

**INFLUENCE OF RISK COMMUNICATION ON INTENTIONS TO
PREPARE FOR FLOOD HAZARDS IN INFORMAL SETTLEMENT**

A thesis submitted for the degree of Doctor of Philosophy

By

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STATEMENT OF ORIGINALITY

I hereby certify that the work embodied in the thesis is my own work, conducted under normal supervision. The thesis contains no material which has been accepted, or is being examined, for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made. I give consent to the final version of my thesis being made available worldwide when deposited in the University's Digital Repository, subject to the provisions of the Copyright Act 1968 and any approved embargo.

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I hereby certify that the work embodied in this thesis contains published paper/s/scholarly work of which I am a joint author. I have included as part of the thesis a written declaration endorsed in writing by my supervisor, attesting to my contribution to the joint publication/s/scholarly work.

By signing below I confirm that Matthew Abunyewah contributed to the structuring, data analysis and writing of the following publications below

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To you Catherine Quansah, I know there were horrendous moments leaving you behind every early morning to go to the University for this Research. As a form of love and pacification, I dedicate this work to you and our adorable newborn baby Samuel Oppong Abunyewah.

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List of Abbreviations

AGFI	Adjusted Goodness of Fit Index
AMA	Accra Metropolitan Area
AMOS	Analysis of Moment Structure
AVE	Average Variance Extracted
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CMIN/DF	Chi-Square Mean/Degree of Freedom
CP	Community Participation
CR	Critical Ratio
Das	District Assemblies
DRR	Disaster Risk Reduction
EFA	Exploratory Factor Analysis
EM	Empowerment
EW	Early Warning
EWS	Early Warning Systems
GAMA	Greater Accra Metropolitan Area
GAR	Greater Accra Region
GFI	Goodness of Fit Index
GIS	Geographic Information Systems
GLS	Generalised Least Square
GMA	Ghana Metrological Agency
GOG	Government of Ghana
GSS	Ghana Statistical Service
IDM	Information Deficit Model
IP	Intentions to Prepare
IS	Information Sufficiency
KMO	Kaiser-Meyer-Olkin
LDCs	Least Developed Countries
MC	Message Clarity
ML	Maximum Likelihood
NADMO	National Disaster Management Organisation
NFI	Normed Fit Index
NGOs	Non-Governmental Organisations
OFDA	Old Fadama Development Association
PAF	Principal Axis Factoring
PC	Principal Component
PDHS	People Dialogue on Human Settlement
PMT	Protection Motivation Theory
RMSEA	Root Mean Square of Approximation
SC	Source Credibility
SE	Self-Efficacy
SEM	Structural Equation Modelling
SPSS	Statistical Package for Social Sciences
TLI	Tucker-Lewis Index
ULS	Unweighted Least Square
UNDP	United Nation Development Plan
UNHCS	United Nation Centre for Human Settlement
UNISDR	United Nation International Strategy for Disaster Risk Reduction

Abstract

Flooding has become the most frequent, recurring and destructive natural hazard accounting for more than half of all disaster-related fatalities and one-third of economic losses from natural catastrophes. Impacts of flood continue to increase with more devastating consequences across the world, especially in informal settlements. Literature indicates that informal settlements, characterized by high poverty levels, high population density, overcrowding and poor condition of infrastructure, are generally located in unsafe positions such as floodplains and marshy areas, making residents highly vulnerable to devastating disaster hazard events.

Flood risk communication has been identified as a major building block for the reduction of vulnerability and exposure levels, disaster impacts and motivation of people to undertake precautionary measures towards flood preparedness. However, there is a limited body of knowledge that explains the influence of risk communication on the intentions of people to undertake measures to prepare towards flood hazards. This research developed a theoretical model proposing sixteen (16) hypotheses, supported by the protection motivation theory and information deficit theory, predicting the intentions to prepare towards floods in informal settlements through ‘communication’ constructs (message clarity, information sufficiency and source credibility) and ‘societal governance’ constructs (community participation, empowerment and self-efficacy).

The study employed the convergent triangulation mixed research methodology involving a case study approach. The quantitative component, underpinned by a positivist paradigm, tested the theoretical model using questionnaire survey data. The theoretical model was tested using structural equation modelling (SEM) with Analysis of Moment Structure with a quantitative dataset consisting of 1064 questionnaire survey responses collected from three (3) informal settlements namely Old Fadama, Kotobabi, and Nima in Accra, Ghana. The results explained the relationships between the variables and how they predict intentions to prepare towards flood hazards. Results of the SEM showed that the quantitative data supports fifteen (15) out of sixteen (16) hypothesized relationships. In addition, the study found that source credibility, community participation, message clarity, information sufficiency, and self-efficacy explain 72.4 percent of variance in intentions to prepare towards flood. Community participation, message clarity, and information sufficiency account for 83.8 percent of variance in source credibility, while community participation and information sufficiency explain 73.2 percent of

variance in message clarity. The percentage of variance explained in this model is an indication that the independent variables are good predictors of the dependent variables.

The qualitative component of the study, underpinned by a constructive paradigm, comprised of twenty (20) household and three (3) institutional interviews. A six (6) step thematic analysis following the principles of Braun and Clarke was undertaken to identify patterns and develop emerging themes from coded responses. Findings from the qualitative analysis were significant as they showed that regular exchanges of flood information between community members and experts provide an avenue where communicators strengthen message credibility, clarify intent and increase sufficiency of flood information to the relevant audience. Another important finding this research discovered was that community participation improves people's skills and instils attitudes towards flood preparedness.

The convergent triangulation was adopted to further explain the quantitative model using qualitative narratives. Findings from the thematic analysis of the qualitative data provided some context-specific explanations for the tested hypothesized paths. Thematic analysis showed that community participation presented a platform to stakeholders to reduce flood message ambiguities and increase message sufficiency through answering of queries. Furthermore, findings from the thematic analysis showed that the provision of adequate flood information does not necessarily translate into intentions to prepare. Efforts such as the clarification of flood messages and enhancement of message audience skills and abilities are needed to help translate the recommended actions into intentions to prepare. The importance of this study is that it contributes to knowledge in the areas of communication, governance and psychological factors that motivate intentions to prepare towards flood hazards. From this study, an understanding of the factors that influence people's intentions to prepare is understood. Subsequently, the outcome of this study can inform experts, advisors, and decision-makers such as policy formulators, development planners and governments about how and why regular expert-community engagement can enhance flood risk communication and preparedness. In addition, findings from this research contribute to an existing body of knowledge to help save lives and reduce economic damages, injuries and death through climate-related disasters.

