS5	88	0	2.869	3	1	5	1.017
TS6	89	0	2.912	3	1	5	1.073
TS7	90	0	2.794	3	1	5	1.063
TS8	91	0	2.85	3	1	5	1.119
TS9	92	0	2.814	3	1	5	1.061
TS10	93	0	2.709	3	1	5	1.068
TS11	94	0	2.588	2	1	5	1.036
TS12	95	0	3.431	4	1	5	0.992
TS13	96	0	3.111	3	1	5	1.004
TS14	97	0	2.948	3	1	5	1.08
TS15	98	0	2.915	3	1	5	1.072
TS16	99	0	2.435	2	1	5	1.139
IP1	100	0	3.817	4	1	5	0.976
IP2	101	0	3.99	4	2	5	0.955
IP3	102	0	4.206	4	2	5	0.741
IP4	103	0	3.559	4	1	5	0.993
IP5	104	0	3.431	4	1	5	1.083
IP6	105	0	3.428	4	1	5	1.071

Age	106	0	1.667	2	1	3	0.709
Gender	107	0	1.601	2	1	3	0.496
Education	108	0	2.415	2	1	6	1.118
Income	109	0	2.801	3	1	5	1.248
HH_size	110	0	5.402	5	1	16	2.223
House_type	111	0	5.343	8	1	8	3.097

Table 2: Skewness and kurtosis

Variables	Number of observations		Median	Std. Deviation	Skewness	Std. Error of Skewness	3*G1	Kurtosis	Std. Error of Kurtosis	3*J1
	Valid	Missing								
PP1	306	0	4.00	.986	-1.022	.139	.418	.267	.278	0.83
PP2	306	0	3.00	.947	0.028	.139	.418	-.505	.278	0.83
PS1	306	0	4.00	1.145	-0.361	.139	.418	-.815	.278	0.83
PS2	306	0	3.00	1.144	0.083	.139	.418	-1.104	.278	0.83
PS3	306	0	4.00	.941	-0.806	.139	.418	.279	.278	0.83
RW1	306	0	4.00	.929	-1.035	.139	.418	.785	.278	0.83
RW2	306	0	4.00	.991	-0.999	.139	.418	.498	.278	0.83
RW3	306	0	4.00	.725	-1.062	.139	.418	1.931	.278	0.83
RW4	306	0	4.00	.721	-1.348	.139	.418	3.543	.278	0.83
PSE1	306	0	4.00	.927	-1.062	.139	.418	1.006	.278	0.83
PSE2	306	0	4.00	.861	-0.897	.139	.418	.748	.278	0.83
PSE3	306	0	3.00	1.091	0.033	.139	.418	-1.152	.278	0.83
PSE4	306	0	4.00	.758	-1.174	.139	.418	2.070	.278	0.83
PSE5	306	0	3.00	1.119	0.071	.139	.418	-1.116	.278	0.83
PSE6	306	0	4.00	1.096	-0.305	.139	.418	-1.031	.278	0.83
PRE1	306	0	4.00	1.037	-0.789	.139	.418	-.149	.278	0.83
PRE2	306	0	4.00	1.014	-1.109	.139	.418	.897	.278	0.83
PRE3	306	0	4.00	1.069	-0.807	.139	.418	-.043	.278	0.83
PRE4	306	0	4.00	1.032	-0.643	.139	.418	-.447	.278	0.83
PRE5	306	0	4.00	1.150	-0.284	.139	.418	-1.152	.278	0.83
PRE6	306	0	4.00	.971	-1.269	.139	.418	1.277	.278	0.83
RC1	306	0	4.00	.973	-0.779	.139	.418	.551	.278	0.83
RC2	306	0	3.00	1.111	-0.305	.139	.418	-.601	.278	0.83
RC3	306	0	3.00	.984	-0.409	.139	.418	-.259	.278	0.83
RC4	306	0	4.00	1.296	-0.451	.139	.418	-.952	.278	0.83
SC1	306	0	5.00	.627	-1.054	.139	.418	1.540	.278	0.83
SC2	306	0	5.00	.662	-1.479	.139	.418	3.913	.278	0.83
SC3	306	0	4.00	.716	-1.163	.139	.418	2.318	.278	0.83
SC4	306	0	4.00	.689	-0.818	.139	.418	1.863	.278	0.83
SC5	306	0	5.00	.716	-1.527	.139	.418	2.888	.278	0.83
SC6	306	0	5.00	1.075	-1.371	.139	.418	1.008	.278	0.83
CI1	306	0	4.00	.982	-1.364	.139	.418	1.738	.278	0.83
CI2	306	0	5.00	.644	-2.236	.139	.418	8.392	.278	0.83

CI3	306	0	3.00	1.321	0.013	.139	.418	-1.364	.278	0.83
CI4	306	0	4.00	1.074	-1.133	.139	.418	.639	.278	0.83
CI5	305	1	4.00	1.298	-0.380	.140	.419	-1.113	.278	0.83
CE1	306	0	4.00	.792	-1.070	.139	.418	1.599	.278	0.83
CE2	306	0	4.00	.875	-0.825	.139	.418	.544	.278	0.83
CE3	306	0	4.00	.859	-0.950	.139	.418	.931	.278	0.83
CE4	306	0	3.00	1.324	0.030	.139	.418	-1.229	.278	0.83
CE5	306	0	4.00	1.135	-0.746	.139	.418	-.312	.278	0.83
CE6	306	0	4.00	.843	-1.314	.139	.418	2.505	.278	0.83
CE7	306	0	4.00	.788	-0.737	.139	.418	.720	.278	0.83
CE8	306	0	4.00	.767	-0.732	.139	.418	.923	.278	0.83
CE9	306	0	4.00	.834	-0.933	.139	.418	1.036	.278	0.83
EM1	306	0	3.00	.886	-0.491	.139	.418	.239	.278	0.83
EM2	306	0	3.00	.872	-0.317	.139	.418	.077	.278	0.83
EM3	306	0	4.00	1.100	-0.827	.139	.418	.072	.278	0.83
EM4	306	0	3.00	1.134	0.087	.139	.418	-.926	.278	0.83
Em5	306	0	3.00	1.033	-0.155	.139	.418	-.520	.278	0.83
EM6	306	0	3.00	1.131	-0.104	.139	.418	-.864	.278	0.83
EM7	306	0	3.00	1.101	0.140	.139	.418	-.648	.278	0.83
TG1	306	0	4.00	.782	-1.021	.139	.418	1.152	.278	0.83
TG2	306	0	3.00	1.152	-0.453	.139	.418	-.764	.278	0.83
TG3	306	0	3.00	1.042	-0.567	.139	.418	-.539	.278	0.83
TG4	306	0	4.00	.860	-0.767	.139	.418	.169	.278	0.83
TG5	306	0	4.00	.849	-1.002	.139	.418	1.332	.278	0.83
TG6	306	0	4.00	.788	-0.889	.139	.418	1.110	.278	0.83
TS1	306	0	4.00	.959	-0.468	.139	.418	-.805	.278	0.83
TS2	306	0	3.00	.958	-0.464	.139	.418	-.598	.278	0.83
TS3	306	0	3.00	.922	-0.191	.139	.418	-.976	.278	0.83
TS4	306	0	3.00	.944	-0.204	.139	.418	-1.012	.278	0.83
TS5	306	0	3.00	1.019	-0.109	.139	.418	-1.148	.278	0.83
TS6	306	0	3.00	1.075	-0.206	.139	.418	-.990	.278	0.83
TS7	306	0	3.00	1.065	-0.056	.139	.418	-.968	.278	0.83
TS8	306	0	3.00	1.121	-0.165	.139	.418	-1.106	.278	0.83
TS9	306	0	3.00	1.063	0.163	.139	.418	-.881	.278	0.83
TS10	306	0	3.00	1.070	0.084	.139	.418	-1.029	.278	0.83
TS11	306	0	2.00	1.037	0.179	.139	.418	-.899	.278	0.83
TS12	306	0	4.00	.994	-0.445	.139	.418	-.355	.278	0.83
TS13	306	0	3.00	1.005	-0.537	.139	.418	-.507	.278	0.83
TS14	306	0	3.00	1.082	-0.318	.139	.418	-.975	.278	0.83
TS15	306	0	3.00	1.074	-0.198	.139	.418	-.945	.278	0.83
TS16	306	0	2.00	1.141	0.289	.139	.418	-.979	.278	0.83
IP1	306	0	4.00	.978	-0.896	.139	.418	.161	.278	0.83
IP2	306	0	4.00	.956	-0.863	.139	.418	-.081	.278	0.83
IP3	306	0	4.00	.742	-1.126	.139	.418	1.868	.278	0.83
IP4	306	0	4.00	.994	-0.597	.139	.418	-.580	.278	0.83