Keywords: floods, societal governance, communication, informal settlements, intention to prepare

CHAPTER ONE

INTRODUCTION

1.1 Background

In the past few decades, flooding has become the most frequent, recurring and destructive natural hazard globally. Flooding accounts for more than half of all disaster-related fatalities and one-third of economic losses from all natural catastrophes (See for example Bradford et al., 2012; Diakakis, Deligiannakis, Pallikarakis, & Skordoulis, 2017; Doss et al., 2018; Leaning & Guha-Sapir, 2013). The 2016 World Disaster Report also confirms that flooding accounted for 50 percent (1719 out of 3439) of all disaster occurrences, claimed an estimated life of 57, 027 people, affected 831 million people and inflicted economic damages worth US\$343 billion between 2006-2015. The danger posed by flooding to the socio-economic development of countries has drawn the attention of international organizations, governments and researchers to investigate the causes and risk reduction approaches. Literature posits that informal settlements are the most heavily affected areas in the world and suffer greatly from the disastrous impacts of flood hazard (Frick-Trzebitzky, Baghel, & Bruns, 2017; Pelling, 2007; Rumbach & Shirgaokar, 2017). According to De Risi et al. (2013) and Tadgell, Doberstein, and Mortsch (2018), vulnerable locations on floodplains, high poverty levels, high population density, overcrowding and poor condition of housing increase flood impacts in the informal settlement. Furthermore, negligence of urban planning authorities towards planning and provision of basic facilities such as drainage systems has worsened the extent of flood vulnerability in informal settlements (Amuzu, 2018; Habitat, 2016; Shaheen, 2018).

Proactive initiatives which involve mitigation and preparedness towards flood hazards has been recommended as an ideal approach to risk reduction in informal settlements (Ziervogel, Waddell, Smit, & Taylor, 2016). A participatory approach to flood governance together with sound risk communication changes perceptions of at-risk individuals and encourages flood preparedness initiatives (Alexander, Doorn, & Priest, 2018; Brass, 2012; Cheng, 2013; de Brito, Evers, Almoradie, & Delos, 2018; Subbiah, Bildan, & Narasimhan, 2008; Williams, 2012). The relationship between risk communication and preparedness has been identified and discussed extensively within the literature (See for example Anson, Watson, Wadhwa, & Metz, 2017; Glik, 2007; Hoffmann & Muttarak, 2017; Lindell, 2018; Maidl & Buchecker, 2015; Mileti & Fitzpatrick, 1992; Ulmer, Sellnow, & Seeger, 2017), however, empirical testing of this relationship is under-researched. With informal settlements highly vulnerable to flooding, an approach to flood management that enables informal settlement residents to live with flood

without harm is the ideal. Based on this idea, the study aims to investigate the influence of risk communication on the intentions of people to prepare towards flood hazard in informal settlements.

1.2 Research Gap

Informal settlements are a ubiquitous urban global phenomenon, existing in urban areas of the world in different forms, locations, and dimensions. Such settlements are found generally in developing countries on the Asian, African and South American continents (Chiloane-Tsoka & Mmako, 2018; Habitat, 2013; Hasselman, 2017) and estimated to harbour about 25 percent of the world's population and 61.7 percent of Africa's urban population (Brown, Msoka, & Dankoco, 2015; Habitat, 2013, 2016). Informal settlements are characterized by high population growth, poor housing, and environmental conditions, and weak governance, and they are disaster-prone (Amis & Lloyd, 2018; Habitat, 2016; Hunter & Posel, 2012; Tsinda, Abbott, Chenoweth, Pedley, & Kwizera, 2018; Wekesa, Steyn, & Otieno, 2011).

Over the past few years, informal settlements have been hotspots for all forms of disaster hazards including fire, flood, earthquake, and landslide. Subsequently, this has been exacerbated by the economic, social and environmental conditions of residents of these settlements (Chatterjee, 2010; Pelling & Wisner, 2012; Sakijege, Sartohadi, Marfai, Kassenga, & Kasala, 2014; Ziervogel et al., 2016). In the quest to improve conditions and to avert increasing disaster impacts in marginalized settlements, studies have explored a range of themes, including upgrading (Del Mistro & A. Hensher, 2009; Ntema, Massey, Marais, Cloete, & Lenka, 2018; Satterthwaite, Sverdluk, & Brown, 2018), disaster response, coping and adaptation strategies (Araos, Ford, Berrang-Ford, Biesbroek, & Moser, 2017; Baker, 2012; Braun & Abheuer, 2011; Sakijege et al., 2014), disaster vulnerability and resilience (Doberstein & Stager, 2013; Gencer, 2013; Hambati & Yengoh, 2018; Isunju, Orach, & Kemp, 2016; Taş, Taş, Durak, & Atanur, 2013), relocation and resettlement (Desai, 2012; Patel, d'Cruz, & Burra, 2002; Tadgell et al., 2018; Viratkapan & Perera, 2006) and disaster preparedness in informal settlements (Texier, 2008). However, even with a significant amount of research, the impacts of disaster events continue to rise.

Disaster risk communication is a major building block for smooth and effective reduction of disaster risk and impacts (Beggs, 2018; Hirata, Kimura, & Ohtomo, 2017). Drastic reduction in flood damages and other related impacts may be achieved through communication that

installs protective and precautionary behaviour in “at risk” individuals towards flood disaster. Several studies have been undertaken on risk communication across the stages of the disaster management cycle including early warning and preparation (Bui, 2018; Girons Lopez, Di Baldassarre, & Seibert, 2017; Mayhorn & McLaughlin, 2014; Sorensen, 2000; Twigg, 2003), during a hazard strike (Coombs, 2010; Kapucu, 2006; Liu, Fowler, Roberts, & Herovic, 2018; Reynolds & Seeger, 2005) and post hazard strike (Blanchard-Boehm & Cook, 2004; Majid & Ahmed, 2008; Saha et al., 2015). In addition, studies such as risk communication and risk perception (Kellens, Terpstra, & De Maeyer, 2013; Paton, Smith, Daly, & Johnston, 2008; Terpstra, Lindell, & Gutteling, 2009), risk awareness and preparedness (Amri, Haynes, Bird, & Ronan, 2018; Burger & Palmer, 1992; Duval & Mulilis, 1999; Hicks et al., 2017; Hoffmann & Mutarak, 2017) and risk perception and preparedness (Ballantyne, 2000; Chan & Ho, 2018; Johnston, Bebbington Chin-Diew Lai, Houghton, & Paton, 1999; Miceli, Sotgiu, & Settanni, 2008; Wachinger, Renn, Begg, & Kuhlicke, 2013) have been conducted as well.

Although studies on risk communication and preparedness have individually received high attention, there is a dearth of research on the combination of these two concepts in tackling flood issues. Correspondingly, there is a vital need to explore risk communication influences on public intentions to prepare towards flood hazard. The importance of this study is that it couples the concepts of risk communication and disaster preparedness to explore the relationship between these concepts. Importantly, the research employs the protection motivation theory and information deficit theory to fully investigate the relationships.

1.3 Research Aim

The aim of the study is:

To investigate the relationship between flood risk communication and intentions to prepare towards flood hazards in informal settlements.

1.4 Research Question

In view of the above, this research seeks to answer the question:

“How does flood risk communication influence preparedness intentions towards flood hazard in informal settlements?”

1.5 Research Objectives

Specifically, the objectives of the study are:

1. Review literature associated with the key concepts of informal settlements, risk communication, and flood hazard preparedness.
2. Create a theoretical model of the influence of risk communication on preparation intentions towards flood hazards.
3. Develop a convergent mixed research methodology to investigate how risk communication influences the intentions to prepare towards flood hazard.
4. Perform SEM analyses to confirm the influence of risk communication on preparation intentions towards flood hazard using quantitative data from a questionnaire survey.
5. Conduct case studies to explore the context-specific narratives on how risk communication influences preparedness intentions towards flood hazards using qualitative data collected through an in-depth interview.
6. Explain how risk communication influences preparedness intentions towards flood hazards by synthesizing quantitative and qualitative results through integrative analysis.

1.6 Significance of the Study

The impacts of flood disasters on human life and property are emotionally and financially costly, with a wide range of effects. For the past few decades, flood disasters have slowed the pace of both social and economic transformation of many developed and developing countries in the world. Subsequently, they have annihilated development efforts and interventions of low and middle-income countries around the world (Basher, 2006; Bulte, Xu, & Zhang, 2018; Desai, Maskrey, Peduzzi, De Bono, & Herold, 2015; Wilhite, 2016). For instance, flood disasters caused total property damage of US\$ 343 billion, killed 57,027 people and displaced 831 million people between 2006 and 2015 (Guha-Sapir, Below, & Hoyois, 2016) (Guha-Sapir et al, 2016). Yet, with such devastating impacts, flood events continue to be the highest recurring climate-related disaster every year (Mal, Singh, Huggel, & Grover, 2018; UNISDR, 2009).

Various scholars such as Tacoli, McGranahan, and Satterthwaite (2015) and (Jiang & O'Neill, 2017) have projected the number of people living in urban areas to grow steadily for decades to come. A large proportion of the increased population is envisaged to live in informal settlements (Habitat, 2016), where population density is already high, and quality of housing, sanitation, and drainage systems are poor and inadequate (Gilbert, 2014; Homer-Dixon &

Percival, 2018). Thus, the prevailing conditions in informal settlements exacerbate the vulnerability of human life and property to flood risks (Dalu, Shackleton, & Dalu, 2018; Frick-Trzebitzky et al., 2017). Therefore, it is imperative to understand disaster vulnerability in informal settlements to protect the safety of lives and socio-economic conditions of informal settlement dwellers that could be worsened by climate-related hazards such as flood hazard events.

With information on how to encourage preparedness among at-risk individuals and communities, government and policymakers can direct and formulate policies that shape the future of urban planning and disaster management efforts. Non-governmental organizations (NGOs) will also have the capacity to consider methodologies by which to disseminate vital information to save lives and reduce economic damages. The contribution of the proposed study can be viewed in three broad dimensional forms, namely: empirical, policy and theory.

1.6.1 Empirical

This research identifies associations between flood risk communication, risk perception and preparedness that will help save lives, and reduce disaster damages and injuries. Furthermore, it proposes a conceptual model that may enhance flood management and provide information to risk managers and experts on the social and psychological factors that motivate intentions to prepare towards flood risk. With existing knowledge of hazard threats (vulnerability and severity) and coping measures (response efficacy and self-efficacy) as motivation variables of disaster preparedness based on PMT, the findings of this study provide other incentives that encourage message audiences to take up precautionary measures towards flood hazards. In other words, apart from threat and coping measures appraisal, message audience also undertakes information assessment, clarity of hazard information, sufficiency of hazard information and credibility of message source in the process of taking up preparatory intentions. In addition, with a view that people fail to prepare because of lack of sufficient information, the study findings suggest that the provision of sufficient information may enhance preparedness if the information provided is clear and emanating from a credible source. The findings can inform DRR policy design in Ghana and aid effective flood risk communication including response to, and preparedness for, flood.

1.6.2 Theory

The conceptual model of the study adds up to an existing body of knowledge on PMT and IDT. Unlike PMT, which indicates that message audience motivation towards preparedness is based on an appraisal of threats and coping measures, findings from this study provide evidence that information assessment (clarity of hazard information, sufficiency of hazard information and credibility of message source) also motivates people to take up preparedness intentions. In other words, findings from this study add information assessment to the threat and coping measures assessment underpinning PMT. Also, findings from this study also add up to the underlying assumption in IDM that suggests that preparedness towards hazard events is low due to audience lack of information. Specifically, the study indicates that the provision of sufficient information can enhance preparedness if the information provided:

- is in a simple and clear language understood by the message audience,
- is emanating from a credible source, and
- the message recipients have the skills, ability, and resources to embark on message recommendations.

1.6.3 Methodology

Few scholars have used this method in the field of risk communication and informal settlement, making the study unique. The findings of the study contribute to existing research methodologies in the field of risk communication and informal settlements. The study employed a mixed method approach involving a case study strategy to explore a purely quantitative model. The study employed this research method to expand existing research methodologies and possibly make suggestions to improve them.

1.7 Definition of Key Concepts

This section presents the definition of key theoretical concepts underpinning this research.

1.7.1 Risk Communication

Within the academic literature, consensus on a definition of ‘risk communication’ has yet to be ascertained. Several researchers and practitioners in the field of public health, environmental risk, disaster management, and conflict studies and management have defined the term differently according to their professional domains. Risk communication could either be unidirectional dissemination of information from expert to the public, or two-way exchange of

information among stakeholders (McComas, 2003; Palenchar & Heath, 2002). Rød, Botan, and Holen (2012) define risk communication as a process, which involves the transfer of risk information from reliable sources and experts to at-risk audiences prior to a disaster. Conversely, Covello, McCallum, and Pavlova (2012) and Scheer et al. (2014) define risk communication as the exchange of information about environmental risk among individuals, groups, and organizations.