IP5	306	0	4.00	1.085	-0.442	.139	.418	-.945	.278	0.83
IP6	306	0	4.00	1.073	-0.470	.139	.418	-.909	.278	0.83
SS1	306	0	4.00	.747	-1.312	.139	.418	2.531	.278	0.83
SS2	306	0	4.00	.643	-0.938	.139	.418	1.734	.278	0.83
SS3	306	0	4.00	.748	-1.199	.139	.418	1.902	.278	0.83
SS4	306	0	4.00	.724	-1.012	.139	.418	1.631	.278	0.83
SS5	306	0	4.00	.866	-0.766	.139	.418	.288	.278	0.83
Age	306	0	2.00	.711	0.583	.139	.418	-.852	.278	0.83
Gender	306	0	2.00	.497	-0.335	.139	.418	-1.687	.278	0.83
Education	306	0	2.00	1.120	0.934	.139	.418	.792	.278	0.83
Income	306	0	3.00	1.250	0.079	.139	.418	-1.054	.278	0.83
HH_size	306	0	5.00	2.226	1.327	.139	.418	3.118	.278	0.83
Depratio	306	0	2.00	31.212	1.871	.139	.418	4.132	.278	0.83
House_type	306	0	8.00	3.102	-0.372	.139	.418	-1.788	.278	0.83

Table 2: Post-hoc Power Analysis

[1] *-- Tuesday, July 24, 2018 -- 14:30:42*

F tests - Linear multiple regression: Fixed model, R^2 deviation from zero

Analysis:	Post hoc: Compute achieved power		
Input:	Effect size f^2	=	0.15
α err prob	= 0.05		
Total sample size	= 306		
Number of predictors	= 16		
Output:	Noncentrality parameter λ	=	45.9000000
Critical F	= 1.6786006		
Numerator df	= 16		
Denominator df	= 289		
Power (1-β err prob)	= 0.9973357		

Composite Reliability and Average Variance Extracted (AVE)

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
CE	0.746	0.854	0.66
CI	0.634	0.844	0.731
CP	0.612	0.763	0.398
CA	0.667	0.766	0.3
EM	0.766	0.841	0.515
IP	0.82	0.894	0.738
PP	0.474	0.791	0.655
RC	0.509	0.763	0.632
PRE	0.754	0.846	0.581
RW	0.701	0.868	0.768
RA	0.765	0.831	0.371
PSE	0.554	0.77	0.53
SC	0.689	0.828	0.616
PS	0.835	0.883	0.602
TR	0.878	0.903	0.465
TS	0.898	0.918	0.584
TG	0.596	0.787	0.552

VIF of reflective indicators

	VIF
CE1	1.548
CE2	1.615
CE3	1.378
CI4	1.275
CI4	1.323
CIv5	1.275
CI5	1.336
EM1	1.342
EM2	1.402
EM3	1.529
EM4	1.56
EM5	1.479
IP4	1.388
IP5	3.057
IP6	2.916
PP1	1.107
PP1	1.312
Pp2	1.107
PP2	1.26
RC1	1.207
RC1	1.132

RC2	1.15
RC2	1.132
PRE1	1.369
PRE1	1.397
PRE2	1.666
PRE2	1.739
PRE3	2.009
PRE3	2.048
RW3	1.41
RW3	1.451
RW	1.41
RW4	1.425
PSE1	1.147
PSE1	1.188
PSE2	1.265
PSE2	1.348
PSE4	1.142
PSE4	1.189
SC2	1.294
SC2	1.346
SC3	1.345
SC3	1.351
SC4	1.399
SC4	1.449
PS1	2.457
PS1	2.506
PS2	2.449
PS2	2.519
PS3	1.648
PS3	1.679
TS1	2.443
TS1	2.559
TS2	2.353
TS2	2.395
TS3	2.137
TS3	2.18
TS5	1.96
TS5	1.977
TG3	1.212
TG3	1.394
TG4	1.239
TG4	1.307
TG5	1.157
TG5	1.274

Latent variable scores derived from the measurement model data

CE	CP	CA	EM	IP	RA	TR
-0.253	-0.195	-0.151	-0.406	-0.14	0.142	0.664
0.305	-0.195	0.268	-0.406	0.585	-0.199	0.131
0.305	-0.195	0.309	1.327	-0.192	0.397	1.229
0.864	1.278	0.431	0.945	0.197	0.911	0.72
0.305	-1.142	-0.023	-0.288	0.585	-0.186	0.798
-2.212	-1.576	-0.668	-0.616	-0.146	-0.183	0.162
0.305	1.541	-0.849	1.885	0.585	-1.047	1.016
0.305	-0.195	0.079	0.167	-0.865	-0.067	1.229
0.305	1.541	-0.849	1.885	0.585	-1.203	1.016
0.305	0.502	-1.264	0.597	-0.163	-0.63	-0.017
0.716	0.239	0.496	1.118	0.585	0.622	0.513
0.305	-0.195	0.408	0.039	-0.14	-0.183	0.294
-0.106	-0.234	-1.146	-0.236	1.698	0.966	0.273
-0.253	-1.059	-0.207	0.039	0.197	0.679	-0.723
1.211	0.502	0.811	0.473	-1.276	0.648	0.667
0.864	-1.261	-0.108	-0.616	0.219	-0.024	0.946
-0.253	-0.195	0.645	0.248	0.585	0.537	0.541
-0.665	-1.585	-0.69	-0.079	-1.642	-0.142	-0.568
0.305	-0.195	0.728	1.327	0.585	0.178	-0.228
-0.106	-2.48	-0.555	-1.366	-0.163	1.232	0.308
-0.253	-0.388	0.052	-0.288	0.585	0.125	0.953
0.305	0.941	-0.186	0.924	1.698	0.793	1.53
0.716	0.879	0.35	1.017	0.591	1.126	0.415
1.769	1.752	1.792	0.924	1.698	1.092	1.53
0.305	0.243	0.345	0.131	-0.14	-0.028	0.699
-0.253	0.243	0.003	-0.252	0.585	-0.089	0.603
0.8	0.506	1.078	1.466	1.31	0.538	1.136
-0.6	0.366	0.289	0.494	0.585	0.699	0.538
0.305	1.278	-0.416	0.682	0.585	0.95	0.842
0.305	-1.006	0.209	-0.288	0.225	0.71	0.18
-0.106	0.068	0.157	0.893	0.585	0.339	-0.18
-0.748	0.077	0.036	-0.389	-0.169	0.377	-0.172
-0.106	-0.493	0.752	-0.861	0.585	0.168	0.526
-0.106	-0.195	0.716	-0.652	-0.192	0.595	0.635
-0.812	-0.721	0.038	-0.519	0.585	0.294	0.57
-0.337	-1.445	0.26	0.182	0.585	-0.3	0.937
0.305	-0.388	0.517	-1.122	-0.14	-0.344	-0.174
0.305	0.454	0.362	-0.007	-0.477	0.601	1.229
0.158	0.147	0.153	0.316	-0.169	0.638	0.231
-0.683	-0.143	1.088	0.893	-0.14	0.701	1.371
-0.253	-0.177	0.229	-1.091	0.585	0.554	0.045
-0.253	1.278	1.053	0.341	0.225	1.319	0.543
-0.253	-0.195	0.35	0.285	0.585	-0.027	0.005