For the purposes of this study, *risk communication is a two-way exchange of timely, accurate and up-to-date information regarding flood risk through the active participation of all stakeholders to change the perception and attitude of receivers towards flood preparedness.*

1.7.2 Hazard Perception

Risk perception is the judgment about the likelihood of a dangerous event occurring (Slovic, 2000, 2016). Rosa (2003) also sees risk perception as a judgment over an uncertain situation where a valuable environmental asset of humans is susceptible to danger.

In line with the definition of Rohrman (2008), the study defines *hazard perception to encompass the judgments made by individuals and societies on the probability of an uncertain event occurring and the magnitude of its impacts based on the information conveyed by the source.*

1.7.3 Intention to Prepare (for flood hazard)

Behavioural intention, according to the Committee on Communication on Behavioural Change in the 21st century cited in Populations (2002), is the perceived likelihood of a person to engage in a given behaviour. Ajzen (2002) also defines behavioural intentions as the amount of effort people are willing to exert to achieve a goal.

In accordance with existing literature, this research defines *intentions to prepare for flood hazard as the effort at-risk individuals and communities are willing to exert to undertake precautionary measures to reduce flood impacts.*

1.7.4 Community Participation

There is a plethora of definition surrounding community participation, however, all definitions point to the active involvement of people in the processes of decisions that affect their lives (Mayaka, Croy, & Cox, 2018).

In this study, *community participation refers to two-way regular discussions of flood preparedness issues among community members as well as the continuous exchange of flood preparedness information between experts and community members.*

1.7.5 Information Sufficiency

According to Griffin, Neuwirth, Dunwoody, and Giese (2004), this refers to the assessment of additional information by an at-risk individual required to cope with risk. Information sufficiency is a major determinant of the risk information seeking and processing model (RISP).

The study, based on Griffin et al. (2004) and existing academic literature, *defines information sufficiency as the quantity and quality of risk information possessed by an individual together with additional information on risk needed to cope with a hazard event.*

1.7.6 Message Clarity

Chesebro and McCroskey (1998) refer to message clarity as the ability of a person to effectively disseminate a message without any ambiguities, verbally or non-verbally. *Message clarity in this study involves the clear articulation of the content of flood messages (severity of flood, expected time and the recommended protective actions to prevent or mitigate the impacts) in simple and plain language to audiences.*

1.7.7 Source Credibility

Source credibility is defined as the belief that a receiver of a message has in the communicator (Case, Lazard, Mackert, & Perry, 2018; O'Keefe, 1990; Pornpitakpan, 2004). Based on the above, the study adopts and defines source credibility in accordance with O'Keefe (1990). *As such, source credibility encompasses the trust and belief flood message recipients perceive for the communication source.*

1.7.8 Empowerment

Wallerstein and Bernstein (1994) defined empowerment as a social process whereby individuals and groups gain mastery over their lives. In the context of this study, *empowerment means equipping people at risk to flood with adequate resources to be motivated to take actions to prepare towards flood hazard.*

1.7.9 Self-Efficacy

Self-efficacy in literature is also referred to as perceived self-efficacy (Bandura, 2007; Farmer & Tierney, 2017; Turner, Rimal, Morrison, & Kim, 2006). Self-efficacy is the belief people have in their capabilities to undertake a given activity without any difficulty (Bandura, 2007). *In accordance with existing literature, this research defines self-efficacy as the extent to which receivers of flood messages have the ability and resources to perform the recommended protective actions.*

1.7.10 Informal Settlements

Informal settlements, according to Habitat (2016), are residential areas located in hazardous environments with no security of land tenure, lacking basic infrastructure and with housing that deviates from building codes and regulations.

The study defines informal settlements as *a section of a major city or urban area that lies outside the scope of planning regulations and laws. An informal settlement in this study is an umbrella term, which encompasses slums, squatter settlements, shantytowns and pirate towns.*

1.8 Scope: Geographical

Three (3) informal settlements in the Accra Metropolitan Area (AMA): Old Fadama, Nima and Kotobabi, with a population of 80,000, 80843 and 33628 respectively, were the focus of this study. They are the largest and most populous settlements in the region and acknowledged as the most culturally diverse (GSS, 2012). In addition, they are identified as the informal settlements in the region that have suffered most from the devastating impact of flood over the last two (2) decades (Masses, 2010).

The Greater Accra Region (GAR) has a total land size of 3,245 square kilometres and had a total population of 4,010,054 in 2010 (GSS, 2012). GAR is divided into twenty-seven (27) metropolitan, municipal and district assemblies to ease its development and administration.

Greater Accra Metropolitan Area (GAMA), which is one of the divisions of the region, was selected as a case for this study. The capital of the metropolis – Accra – is the regional and national capital. The Metropolis covers a total land area of 173 sq km and has a total population of 1,665,005, representing 6.6 percent and 42 percent of the national population and the region’s population respectively. It shares boundaries to the East with the Ledzokuku-Krowor District, West with the Ga South District, North with the Ga East and Ga West and to the South with the Gulf of Guinea (GSS, 2012). Figure 1.1 shows the study area in regional and national contexts.

Research by Abraham, Drechsel, and Cofie (2006) showed that about 60 percent of the region’s population resides in the informal settlement in low-lying flood-prone areas. The region shares a boundary to the north with the Eastern Region, West with the Central region, East with Lake Volta and to the South with the Gulf of Guinea. The metropolis is generally characterized by lowlands/valleys with few hilly areas ranging from 20m to 70m above sea level (Nyarko, 2002). It is drained by a number of streams and stormwater drains. Notable of the streams and rivers are Odaw, Sakummo, Mahahuma, Korle Lagoon, Lador and Dzorwula, which all take their sources from the Akuapim Range. Nyarko (2002) categorizes the catchment areas of all rivers, streams, and lagoons in four areas, namely; Densu-Sakumo catchment (393sq. km), Kpeshie (62.6 sq. km), Songo-Mokwe (30.7 sq. km) and Odaw-Korle Chemu (250 sq. km). The Korle-Lagoon is the central drainage that empties its water into the sea (Biney, 1982). It receives a water discharge from the Odaw River and two major drainages with a total catchment area of over 400 sq.km (Abraham et al., 2006). The pace of urbanization or urban growth of 4.3 percent has led to widespread exposure to flood hazards. According to Frimpong (2013), a total of 152,143 people live between and within the catchment area of the drainage in Accra. Also, Nyarko (2002) asserts that 72 percent of the land areas of the metropolitan area are susceptible to flood. The interspersed nature of rivers and streams and few organized drains make the region one of the most vulnerable to flooding in Ghana. Due to the poor storm drains in Ghana, the French Government disbursed an amount of US\$5 million to Ghana to construct drains in its major cities, especially Accra (Aid, 2006). In addition, the region has several coastal communities.

GAR is in the dry semi-equatorial climatic region with a double maxima rainfall pattern and a prolonged dry season. The major rainy season occurs between April-July and the minor season

in September-November, giving an annual rainfall of 780mm-1200mm. The hottest month is February-March with an average temperature of 27 °C and 21 °C in the coolest month of June-August (GSS, 2012).

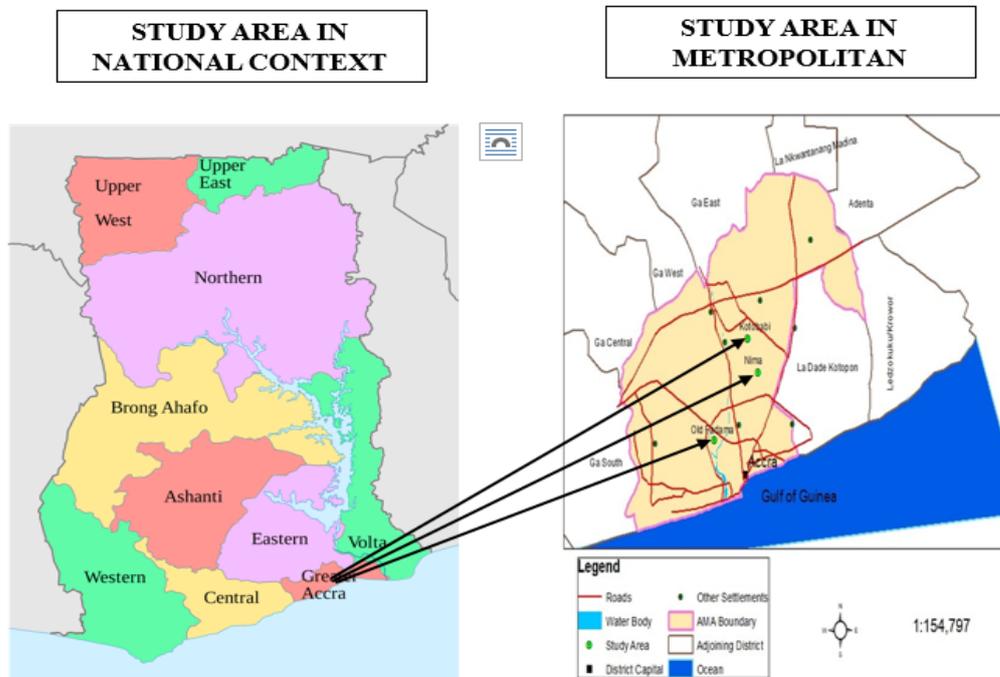


Figure 1. 1: Study Area in National and Metropolitan Context. Source: Geographic Information Systems (GIS), 2018

1.9 Research Design and Methodology

This research was underpinned by the pragmatism philosophical position involving a case study approach. While the quantitative aspect of the study was underpinned by the positivist paradigm, the principles of constructivism guided the qualitative component of the study. The study employed the concurrent triangulation mixed research method together with a single case study strategy. Existing literature on risk communication and preparedness has yet to consider concurrent triangulation research methodology in risk communication and preparedness literature. The concurrent triangulation was selected given the research aim, objectives and question to be explored. With respect to the technique for data collection, the simple random and purposive sampling techniques were adopted, respectively, to collect quantitative and qualitative data.

Primary data collection involved two stages. The first stage included a survey of residents at Old Fadama, Nima and Kotobabi. The second stage involved a follow-up in-depth interview with sampled community members and staff of the National Disaster Management Organisation (NADMO) in each of the case study areas. The primary data validated and addressed risk communication and preparedness relationships that were absent in the literature.

Data analysis involved two phases. The first stage involved the analysis of quantitative data with AMOS SPSS. The qualitative data gathered from the interview was analysed with the assistance of the NVIVO software. The two results were synthesized, which assisted in categorizing results into triangulation, complementary and contrasting findings. The use of both qualitative and quantitative approaches was to provide a more detailed richness to the study and support findings. The use of both methods helped to bracket biases under quantitative and qualitative methods when used separately and made the research outcome robust.

The research method and tools specifically used to achieve each of the seven objectives of the study are summarized in Table 1.1. Objective 1 and 2 were accomplished through a comprehensive literature review on risk communication and disaster preparedness. Similarly, Objective 3 was executed through the review and evaluation of existing knowledge on research methodology and designs used in risk communication and disaster preparedness studies. The process helped to present a suitable research methodology to answer the research question and achieve the research aim. Objective 4 and 5 were achieved through the analysis of both quantitative and qualitative data (survey and interview) using SPSS Amos 24 and NVIVO 11 respectively. With Objective 6, results from both questionnaire survey and interviews were merged. This was to complement quantitative results with findings from in-depth qualitative interviews.

Table 1. 1: Linkage Between Research Objectives, Research Method and Tools

Objectives of this Study	Research Method	Research Tool
1. Review literature associated with the key concepts of informal settlements, risk communication, and flood hazard preparation.	Critical literature review	<ul style="list-style-type: none"> • Books • Book chapters • Scholarly Journal Articles • Conference papers • Working papers
2. Create a theoretical model of the influence of risk communication on preparation intentions towards flood hazard	Critical literature review	<ul style="list-style-type: none"> • Books • Book chapters • Scholarly Journal Articles • Conference papers <p>Working papers</p>
3. Develop a convergent mixed research methodology to investigate how risk communication influences the intentions to prepare towards flood hazard	Critical literature review	<ul style="list-style-type: none"> • Books • Book chapters • Scholarly Journal Articles • Conference papers <p>Working papers</p>
4. Perform SEM (Structural Equation Modelling) analyses to confirm the influence of risk communication on preparation intentions towards flood hazard using quantitative data from a questionnaire survey	Quantitative analysis (SEM)	<ul style="list-style-type: none"> • Questionnaire survey • SPSS AMOS 24
5. Conduct qualitative case studies to explore context-specific narratives on how risk communication influences preparation intentions towards flood hazard using data collected through an in-depth interview	Qualitative analysis (Thematic Analysis)	<ul style="list-style-type: none"> • Interview • NVIVO 11
6. Explain how risk communication influences the preparation intentions towards flood hazard by synthesizing the quantitative and qualitative results through integrative analysis	Integrative and Interpretive synthesis	

1.10 Organisation of Thesis

The thesis is divided into seven chapters. Chapter One provides a snapshot and synopsis of the research: background of the study, the research gap, aim, and objectives. In addition, the geographical scope, limitations, and significance of the study are explained.