0.8	-0.62	0.304	0.994	0.225	0.653	1.23
0.305	-0.616	1.234	1	-0.146	0.47	1.497
1.211	-0.195	0.624	0.076	0.585	0.95	-0.214
0.305	-1.142	0.771	-0.165	0.95	0.589	0.539
0.305	0.239	0.765	0.039	-0.865	0.131	1.032
0.305	1.278	0.835	0.667	0.973	0.316	1.628
-1.159	-1.318	-1.073	-1.143	-0.146	-0.186	0.521
-1.159	-1.318	-1.073	-1.143	-0.146	-0.186	0.521
-0.517	-0.195	0.019	0.704	-0.192	0.81	-0.084
1.769	1.068	-0.599	1.676	1.698	0.334	0.548
1.769	1.752	0.513	2.228	1.31	1.274	0.855
0.716	-0.406	0.321	0.473	-1.276	0.323	0.828
-0.6	-0.84	-0.385	-0.273	-0.169	0.647	-1.813
0.158	-0.796	-0.584	0.146	-0.134	-0.245	-1.393
1.211	1.151	-0.465	1.118	0.585	1.118	0.531
0.652	1.068	1.133	1.103	0.973	0.815	1.141
0.864	0.467	-0.27	0.341	0.585	-0.187	0.975
-0.253	-0.388	0.992	-0.236	0.95	0.184	0.718
0.305	1.278	0.431	1.031	1.698	1.639	0.549
-0.683	-0.703	0.792	-0.427	0.585	1.111	-0.429
1.358	1.752	1.823	2.213	1.698	0.994	0.978
-0.253	0.243	0.392	-0.744	0.585	0.125	0.32
0.716	1.541	0.529	0.473	0.973	0.417	0.145
-0.665	-1.05	-0.304	-0.999	-1.282	0.549	-1.425
-0.665	0.506	0.579	0.808	0.585	1.163	-1.496
0.305	-0.195	-0.191	0.525	-0.192	0.641	-1.676
1.358	1.103	-0.174	1.118	1.698	1.484	0.451
-1.223	0.243	-0.17	1.67	-0.169	0.852	0.533
0.864	0.405	0.716	1.885	0.944	0.389	-0.203
0.716	-0.099	-1.711	-0.186	-1.59	-0.232	-0.142
-0.517	1.054	1.18	1.221	0.973	0.062	0.719
-2.193	-2.804	-0.906	-0.988	-0.888	0.187	-1.001
0.305	0.278	-0.007	-0.027	0.585	0.751	-1.117
0.305	-0.195	-0.087	0.582	0.585	0.449	-0.862
0.305	-0.182	-0.283	-0.17	-0.192	-0.634	-1.749
0.864	0.037	-0.418	0.96	-0.14	0.851	0.963
-0.517	0.84	0.411	1.031	0.585	0.059	-0.313
0.305	-0.616	0.349	-0.345	0.944	0.408	-1.499
1.358	1.331	1.18	-1.158	0.944	0.815	0.69
0.241	-0.388	0.399	-0.443	0.556	0.307	-0.287
0.305	0.506	0.415	0.734	-0.14	0.7	-0.084
0.864	1.752	0.528	0.458	-0.134	-0.224	-1.638
-1.223	-0.655	-1.609	-0.324	-2.389	-0.003	0.319
-0.665	0.239	-0.17	-0.166	0.585	1.18	-1.777
0.305	0.243	0.35	0.704	0.944	0.966	-1.009

0.8	-0.879	-0.275	-1.05	-1.642	0.767	0.296
-1.223	0.506	-0.308	0.96	-0.917	1.303	-0.36
0.716	0.243	-0.331	0.704	0.944	0.966	-1.43
-0.253	0.243	-0.057	1.103	-0.923	0.502	-2.054
0.305	-0.195	-0.026	-1.137	-0.192	0.716	-1.525
0.8	1.752	0.561	0.163	1.698	-0.477	0.358
-0.106	-0.024	1.192	-0.671	0.219	1.028	-1.121
-1.012	-0.406	0.592	-0.288	0.585	1.07	-1.031
0.8	0.506	0.351	0.806	0.585	0.913	-1.944
0.864	0.068	1.029	0.719	0.585	0.966	-0.947
-0.189	0.068	-0.702	0.039	-0.865	-0.222	-1.494
-1.306	-0.195	0.095	0.054	0.585	0.235	-1.188
-0.517	0.506	-0.474	0.597	-0.865	1.06	-1.791
0.864	-0.796	0.117	0.024	-0.557	0.392	-1.947
-0.106	-0.914	0.775	-0.149	0.219	0.117	-0.624
0.864	0.243	0.147	1.707	0.585	0.966	-1.525
0.305	-0.182	-0.893	0.248	-0.865	0.235	-2.052
0.305	1.752	0.982	1.329	1.698	1.628	0.577
1.211	1.752	1.569	0.233	1.698	1.795	0.849
-1.012	-0.129	0.422	-0.616	0.585	1.111	0.419
1.211	1.752	1.179	0.192	1.698	0.738	1.205
0.305	-0.195	-0.142	0.177	-0.192	0.699	-1.656
0.305	-0.195	0.415	0.597	-0.192	0.913	-1.873
1.358	0.858	-1.231	-1.223	0.534	-0.519	0.134
0.241	0.506	0.966	0.132	0.585	1.167	-1.311
0.652	1.151	-1.99	-1.192	-1.642	-0.88	-0.657
-0.253	-0.353	-0.92	-0.513	-1.642	-0.363	-0.266
0.305	-0.195	0.247	0.024	0.585	1.18	-1.534
0.305	0.239	0.603	0.924	0.95	1.303	-2.152
0.305	-0.721	0.203	-0.238	-0.192	0.81	-2.371
0.864	-0.367	0.787	0.06	0.95	0.304	-1.393
1.211	0.629	-0.342	-0.467	-0.477	-0.009	-1.374
1.769	1.331	0.906	0.444	1.698	1.795	0.294
1.769	1.541	1.728	1.537	1.698	1.639	0.823
0.305	-0.195	-0.557	0.386	0.585	1.008	-1.125
0.716	0.029	1.075	-0.238	-0.506	0.168	-0.639
-0.517	0.318	-0.705	-0.722	0.585	-0.396	-0.196
0.305	0.332	-1.739	-1.519	-0.888	-0.742	-1.046
0.305	-1.142	0.919	0.525	0.585	0.966	-1.62
0.305	-0.195	0.726	-0.134	0.197	1.597	-1.245
-1.506	1.752	-0.095	0.459	0.585	1.43	-0.047
0.305	-0.195	-0.638	0.177	0.944	0.508	-2.177
-0.665	1.278	1.02	0.269	-0.163	1.795	-0.973
-2.065	-1.348	0.409	0.248	-0.163	0.966	-1.918
-0.812	0.243	0.604	0.403	0.585	0.966	-1.89

0.305	0.506	-0.465	-0.288	0.585	0.93	-2.026
0.305	-0.195	0.415	-0.988	0.585	1.215	-1.626
0.716	1.752	2.083	0.146	0.585	1.146	0.172
0.305	-0.195	0.691	0.682	0.585	1.274	-1.62
0.864	-0.195	0.972	0.473	0.585	-1.177	-1.246
0.094	-0.892	-1.884	-1.274	-1.642	-1.598	-0.392
0.305	0.243	1.201	-0.064	0.585	0.966	-1.635
1.211	0.462	1.977	1.676	1.698	1.597	-0.092
0.864	-0.125	-1.579	-0.692	-1.658	-1.486	-1.379
-0.253	0.879	-3.348	-0.027	-0.477	-0.056	-0.087
-1.287	-0.151	-0.978	-2.512	-2.367	-2.224	-1.08
1.211	-1.409	-0.226	-0.759	0.944	0.038	0.649
-0.928	-1.615	1.06	0.758	0.585	-2.175	1.171
0.8	-0.406	-1.492	-0.758	0.585	0.966	-1.865
0.8	0.405	0.837	0.51	0.944	1.118	-1.62
0.8	0.405	0.837	0.51	0.944	1.118	-1.62
0.305	0.529	0.682	0.035	0.585	1.123	-0.824
0.305	-0.195	-2.938	-1.315	-0.58	-1.303	-0.598
-0.253	-1.006	-0.302	-0.027	-0.163	0.085	-0.898
0.716	0.243	0.162	0.112	0.944	0.294	0.845
1.211	1.752	-0.699	1.031	0.585	0.502	1.388
-0.665	-0.182	0.548	0.704	0.585	0.68	0.921
-0.517	0.506	0.543	0.387	0.585	0.959	1.066
0.864	0.444	0.11	0.372	0.585	0.856	0.401
-0.253	-0.63	0.154	-0.427	-0.146	0.148	1.105
-0.272	0.296	0.685	1.139	0.973	0.294	1.088
1.211	1.752	-0.699	1.031	0.585	0.502	1.388
0.305	-1.142	0.162	-1.23	-0.528	-1.013	0.69
-0.189	-1.142	-0.358	1.931	0.585	-0.471	0.155
0.305	0.467	-0.861	0.177	-1.254	0.064	0.687
0.864	0.405	-0.461	1.327	0.944	-1.053	0.828
-0.106	-0.216	-0.983	0.285	-1.254	-1.245	-1.099
0.305	-0.195	1.217	0.458	0.973	0.508	1.495
-0.748	0.467	-0.153	-0.395	1.332	-0.036	1.138
0.305	1.278	0.913	0.736	0.95	-0.416	1.091
0.8	1.278	0.782	0.387	1.338	1.238	0.642
1.275	-0.195	0.901	1.204	1.698	-0.17	0.949
0.716	1.05	1.019	-0.186	0.95	0.066	1.631
-1.653	-0.84	-0.195	-0.81	0.585	1.232	0.107
0.864	0.405	1.106	2.437	1.698	1.278	1.944
-1.159	-3.085	-2.269	-1.03	-2.03	-1.87	-0.284
0.305	0.467	0.121	0.06	0.225	-0.663	-0.099
0.716	0.213	0.309	0.576	0.585	0.067	0.825
0.305	1.752	-1.891	1.031	-1.642	1.43	1.229
0.305	-0.182	0.203	1	-0.865	-0.819	0.204

0.305	-0.269	0.598	0.479	-0.911	-1.297	1.496
-0.106	1.541	0.355	1.312	0.585	0.871	0.993
0.305	0.858	0.545	0.893	0.585	-1.491	0.347
-1.506	-0.125	-1.619	-1.106	-1.642	-0.579	-0.682
0.305	-1.142	-1.709	-1.26	-0.146	0.758	0.821
-4.087	-1.743	-2.195	-2.115	-0.5	-0.118	-0.38
0.388	0.73	1.853	2.213	0.585	-0.183	1.25
0.305	0.257	0.229	0.479	-1.254	0.021	0.818
0.864	-0.778	0.043	-1.106	-1.254	-0.224	1.393
0.305	0.257	0.13	-0.033	-1.254	-1.127	0.95
0.8	-0.708	0.431	0.473	-0.894	-1.742	-0.264
0.305	1.752	1.539	1.031	0.585	-0.654	0.543
-0.106	1.151	0.329	0.473	1.698	-0.067	1.371
0.305	-0.195	0.697	-0.079	0.585	-0.576	0.601
-0.665	-0.02	-0.979	-1.383	-1.642	-1.934	-0.265
0.305	0.243	-0.089	-0.288	0.585	-0.17	0.915
-1.57	-1.2	-1.162	-1.638	-1.642	-2.992	-0.284
-0.748	-0.182	0.51	-0.533	-0.192	-1.957	0.459
-0.189	1.541	0.538	0.146	-0.192	-0.355	-1.381
0.716	-1.177	0.121	-1.315	-0.134	-1.017	0.127
0.305	1.752	0.52	0.734	0.973	0.278	0.699
-0.106	-1.274	-0.467	-0.374	0.585	-0.024	-0.075
-0.253	-0.796	0.089	-1.244	1.31	-0.854	-0.373
-0.665	0.467	-0.212	0.355	0.585	-0.025	0.412
-0.812	0.257	0.62	0.269	-0.917	-1.198	-1.153
-0.665	-0.703	0.396	1.358	-0.865	-1.436	-1.114
1.275	-1.142	0.242	0.422	-0.865	0.334	0.596
-1.223	-0.195	0.265	0.357	0.585	1.471	0.41
1.769	1.068	1.027	1.031	-1.254	0.461	0.469
0.305	1.752	-1.621	-0.134	-2.367	0.31	-0.118
-0.6	-1.142	-1.339	-1.837	0.585	-0.203	-0.083
-1.718	-0.269	-0.13	0.669	-0.551	-0.755	-0.986
0.305	0.257	-0.571	-0.042	-1.254	-0.819	-0.84
-0.253	-0.563	-3.675	-1.643	-1.642	-2.098	-1.381
-1.306	-2.085	-1.43	-2.099	-1.642	-1.955	-0.724
-0.6	-0.269	-0.492	-1.557	-1.254	-1.778	-0.566
-2.623	-0.988	-2.933	-1.797	-1.642	-1.394	0.138
0.305	-0.362	-0.964	-0.461	-0.146	0.814	0.891
1.275	1.752	0.707	0.458	0.585	-0.88	1.886
-0.189	0.405	0.992	0.269	0.219	-0.021	-0.35
-1.306	-2.423	-3.339	-3.188	-1.642	-0.873	-0.807
-1.242	-2.069	-1.838	-2.164	-0.528	-2.805	-1.389
1.769	1.278	1.106	0.285	0.585	0.121	1.118
0.305	0.033	0.736	-0.498	0.585	0.148	0.58
0.305	-0.826	0.467	-0.498	0.585	0.496	0.053

1.358	-0.195	0.079	-0.374	0.585	-0.998	-0.788
-0.106	-1.761	0.516	-0.498	0.197	-0.358	0.183
-0.253	0.52	-1.341	-0.842	-1.642	-1.586	-0.442
0.305	0.257	-0.34	1.016	-0.865	-1.84	-0.932
0.305	1.121	0.87	1.655	-0.477	-0.772	1.216
-0.253	0.239	0.488	-0.374	0.585	0.679	0.596
0.241	-1.073	-1.369	-1.526	-1.642	-1.296	0.611
-0.748	-0.479	-0.734	-1.003	-1.642	-0.449	-1.401
0.305	-0.778	-0.542	-0.134	-1.642	-1.455	0.474
0.305	0.243	0.341	0.233	0.585	0.758	0.49
0.305	1.121	0.001	0.628	-1.642	-1.005	-0.223
1.769	1.278	0.258	0.821	0.944	-0.61	2.061
-0.106	-0.458	1.406	-0.079	0.585	0.143	0.364
-1.506	-0.914	0.268	-1.296	-0.522	-0.05	0.034
0.716	0.047	0.349	-1.07	-2.007	-0.254	-1.131
-0.253	-0.479	-1.893	0.858	-1.254	-0.183	-0.104
-1.634	0.015	-0.423	-0.926	0.585	0.13	1.229
0.716	0.678	0.402	2.228	-0.528	1.163	-0.351
0.305	-0.195	-0.598	-0.358	0.585	-0.027	0.309
1.211	-0.44	-0.56	-0.671	0.585	-0.906	-0.064
1.211	0.91	0.333	1	1.31	-1.204	1.23
-0.17	0.7	0.545	0.269	-0.528	0.039	0.317
1.211	0.941	-1.288	1.327	0.585	-0.646	0.302
0.305	1.278	0.63	0.479	-1.254	0.011	0.306
0.305	0.858	0.496	0.024	-0.894	-1.033	-0.498
0.305	1.278	1.322	0.473	0.585	1.429	1.229
-2.623	-1.743	-0.032	-1.445	0.585	-2.27	0.855
0.305	-1.177	-1.966	-0.427	-1.254	-0.624	0.313
1.211	1.541	1.139	-0.203	0.219	0.403	0.816
0.305	-0.826	0.448	0.581	0.585	0.329	1.245
1.211	-0.103	0.092	-0.585	-0.14	0.641	0.702
0.305	0.647	0.489	1.434	-0.865	0.323	1.112
-2.623	0.941	-1.328	-1.833	-0.192	-0.843	1.256
-2.623	-0.792	0.43	-2.057	-0.865	-2.354	-0.25
0.305	0.257	-0.488	0.734	-1.642	-1.017	0.163
-1.718	0.712	-0.577	1.327	-0.192	0.449	0.869
1.211	-0.918	-1.225	-0.141	-1.254	-1.047	-0.436
-0.665	-1.441	-0.278	-0.513	-0.911	-1.053	-1.763
0.305	-0.388	1.18	0.039	0.973	-1.001	0.707
0.716	0.033	1.174	-0.288	0.585	-0.106	0.541
0.305	0.086	1.595	0.039	0.973	-0.363	0.7
0.305	1.752	-0.489	1.762	0.225	1.425	-0.723
-1.718	0.033	-0.319	-0.498	0.585	0.087	-0.358
0.8	-0.826	-3.206	-1.509	-0.477	-1.726	-0.259
0.305	0.239	-1.175	0.302	-0.865	1.316	0.657