Chapter Two presents the theoretical basis for the study. The key themes and concepts of flood risk communication and preparedness underlying the study are defined in this chapter. Furthermore, the theoretical basis and proposed model to enhance risk communication are highlighted.

Chapter Three emphasizes the methodology used to accomplish the aim of the study. The chapter provides details on the research paradigm, research approach, and strategy, study population and participants for the study. Furthermore, discussions on ethical issues, sample size, sampling technique, data collection tool, and analysis are all explained.

Chapter Four contains the analysis of the quantitative data using SPSS Amos version 24. It involves both exploratory factor and confirmatory factor analysis to develop a structural equation model to enhance risk communication.

Chapter Five concerns the thematic analysis of the qualitative case study data employing assisted computer software, NVIVO version 11.

Chapter Six discusses the findings of the study and provides a synthesis of the qualitative and quantitative data for the purposes of triangulation, complementarity and contrasting with the quantitative findings. Findings from both qualitative and quantitative study are also discussed extensively in this chapter

Chapter Seven concludes the research with suggestions on policy implications and recommendations for government, flood risk professionals and future research studies. Figure 1.2 summarizes the research design, strategy and the organization of the thesis chapters.

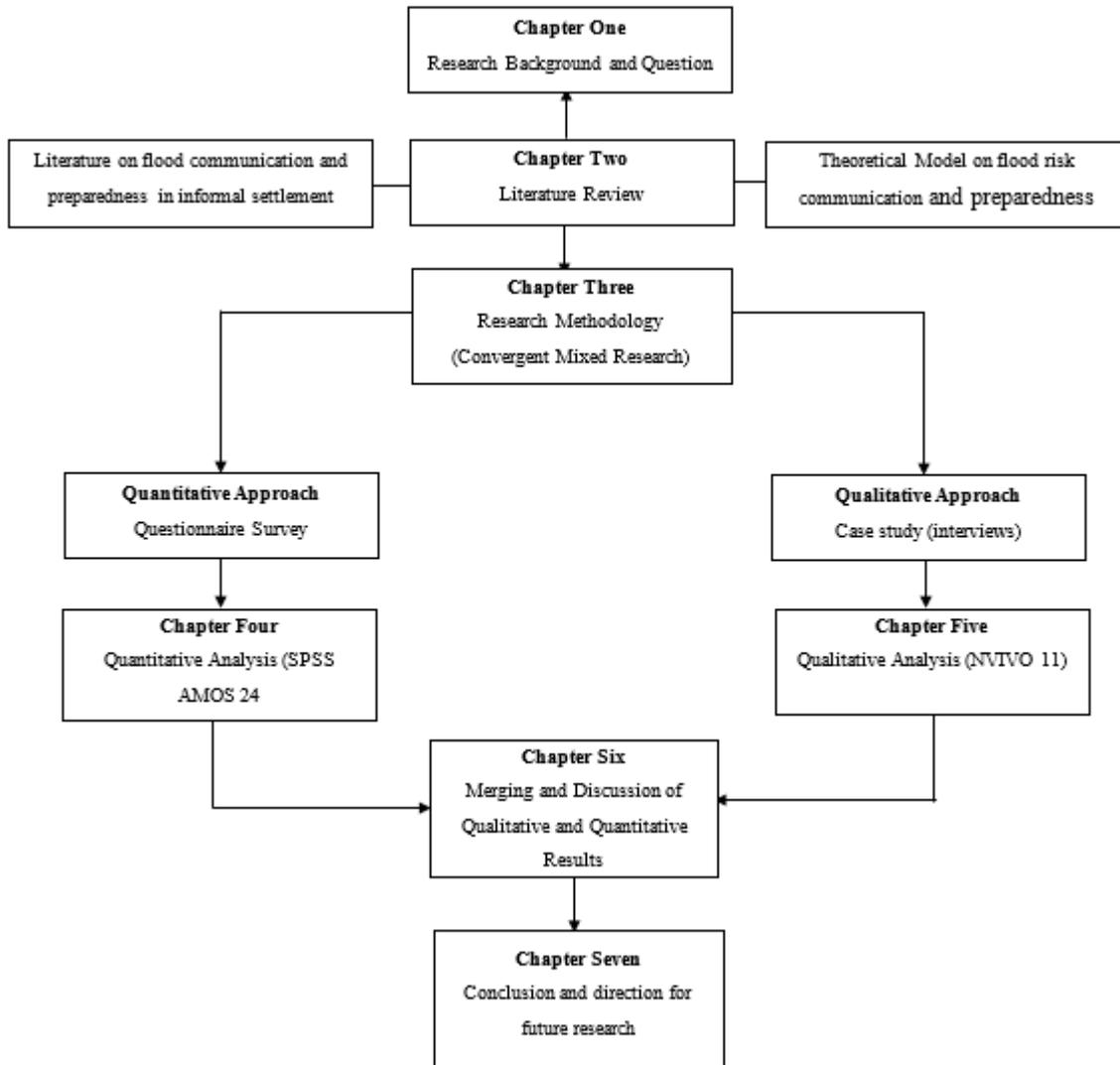


Figure 1. 2: Research Map and Thesis Organisation

1.11 Summary

Chapter One has introduced the background to the study and highlighted the research gap within the context of flood risk communication and preparedness, articulated through the research question, research aim and objectives of the study. The study has also highlighted the definitions of key variables and concepts used in the study. Emphasis has also been laid on the geographical scope of the study, research design, methodology and benefits of the study. The next chapter presents current knowledge on flood risk communication and preparedness to provide a theoretical basis for the research. The significance of this research is that it combines the concepts of risk communication and disaster preparedness to explore the relationship between these concepts. Importantly, the research employs the protection motivation theory and information deficit theory to fully investigate the relationships.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Chapter Two (2) presents a review of academic literature to highlight the issue of how risk communication influences actions towards flood hazard preparedness in informal settlements. This chapter reviews key concepts such as disaster vulnerability and exposure in informal settlements, risk communication, risk perception, and disaster hazard preparation. The intent of this chapter is:

- To review literature on disaster vulnerability and exposure in informal settlements.
- To review literature on the risk communication influence on disaster risk reduction and preparation.
- To review the protection motivation theory and information deficit theory to contextualise the risk communication for disaster preparedness.
- To develop a conceptual framework to explain the risk communication influence on intentions to prepare

2.2 The Research in Context: Building Disaster Resilience in Informal Settlements

Flooding between 1980 and 2011 has been considered the type of climatological disaster hazard with the highest occurrence rate of three thousand four hundred and fifty-five (3,455) times (Guha-Sapir, Vos, Below, & Ponserre, 2012). Flood hazard strikes have varying degrees of impacts on human life, property, and infrastructure. Subsequently, experts in flood management have raised concerns about the difficulty of finding an ideal approach to prevent and provide a lasting solution for devastating flood hazard events (Bennett, Kean, Rengers, Ryan, & Rathburn, 2017; Chen, 2017; Haer, Botzen, de Moel, & Aerts, 2017; Shah, Rahman, & Chowdhury, 2018; Tullos, 2018). Although a concerted effort has been made to reduce flood impacts (Cutter, Emrich, Gall, & Reeves, 2017; Meyer, 2018; O'Hare & White, 2018), stakeholders still face the challenge of presenting a long-term solution to flood hazards (Kellens et al., 2013). Rigorous studies that consider sustainable pathways to flood risk reduction have suggested that a proactive, integrated and multi-disciplinary approach is the best way to significantly reduce the impacts presented by flood hazards (Xu, Cheng, & Ren, 2017).