1.211	0.506	0.519	0.643	1.698	-1.196	1.401
0.8	0.015	0.309	0.218	0.95	-1.391	1.907
0.716	0.941	0.34	0.511	0.585	1.597	1.256
0.305	0.858	0.579	0.248	-1.642	-1.299	0.572
-0.253	-0.226	0.931	-0.498	-1.642	0.095	-1.194
-0.253	-0.406	1.306	0.248	0.585	-0.842	0.649
0.305	0.257	0.496	0.039	-0.169	-0.527	-0.581
1.211	1.489	0.643	1.343	0.973	-0.179	1.371
-1.159	-2.65	-2.112	-2.84	-1.642	-1.585	-0.524
0.305	-1.405	1.074	-0.57	-0.494	0.297	0.146
0.286	1.331	1.019	0.812	1.338	0.138	0.978
0.8	1.121	0.893	-0.165	-0.917	-0.099	1.14
-2.623	-2.88	-4.052	-1.189	-0.477	-3.253	-0.813
-1.634	-1.142	-0.663	-0.281	0.585	-0.529	1.229
-0.6	-0.323	0.706	-0.498	-0.865	0.273	0.052
0.305	-0.388	0.207	0.269	-1.59	-0.921	0.312
0.305	1.313	1.328	1.205	0.585	-0.303	-0.412
-0.106	1.752	0.456	1.031	1.698	-0.842	-1.115
-0.253	-0.182	0.01	-1.679	-1.642	-1.596	-1.167
1.211	1.278	0.554	1.098	1.698	1.253	1.971
-4.087	-3.962	-1.369	-2.861	-1.642	-2.633	-0.478
0.305	-0.388	0.64	-0.079	-1.59	-0.399	0.716
-0.189	-0.918	0.89	-0.498	-0.192	-1.044	0.588
-3.182	0.647	0.318	-1.782	0.562	1.43	-0.033
-2.623	-0.742	-1.122	-1.854	-1.642	0.005	-0.635
-2.623	-0.923	-3.415	-2.491	-1.642	-3.451	-0.498
-1.653	-0.778	-0.794	-1.433	-1.642	-0.929	-0.357
-1.634	-2.393	-1.085	-1.867	-1.642	-1.424	-0.768
-0.748	-0.708	-0.902	-1.889	-2.007	-1.26	-2.349
-0.812	-0.703	-0.435	-0.186	-0.865	-0.486	-0.785
-0.253	0.678	0.96	-0.288	0.585	0.388	0.048
-2.623	-0.523	-1.033	-1.06	-1.254	-0.305	-0.417
-3.182	-1.777	-0.517	-2.32	-1.642	-0.945	0.638
0.305	-0.616	0.29	0.178	0.585	-0.169	-0.159
-1.012	-1.651	-0.456	-1.679	-2.007	-1.117	-1.702
0.716	-0.195	0.585	-0.288	0.585	-0.298	-0.299
-1.076	-1.2	-0.483	-0.862	-1.642	-2.869	0.051
-2.212	-0.742	0.277	-2.216	-1.642	-0.449	0.816

Structural model: Path coefficients-values and p-values (bootstrapping, 5000 sub-samples two tailed test at 0.05 alpha).

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
CA -> CE	0.261	0.26	0.054	4.835	0
CA -> CP	0.131	0.132	0.057	2.314	0.021
CA -> IP	0.265	0.265	0.058	4.562	0
CE -> CP	0.38	0.379	0.053	7.153	0
CE -> EM	0.3	0.299	0.056	5.328	0
CP -> EM	0.452	0.453	0.049	9.174	0
EM -> IN	0.191	0.189	0.053	3.575	0
EM -> TR	0.263	0.263	0.051	5.17	0
RA -> CE	0.228	0.227	0.064	3.552	0
RA -> CP	0.243	0.241	0.055	4.438	0
RA -> IP	0.3	0.301	0.053	5.698	0
TR -> IP	0.153	0.153	0.046	3.353	0.001

Predictive power of model (R-square values), t-test and p-values (bootstrapping, 5000 sub-samples, two tailed test at 0.05 alpha).

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
CE	0.168	0.174	0.046	3.694	0
CP	0.224	0.228	0.049	4.597	0
EM	0.432	0.435	0.049	8.898	0
IP	0.416	0.422	0.041	10.116	0
TR	0.069	0.071	0.026	2.609	0.009

Model Fit results (bootstrapping, 5000 sub-samples two tailed test at 0.05 alpha).

	Saturated Model	Estimated Model
SRMR	0	0.161
d_ULS	0	0.729
d_G	0	0.122
Chi-Square		169.888
NFI	1	0.74

Mediation Analysis

Direct effect test: Bootstrapping results (5000 sub-samples, parallel processing, two-tailed test at alpha 0.05)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Bias	2.50 %	97.50 %
CA -> CE	0.261	0.26	0.054	4.835	0	-0.001	0.158	0.368
CA -> CP	0.131	0.132	0.057	2.314	0.021	0	0.02	0.242
CA -> IP	0.265	0.265	0.058	4.562	0	0	0.144	0.374
CE -> CP	0.38	0.379	0.053	7.153	0	0	0.271	0.479
CE -> EM	0.3	0.299	0.056	5.328	0	-0.001	0.183	0.404
CP -> EM	0.452	0.453	0.049	9.174	0	0.001	0.352	0.547
EM -> IP	0.191	0.189	0.053	3.575	0	-0.002	0.081	0.292
EM -> TR	0.263	0.263	0.051	5.17	0	0	0.16	0.357
RA -> CE	0.228	0.227	0.064	3.552	0	-0.001	0.104	0.353
RA -> CP	0.243	0.241	0.055	4.438	0	-0.002	0.138	0.351
RA -> IP	0.3	0.301	0.053	5.698	0	0.002	0.188	0.397
TR -> IP	0.153	0.153	0.046	3.353	0.001	0	0.063	0.239

Indirect effect test: Bootstrapping results (5000 sub-samples, parallel processing, two-tailed test at alpha 0.05)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Bias	2.50 %	97.50 %
CA -> CE								
CA -> CP	0.099	0.098	0.024	4.16	0	-0.001	0.058	0.151
CA -> EM	0.182	0.183	0.04	4.606	0	0	0.109	0.263
CA -> IP	0.042	0.042	0.014	2.983	0.003	0	0.02	0.077
CA -> TR	0.048	0.048	0.015	3.282	0.001	0	0.024	0.081
CE -> CP								
CE -> EM	0.172	0.172	0.03	5.632	0	0	0.117	0.234
CE -> IP	0.109	0.109	0.03	3.615	0	0	0.053	0.173
CE -> TR	0.124	0.124	0.027	4.543	0	0	0.072	0.179
CP -> EM								
CP -> IP	0.104	0.104	0.027	3.863	0	0	0.053	0.161
CP -> TR	0.119	0.119	0.028	4.242	0	0.001	0.068	0.178
EM -> IP	0.04	0.04	0.015	2.674	0.008	0	0.015	0.073
EM -> TR								

RA -> CE								
RA -> CP	0.087	0.087	0.03	2.862	0.004	0	0.037	0.157
RA -> EM	0.218	0.217	0.043	5.032	0	-0.001	0.136	0.305
RA -> IP	0.05	0.05	0.015	3.281	0.001	-0.001	0.025	0.087
RA -> TR	0.057	0.057	0.016	3.507	0	0	0.03	0.095
TR -> IP								

Total effect test: Bootstrapping results (5000 sub-samples, parallel processing, two-tailed test at alpha 0.05)

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Bias	2.50 %	97.50 %
CA -> CE	0.261	0.26	0.054	4.835	0	-0.001	0.158	0.368
CA -> CP	0.23	0.23	0.06	3.843	0	-0.001	0.115	0.347
CA -> EM	0.182	0.183	0.04	4.606	0	0	0.109	0.263
CA -> IP	0.307	0.308	0.054	5.739	0	0	0.199	0.41
CA -> TR	0.048	0.048	0.015	3.282	0.001	0	0.024	0.081
CE -> CP	0.38	0.379	0.053	7.153	0	0	0.271	0.479
CE -> EM	0.472	0.47	0.049	9.652	0	-0.001	0.369	0.562
CE -> IP	0.109	0.109	0.03	3.615	0	0	0.053	0.173
CE -> TR	0.124	0.124	0.027	4.543	0	0	0.072	0.179
CP -> EM	0.452	0.453	0.049	9.174	0	0.001	0.352	0.547
CP -> IP	0.104	0.104	0.027	3.863	0	0	0.053	0.161
CP -> TR	0.119	0.119	0.028	4.242	0	0.001	0.068	0.178
EM -> IP	0.231	0.23	0.054	4.293	0	-0.001	0.118	0.331
EM -> TR	0.263	0.263	0.051	5.17	0	0	0.16	0.357
RA -> CE	0.228	0.227	0.064	3.552	0	-0.001	0.104	0.353
RA -> CP	0.33	0.328	0.06	5.536	0	-0.002	0.213	0.444
RA -> EM	0.218	0.217	0.043	5.032	0	-0.001	0.136	0.305
RA -> IP	0.35	0.351	0.052	6.793	0	0.001	0.242	0.444
RA -> TR	0.057	0.057	0.016	3.507	0	0	0.03	0.095
TR -> IP	0.153	0.153	0.046	3.353	0.001	0	0.063	0.239

Multi-group analysis for Gender, path coefficients and significance test

	Path Coefficients Original (Female(1.0))	Path Coefficients Original (Male(0.0))	Path Coefficients Mean (Female(1.0))	Path Coefficients Mean (Male(0.0))	STDEV (Female(1.0))	STDEV (Male(0.0))	t-Values (Female(1.0))	t-Values (Male(0.0))	p-Values (Female(1.0))	p-Values (Male(0.0))
CA -> CE	0.213	0.237	0.216	0.235	0.092	0.076	2.311	3.109	0.021	0.002
CA -> CP	0.054	0.114	0.052	0.115	0.089	0.075	0.606	1.514	0.545	0.13
CA -> IP	0.269	0.273	0.273	0.271	0.099	0.069	2.713	3.969	0.007	0
CE -> CP	0.474	0.305	0.475	0.301	0.069	0.078	6.893	3.93	0	0
CE -> EM	0.305	0.307	0.301	0.305	0.102	0.073	2.988	4.219	0.003	0
CP -> EM	0.415	0.461	0.418	0.462	0.093	0.064	4.476	7.213	0	0
EM -> IP	0.307	0.144	0.302	0.145	0.085	0.069	3.625	2.09	0	0.037
EM -> TR	0.240	0.234	0.24	0.234	0.083	0.062	2.907	3.804	0.004	0
RA -> CE	0.353	0.151	0.348	0.145	0.089	0.097	3.959	1.562	0	0.118
RA -> CP	0.302	0.261	0.303	0.256	0.086	0.076	3.512	3.416	0	0.001
RA -> IP	0.159	0.351	0.163	0.352	0.097	0.06	1.631	5.898	0.103	0
TR -> IP	0.220	0.093	0.218	0.094	0.069	0.055	3.18	1.688	0.001	0.091

Multi-group analysis for Gender MGA, Welchs tests and Parametric test
(5000 sub-samples, parallel processing, two-tailed test at alpha 0.05)

Paths		MGA	t-parametric test		t-Welch	
	Path Coefficients-diff (| Male(0.0) - Female(1.0) |)	p-Value(Male(0.0) vs Female(1.0))	t-Value(Male(0.0) vs Female(1.0))	p-Value(Male(0.0) vs Female(1.0))	t-Value(Male(0.0) vs Female(1.0))	p-Value(Male(0.0) vs Female(1.0))
CA -> CE	0.023	0.424	0.193	0.847	0.194	0.847
CA -> CP	0.06	0.305	0.514	0.607	0.518	0.606
CA -> IP	0.005	0.484	0.041	0.967	0.04	0.968
CE -> CP	0.168	0.948	1.53	0.127	1.627	0.106
CE -> EM	0.003	0.494	0.023	0.982	0.022	0.982
CP -> EM	0.047	0.34	0.432	0.666	0.418	0.677
EM -> IP	0.163	0.931	1.505	0.133	1.502	0.135
EM -> TR	0.006	0.529	0.055	0.956	0.054	0.957
RA -> CE	0.202	0.936	1.458	0.146	1.539	0.126
RA -> CP	0.04	0.636	0.347	0.729	0.353	0.724
RA -> IP	0.192	0.046	1.788	0.075	1.691	0.093
TR -> IP	0.126	0.922	1.437	0.152	1.431	0.155

Multi-group analysis for Age, path coefficients and significance test

	Path Coefficients Original (GROUP_Agegp1(1.0))	Path Coefficients Original (GROUP_Agegp2(1.0))	Path Coefficients Original (GROUP_Agegp3(1.0))	Path Coefficients Mean (GROUP_Agegp1(1.0))	Path Coefficients Mean (GROUP_Agegp2(1.0))	Path Coefficients Mean (GROUP_Agegp3(1.0))	STDEV (GROUP_Agegp1(1.0))	STDEV (GROUP_Agegp2(1.0))	STDEV (GROUP_Agegp3(1.0))	t-Values (GROUP_Agegp1(1.0))	t-Values (GROUP_Agegp2(1.0))	t-Values (GROUP_Agegp3(1.0))	p-Values (GROUP_Agegp1(1.0))	p-Values (GROUP_Agegp2(1.0))	p-Values (GROUP_Agegp3(1.0))

												))			
CE -> CP	0.321	0.495	0.226	0.32	0.492	0.197	0.082	0.064	0.182	3.914	7.681	1.241	0	0	0.215
CP -> EM	0.447	0.425	0.471	0.449	0.426	0.484	0.078	0.084	0.107	5.7	5.074	4.402	0	0	0
RA -> IP	0.225	0.387	0.368	0.226	0.388	0.362	0.075	0.085	0.142	3.002	4.55	2.585	0.003	0	0.01
CE -> EM	0.237	0.276	0.469	0.234	0.271	0.468	0.091	0.097	0.118	2.611	2.844	3.982	0.009	0.004	0
EM -> IP	0.164	0.217	0.107	0.161	0.211	0.123	0.078	0.087	0.145	2.116	2.495	0.738	0.034	0.013	0.46
RA -> CE	0.245	0.196	0.172	0.24	0.196	0.162	0.086	0.079	0.222	2.845	2.486	0.776	0.004	0.013	0.438
CA -> CE	0.273	0.182	0.31	0.272	0.186	0.314	0.075	0.074	0.177	3.631	2.455	1.751	0	0.014	0.08
TR -> IP	0.178	0.16	-0.007	0.177	0.158	-0.01	0.065	0.085	0.111	2.739	1.892	0.061	0.006	0.059	0.951
CA -> IP	0.368	0.112	0.366	0.372	0.117	0.358	0.08	0.1	0.13	4.59	1.123	2.811	0	0.261	0.005
CA -> CP	0.148	0.08	0.18	0.145	0.08	0.206	0.08	0.093	0.198	1.852	0.851	0.908	0.064	0.395	0.364
RA -> CP	0.298	0.078	0.427	0.3	0.076	0.408	0.081	0.087	0.158	3.685	0.895	2.706	0	0.371	0.007
EM -> TR	0.398	0.07	0.208	0.397	0.072	0.207	0.075	0.084	0.139	5.285	0.842	1.493	0	0.4	0.136

Multi-group analysis for Age MGA test (5000 sub-samples, parallel processing, two-tailed test at alpha 0.05)