The debate on flood risk reduction and resilience in informal settlements has centred primarily on flood mitigation and preparedness as well as reconstruction following a disaster event

(Brass, 2012; Hambati & Yengoh, 2018; Twigg, Christie, Haworth, Osuteye, & Skarlatidou, 2017; Usamah, Handmer, Mitchell, & Ahmed, 2014). Flood risk communication is seen as an appropriate strategy for effective reduction of disaster risk. Reduction in flood damages and other related impacts may be achieved through risk communications that instill protective and precautionary behaviour in “at risk” individuals towards flood. Although studies on risk communication and preparedness have individually received attention, research on the combination of these two concepts in tackling disaster issues and impacts has yet to be fully explored. Correspondingly, there is a limited body of work that looks at the risk communication influence on public intentions to prepare towards flood hazard. The importance of this study is that it couples the concepts of risk communication and disaster preparedness to explore how risk communication influences flood risk preparedness intentions in informal settlements. The following sections review literature on disaster vulnerability and exposure in the context of an informal settlement.

2.3 Informal Settlements: Hazard Vulnerability Perspective

It has been identified within literature that factors such as urban development characteristics and social characteristics affect flood vulnerability. The location of informal settlements (floodplains, marshy areas, low-lying areas, and river courses) coupled with high population growth, poor planning and quality of housing (Agarwal, Satyavada, Kaushik, & Kumar, 2018; King & Amponsah, 2012) renders them vulnerable to natural hazards (Pelling, 2007). Occupants of informal settlements, mostly immigrant, have low economic capabilities (Fekade (2000) that may impact on their ability to prepare adequately for impending natural hazards. The majority of the occupants of informal settlements are engaged in low-income activities such as the production of handicraft products and small-scale commercial activities like the sale of groceries. This situation renders informal settlement dwellers incapable of renting a house or room in a properly laid out residential area. Their economic position pushes them to rent apartments in informal locations, as these areas provide cheaper residential opportunities. In addition, low-income characteristics often hinder the use of structural mitigation measures to reduce hazard impacts, given the expensive nature of remediation actions (Bubeck et al., 2017).

Expansion of population and industry across informal settlements triggers increased demand for natural resources such as land for both residential and industrial development reasons. This, in turn, results in natural vegetation destruction in these areas to accommodate the rising

construction activities, which increases settlers' susceptibility to different types of natural hazards. Furthermore, changes in land-use patterns are another phenomenon that arises during urban population increase. The predominant changes usually occur with agricultural, residential and industrial land-uses (Nations, 2006) that often include features of urban construction such as paving of surfaces affecting infiltration and permeability of run-off water through the soil (Löwe et al., 2017).

Inequality among humans, communities, and countries gives rise to social vulnerability, which shapes the susceptibility of various groups to natural hazards. The vast differences in susceptibility levels result in differences in preparation and the resilience rate. Informal settlements are characterized by low access to political power and low levels of education, together with culturally and linguistically diverse minority groups (Gilbert, 2014; Kuffer, Pfeffer, Sliuzas, Baud, & Maarseveen, 2017; Taubenböck, Kraff, & Wurm, 2018). Low-level, or no, education in informal settlements hinders individual capacity to decipher warning information and access to preparatory and recovery information (Dalu et al., 2018; Paul, 2005). Additionally, the diverse culture and ethnic structure of informal settlements may make communication of risk an arduous task, as risk messages need to be communicated in several languages to promote effective communication responses (Abubakar, Romice, & Salama, 2017; DONG, 2018).

Failures of housing policies to improve poor people's access to housing have been identified as one of the reasons for increased disaster vulnerability and exposure in informal settlements (Choguill, 1996; Fields & Hodkinson, 2018). Housing policies in the Least Developed Countries (LDCs) do not create a serene environment for the poor to access urban land and housing (Aldrich & Sandhu, 1995; Amis & Lloyd, 2018). Low-income groups often consider cheaper and affordable areas, which are predominantly floodplains, marshy areas and other unsafe places (De Risi et al., 2013; Ouikotan, van der Kwast, Mynett, & Afouda, 2017). Urban authorities have also sidelined the planning process across informal settlements based on the perception that the communities are problematic (Amoako & Boamah, 2017; Choguill, 1996; Madon & Sahay, 2017), due mostly to illegal habitation of the land or often lying outside the scope of planning regulations and laws. As a result, informal settlements are characterized by inadequate access to infrastructure such as storm drains, and to poor waste management, which increases the susceptibility of informal settlements to flood hazards. Failure of housing policies and neglect of informal settlements by the city have expanded the size of old informal

settlements and encouraged the development of new ones, thereby increasing disaster vulnerability and exposure levels.

2.4 Building Resilience Amidst Vulnerability in Informal Settlements

The nature and range of vulnerabilities present in informal settlements require pragmatic measures to ensure reduced disaster impacts and resilience. Building resilience could either be before hazard strikes or during reconstruction after a disaster occurs. While scholars such as Brass (2012) and Subbiah et al. (2008) have a strong conviction that resilience is best built before the occurrence of a disaster, Usamah et al. (2014) view the disaster re-construction period as the most important period to build robust resilience. However, resilience in a highly vulnerable location like an informal settlement may also be achieved through a combined effort involving pre-disaster preparedness and post-disaster reconstruction.

According to Durand-Lasserve and Royston (2002) and Gryc (2005), resilience in informal settlements is recommended through the reduction and eradication of vulnerability characteristics. The New Delhi Declaration by the United Nations Centre for Human Settlements (UNHCS) in 1996, cited in Durand-Lasserve (2006), supports this assertion by stating that improving upon the insecure tenure of informal settlement is one of the ideal ways of building resilience. Nevertheless, improving the characteristics of the informal settlement alone is not a guarantee of reducing disaster impacts and building robust resilience. Finding solutions to disaster vulnerabilities in informal settlements together with effective preparation of occupants to take up initiatives towards disaster preparedness presents the preeminent way of reducing disaster impacts. Importantly, preparation for disaster hazards has been acknowledged as being anchored on sound and effective communication of risk (Eriksen & Prior, 2013; Lundgren & McMakin, 2018).