	Path Coefficients-diff (| GROUP_Agegp3(1.0) - GROUP_Agegp1(1.0) |)	Path Coefficients-diff (| GROUP_Agegp3(1.0) - GROUP_Agegp2(1.0) |)	p-Value(GROUP_Agegp3(1.0) vs GROUP_Agegp1(1.0))	p-Value(GROUP_Agegp3(1.0) vs GROUP_Agegp2(1.0))
CA -> CE	0.037	0.129	0.429	0.253
CA -> CP	0.032	0.1	0.449	0.327
CA -> IP	0.002	0.255	0.489	0.066
CE -> CP	0.096	0.269	0.669	0.93
CE -> EM	0.232	0.193	0.063	0.106
CP -> EM	0.023	0.046	0.432	0.37
EM -> IP	0.058	0.111	0.668	0.765
EM -> TR	0.19	0.138	0.885	0.2
RA -> CE	0.073	0.024	0.62	0.543
RA -> CP	0.129	0.349	0.225	0.031
RA -> IP	0.143	0.019	0.18	0.533
TR -> IP	0.185	0.167	0.924	0.884

Multi-group analysis for Age Parametric test (5000 sub-samples, parallel processing, two-tailed test at alpha 0.05)

	Path Coefficients-diff (| GROUP_Agegp3(1.0) - GROUP_Agegp1(1.0) |)	Path Coefficients-diff (| GROUP_Agegp3(1.0) - GROUP_Agegp2(1.0) |)	t-Value(GROUP_Agegp3(1.0) vs GROUP_Agegp1(1.0))	t-Value(GROUP_Agegp3(1.0) vs GROUP_Agegp2(1.0))	p-Value(GROUP_Agegp3(1.0) vs GROUP_Agegp1(1.0))	p-Value(GROUP_Agegp3(1.0) vs GROUP_Agegp2(1.0))
CA -> CE	0.037	0.129	0.224	0.797	0.823	0.426
CA -> CP	0.032	0.1	0.176	0.517	0.86	0.606
CA -> IP	0.002	0.255	0.012	1.4	0.99	0.163
CE -> CP	0.096	0.269	0.533	1.775	0.594	0.078
CE -> EM	0.232	0.193	1.306	1.101	0.193	0.273
CP -> EM	0.023	0.046	0.149	0.299	0.882	0.765
EM -> IP	0.058	0.111	0.356	0.66	0.722	0.51
EM -> TR	0.19	0.138	1.212	0.854	0.227	0.394
RA -> CE	0.073	0.024	0.368	0.127	0.713	0.899
RA -> CP	0.129	0.349	0.754	2.027	0.452	0.044
RA -> IP	0.143	0.019	0.913	0.116	0.362	0.908
TR -> IP	0.185	0.167	1.388	1.079	0.167	0.282

Multi-group analysis for Age Welchs tests (5000 sub-samples, parallel processing, two-tailed test at alpha 0.05)

	Path Coefficients -diff (| GROUP_Agegp3(1.0) - GROUP_Agegp1(1.0) |)	Path Coefficients-diff (| GROUP_Agegp3(1.0) - GROUP_Agegp2(1.0) |)	t-Value(GROUP_Agegp3(1.0) vs GROUP_Agegp1(1.0))	t-Value(GROUP_Agegp3(1.0) vs GROUP_Agegp2(1.0))	p-Value(GROUP_Agegp3(1.0) vs GROUP_Agegp1(1.0))	p-Value(GROUP_Agegp3(1.0) vs GROUP_Agegp2(1.0))
CA -> CE	0.037	0.129	0.196	0.677	0.845	0.502
CA -> CP	0.032	0.1	0.151	0.463	0.881	0.646
CA -> IP	0.002	0.255	0.013	1.566	0.99	0.123
CE -> CP	0.096	0.269	0.484	1.41	0.631	0.165
CE -> EM	0.232	0.193	1.576	1.274	0.121	0.208
CP -> EM	0.023	0.046	0.176	0.338	0.861	0.737
EM -> IP	0.058	0.111	0.355	0.662	0.724	0.511
EM -> TR	0.19	0.138	1.213	0.855	0.231	0.397
RA -> CE	0.073	0.024	0.308	0.101	0.759	0.92
RA -> CP	0.129	0.349	0.733	1.953	0.467	0.057
RA -> IP	0.143	0.019	0.9	0.115	0.373	0.909
TR -> IP	0.185	0.167	1.448	1.203	0.154	0.234

Appendix C: Qualitative data

Semi-Structured Interview Guide

How would you rate the value of preparing for earthquakes – either very important or not important at all?

What have you done to prepare for hazards? For earthquakes? Why would you prepare/not prepare for hazards?

Tell me about any past experiences you have had with hazards? (e.g., Hazards general and earthquakes)

If experienced, how did you cope with the earthquake consequences? And Why?

Why do you approach community and organisations when coping?

What information has you received or seen/heard about hazards? What do you think of this information?

What did you with the information and why?

Who do you talk to about hazards? Why/why not? What things do you talk about? What do other people say about it?

Why do you talk to community and organisations about hazards?

Whose responsibility is it to deal with hazards (or the impacts of hazards)? Why do you say so?

Codes and sub-codes from open and axial coding

	Codes	Sub-code
1	Anxiety	1. Emotions
		2. Crying
		3. Regret due to loss and damage
		4. Distress/trauma
2	Fatalism	5. Not interested to prepare
		6. Disbelief in preparing
3	Gambler's Fallacy	7. Uncertainty of earthquake occurrence and damage
4	Attitude change	8. Retention of alternative shelter
		9. Adopted preparedness e.g. building codes
		10. Coordinating with others
	Awareness	11. Talking with family
		12. Talking to neighbours
		13. Discussing in groups
5	Collective coping	14. Living in groups
		15. Clearing debris and dead bodies
		16. Recover food and other resources
		17. Rescue people and animals
		18. Sharing food
6	Risk perception	19. Aftershocks
		20. Fear of earthquake
		21. Threat from fragile infrastructures
		22. Fragile houses
7	External support	23. Relief support from government
		24. Collaboration with external organisations for relief
		25. Technical support from VDC
		26. Relief and grant from development aid agencies

		27. Loan from cooperatives
		28. Financial support from development partners to resume the ongoing activities
8	Unpreparedness	29. Delay in grant distribution
		30. Family circumstances
		31. Financial barriers
		32. Lack of awareness
		33. Non compliance
		34. Reluctant to prepare
		35. Time constraint
9	Past experience	36. House and property
	Individual experience	37. devastation
		38. Livestock loss
		39. Injury to people
		40. Loss of people (family members)
	Shared experience	41. Community resources loss (schools, hospital)
		42. Loss of water sources
		43. Damage and loss in the community
		44. Disruptions prevented effective search and rescue
10	Preparedness	45. Emergency bags
		46. Following building codes
		47. Food storage
		48. Planning to construct house
		49. Safety plan discussion with children
11	Protection	50. Escape danger
		51. Fundamental right
		52. Preparing is must for protection
		53. Safety of family and children
		54. Protect people

12	Physical protection	55. Housing a primary aspect of physical protection
		56. Prevent exposure to hazards
13	Risk assessment	57. Earthquake induced landslides
		58. Residential area damage
		59. Road and access to residential area disrupted
14	Shelter	60. Forced to reside
		61. An alternative place
		62. Temporary arrangement
		63. Reduces security
		64. Reduced capacity to work
15	Social structure	65. Networks, community-based groups
		66. Women's groups
		67. Local government
		68. Cooperatives
		69. INGOs and development aid agencies
		70. NGOs and other local organisations
17	Social support	71. Moral support
		72. Support from extended family
		73. Social bonding
		74. Platform to share
		75. Mutual help
		76. Soft loan
18	Trust	77. Access to house reconstruction grant
		78. Support from VDC (grant, technicians)
		79. Legal authority to regulate building codes (local government)
		80. Access to relief support from multiple organisations
		81. Access to in-group resources
19	Distrust	82. Delay in grant approval

		83. Deprived of external support
		84. Property ownership issue
		85. Deprived of in-group resources
		86. Lack of access to relief
20	Mutual obligation	87. Collective responsibility
		88. Sense of social obligation
		89. Helping others in crisis
21	Information sources	90. Impact of secondary sources of information (children's death)
		91. Irrelevant message framing
22	Uncertainty	92. Dilemma to reconstruct house due to landslip
		93. Uncertainty about response
		94. Uncertainty about preparing
23	Initial coping	95. Self-evacuation
		96. Search and rescue family
		97. Private resource search
25	Sustenance	98. Preservation of food grains and resources
		99. Self-reliance
		100. Support others in crisis
		101. Traditional practice
	Hazard knowledge	102. Earthquake occurs without warning
		103. Buildings and infrastructures cause the loss and damage
		104. Destructive nature of earthquake
26	Survival	105. Survive through crisis
		106. Basic strategy
27	Salience of preparing	107. Retrospective reflections of preparing leads to less damage and loss
		108. Self-reliance during crisis
		109. Restoration of activities easier
		110. Reduce the risk from future events

Individual participant's ladders

Values	Codes	No		Shyam						
A	Salience	1		Shyam1	1	21	26			
A	Hazard knowledge	2		Shyam2	2	3	6	18		
A	Risk perception	3		Shyam3	7	5	15	26		
A	Hazard Awareness	4		Shyam4	7	3	15	23	26	
A	Social support	5		Shyam5	15	23				
A	Risk Assessment	6		Shyam6	15	17	20			
A	Previous experience	7		Shyam7	15	24				
A	Fatalism	8		Shyam8	3	24				
A	Sources of information	9		Shyam9	3	15	23			
A	Uncertainty	10		Shyam10	4	17	21			
A	Social structure	11		Ramesh						
A	Gambler's Fallacy	12		Ram1	1	2	19			
C	Anxiety	13		Ram2	2	6	19	23	25	
C	External support	14		Ram3	7	5	15			
C	Collective coping	15		Ram4	7	2	15			
C	Initial coping	16		Ram5	19	23				
C	Change in attitude	17		Ram6	4	25				
C	Unprepared	18		Ram7	11	16				
C	Prepared	19		Gopi						
C	Trust	20		Gopi1	1	3	24	25		
C	Distrust	21		Gopi2	9	3				
V	Physical protection	22		Gopi3	3	15				
V	Sustenance	23		Gopi4	19	25				
C	Shelter	24		Gopi5	6	21				
V	Protection	25		Gopi6	3	4	19	23		
V	Mutual obligation	26		Gopi7	17	21				
V	Survival	27								
Values	Main codes	No	Raj							
A	Salience	1	Raj1	1	10	18				
A	Hazard knowledge	2	Raj2	18	24	17				
A	Risk perception	3	Raj3	7	3	22	15			
A	Hazard Awareness	4	Raj4	11	17	20	19	25		
A	Social support	5	Raj5	4	12	6				
A	Risk Assessment	6	Raj6	19	23	27				
A	Previous experience	7	Raj7	11	16	26				
A	Fatalism	8	Raj8	11	17	15				
A	Sources of information	9	Hem							
A	Uncertainty	10	Hem1	1	4					
A	Social structure	11	Hem2	3	14	19	23	27		
A	Gambler's Fallacy	12	Hem3	3	14	22	25			
C	Anxiety	13	Hem4	7	3	15	16	26		
C	External support	14	Hem5	7	3	15	16	23		
C	Collective coping	15	Hem6	7	3	17				

C	Initial coping	16	Hem7	4	14	19				
C	Change in attitude	17	Hem8	4	3	25				
C	Unprepared	18	Hem9	11	16	27				
C	Prepared	19	Hem10	16	27	28				
C	Trust	20	Bhagawati							
C	Distrust	21	Bhaga1	1	18	12				
V	Physical protection	22	Bhaga2	7	3	15				
V	Sustenance	23	Bhaga3	7	5	13	15	23		
C	Shelter	24	Bhaga4	3	15	26				
V	Protection	25	Bhaga5	3	15	23				
V	Mutual obligation	26	Bhaga6	4	3	25				
V	Survival	27	Bhaga7	11	16	23				
			Bhaga8	11	17	15				
Values	codes	No	Kamala							
A	Salience	1	Kam1	1	3	24	18			
A	Hazard knowledge	2	Kam2	5	23					
A	Risk perception	3	Kam3	6	18					
A	Hazard Awareness	4	Kam4	7	3	5	15	24		
A	Social support	5	Kam5	7	6	24				
A	Risk Assessment	6	Kam6	4	22	25				
A	Previous experience	7	Kam7	11	16					
A	Fatalism	8	Kam8	11	17	24	18			
A	Sources of information	9	Januka							
A	Uncertainty	10	Januka1	1	25					
A	Social structure	11	Januka2	1	3	22	25			
A	Gambler's Fallacy	12	Januka3	3	15	17				
C	Anxiety	13	Januka4	3	15	16				
C	External support	14	Jnauka5	4	19	23				
C	Collective coping	15	Januka6	15	23					
C	Initial coping	16	Januka7	11	16	17				
C	Change in attitude	17	Sapana							
C	Unprepared	18	Sapana1	1	2	3	25			
C	Prepared	19	Sapana2	7	13	15				
C	Trust	20	Sapana3	13	15					
C	Distrust	21	Sapana4	3	15	25				
V	Physical protection	22	Sapana5	18	17	20				
V	Sustenance	23	Sapana6	11	16	23				
C	Shelter	24	Sapana7	2	3	11	16			
V	Protection	25	Sapana8	2	3	11	17	21		
V	Mutual obligation	26								
V	Survival	27								
Values	Codes	No	Ashok							
A	Salience	1	Ashok1	1	2	19	25			
A	Hazard knowledge	2	Ashok2	1	6	19	25			
A	Risk perception	3	Ashok3	7	3	15				

A	Hazard Awareness	4	Ashok4	7	5	13	15	26		
A	Social support	5	Ashok5	3	17	20				
A	Risk Assessment	6	Ashok6	9	3	19				
A	Previous experience	7	Ashok7	4	10	19				
A	Fatalism	8	Ashok8	14	27					
A	Sources of information	9	Ashok9	4	25					
A	Uncertainty	10	Ashok10	11	17					
A	Social structure	11								
A	Gambler's Fallacy	12								
C	Anxiety	13								
C	External support	14								
C	Collective coping	15								
C	Initial coping	16								
C	Change in attitude	17								
C	Unprepared	18								
C	Prepared	19								
C	Trust	20								
C	Distrust	21								
V	Physical protection	22								
V	Sustenance	23								
C	Shelter	24								
V	Protection	25								
V	Mutual obligation	26								
V	Survival	27								

Implication Matrix

6	Main codes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		18	19	20	21	22	23	24	25	26	27	Total
1	Salience		3	3.01	1.01		1			1	1		0.01							1.01	0.03			1.01		0.02	1		0.01	13.11
2	Hazard knowledge			3			1														2.01						0.03			6.04
3	Risk perception				1		1					1		2	2	8.04	4	1		0.01	1.02	0.01		2	0.04	2.01	3.03			28.16
4	Hazard Awareness			2			0.01				1		1		1			1		0.01	3.01		0.02	1	0.01		2.02			12.08
5	Social support															3					1	2			2.02			0.01		8.03
6	Risk Assessment																			2	1		1		0.01	1	0.02			5.03
7	Previous experience		1	8	1		1							2	0.01	0.06	3.02				0.01			0.01		0.01				16.12
8	Fatalism																													
9	Sources of information			2	1																0.02									3.02
10	Uncertainty																			2										2
11	Social structure					7									8	0.05					0.01	0.04	0.03		0.01	0.01				15.15
12	Gambler's Fallacy						1																							1
13	Anxiety															4									0.01					4.01
14	External support															2				0.01	0.01	3	4			1				10.02
15	Collective coping																					0.01			4	3	1	4.03	0.01	12.05
16	Initial coping															7									1.02	0.01		0.02		8.05
17	Change in attitude																				1			1	0.01				1	3.01
18	Unprepared												1		1.01								0.01			1				3.02
19	Prepared																						1		4		3.01		0.02	8.03
20	Trust																				1				1				0.01	2.01
21	Distrust																													
22	Physical protection																										3		1	4
23	Sustain																										1	3	3	7
24	Shelter														1					1							1			3
25	Protection																													
26	Mutual obligation																													
27	Survival																													
	Total	0	4	18.01	4.01	7	5.01			1	2	1	2.01	4	13.02	24.15	7.02	2		6.04	10.12	5.06	6.06	5.02	12.13	8.06	15.11	7.06	5.05	173.94
		1	2	3	4	16	6	7	8	9	10	11	12	13	17	15	16	14		18	19	20	21	22	23	24	25	26	27	