Communication between experts, authorities and informal settlers presents a scenario where stakeholders can clarify misperceptions about stakeholders and on disaster hazards in terms of impacts and vulnerabilities. Communication also affords an opportunity for disaster managers and public authorities to create awareness and increase knowledge of risk, recommend actions to reduce disaster impacts and, importantly, provide motivation for individuals to take actions to prepare adequately for risk (Reynolds & Seeger, 2005). Informal settlement dwellers' trust in public authorities is low (Chand & Yala, 2008; Kyessi, 2018) and has been identified as a

major hindrance to risk communication (Palen & Hughes, 2018; West, 2001; West & Orr, 2007; Williams, Valero, & Kim, 2018).

Conversely, respect for culture and societal values have encouraged informal settlement inhabitants to trust traditional authorities more (Galperin, Michaud, Senaji, & Taleb, 2018). Therefore, this presents a platform to ensure sound communication of risk, especially if risk messages emanate from a team of city authorities (Power (2018) and traditional authorities. Resilience to disaster depends highly on the strong social cohesion between community members and authorities (Maguire & Hagan, 2007; Osofsky, Osofsky, Hansel, Lawrason, & Speier, 2018; Paton, 2003). The social characteristics, such as respect for culture and authority, a strong sense of community attachment to each other, common values, social solidarity, and strong social cohesion enable social resilience (Usamah et al., 2014). These characteristics could be used as a podium to organize community meetings to create awareness and build preparatory character among informal settlers. Furthermore, strong social networks may permit community members to oversee their communities in terms of preparation towards and during a disaster event.

Although it has been proven that reduction of risk is best approached before a disaster, most communities including informal settlements continue to use the aftermath of disaster as a major opportunity to implement measures toward disaster reduction (See for example Da Silva, Lubkowski, & Batchelor, 2010; Hallegatte, Rentschler, & Walsh, 2018; Napier, 2007; Walker, de Vries, & Nilakant, 2017). Post-disaster reconstruction also provides another lens through which vulnerability reduction and resilience may be enhanced. Communication during the reconstruction phase may involve housing design and community upgrading. Self-help assistance found in informal settlements (Gillespie, 2018; La Ferrara, 2002) is an incentive to help rebuild informal settlements after a disaster event.

2.5 Risk Communication and Disaster Management Cycle

Communication is the anchor to effective management of risk before, during and after the occurrence of a disaster. Risk communication is seen to be different from crisis communication in disaster management (Covello, 2003; Seeger, 2018; Seeger & Griffin Padgett, 2010; Ulmer et al., 2017). On one hand, risk communication presents information on the dangers posed by a hazard earlier so that people can take actions to prevent or mitigate disaster impacts, while crisis communication places emphasis on the need to disseminate accurate, timely and useful

information during disaster (Bakker, Kerstholt, & Giebels, 2018; Sellnow, Sellnow, Helsel, Martin, & Parker, 2018). Currently, scholars such as Seeger (2018) and Heath, Lee, Palenchar, and Lemon (2018) have expanded the scope of crisis communication to include pre and post-crisis stages of disaster management.

2.5.1 Crisis Communication: Timely and Relevant Information

The basis for averting the disastrous impacts of natural hazards is the development and installation of Early Warning Systems (EWS). EWS is an important tool for sensing, detecting and assessing disaster risk (Basher, 2006). It encompasses the development and installation of modern and sophisticated technologies and in some cases the use of other techniques, such as observation. The observation technique is mostly used in areas that lack sophisticated technology for the forecast and prediction of an impending hazard. For instance, the neighbouring communities in the city of Kuala Lumpur, Malaysia, lack modern technology to accurately predict flood and community members personally monitor for signs of flooding based on past experiences (Zahari & Ariffin, 2013).

Combining technology and observation is the best practice for sensing and detecting risk, as the two will complement each other's weaknesses. The United Nation International Warning Program (ISDR-PPEW 2005), cited by Haigh, Amartunga, and Hemachandra (2018), suggests that risk knowledge, monitoring and warning service, dissemination and communication, and response capabilities are the four major components of an effective early warning. A monitoring and warning service, which refers to the technical capacity to monitor hazard precursors, to forecast the hazard evolution, and to issue warnings, is an aspect of early warning that is very important and pressing (Basher, 2006; Girons Lopez et al., 2017). Human beings are at the core of monitoring and warning services, thus a failure in EW is as a result of human inability to communicate the detected hazard (Twigg, 2003). This suggests that the installation of sophisticated technology to detect impending risk is not sufficient to drastically reduce the expected losses.

The overall aim of crisis communication is to provide accurate, timely and useful information on evacuation and rescue (Fearnley, Winson, Pallister, & Tilling, 2017; Seeger, 2006). The best approach for assessing crisis communication is to ascertain its importance in relation to pre-event planning, treating the public as a legitimate partner, understanding and considering public concerns, working with credible sources, using honest communication that

acknowledges uncertainties, working pro-actively with the media, and providing concrete actions people can take (Coombs, 2014; Seeger, 2006). Heath, Lee, and Ni (2009) buttress the statement made by Coombs and Seeger, stating that partnership between community members and experts is the surest way to ensure effective crisis communication.

2.5.2 Risk Communication: An Ongoing Interactive Process

Communication of risk after the occurrence of a disaster plays a key role in preparations and response for future hazards. Risk communication during the aftermath of a disaster builds the grounds toward equipping individuals with various mechanisms for DRR (Blanchard-Boehm & Cook, 2004; Kimura, 2018). Warning about subsequent future occurrence and measures to reduce death, injury, and property loss are the basic components of communication after a disaster. For instance, the 10th Anniversary of the Edmonton Tornado provided safety tips for future tornado occurrence. Also, the anniversary provided the platform to educate people about previous tornado occurrence and prevent repetition in subsequent tornadoes (Blanchard-Boehm & Cook, 2004). In this context, disaster risk communication has emerged as a key construct in disaster risk reduction.

The interaction among all stakeholders at risk from a hazard is important for the tenacity of risk communication to be achieved. The purpose of risk communication fails totally when it disregards public concerns during decision making (Leiss, 2004; Umansky & Fuhrberg, 2018). One major and recurring issue of risk communication is the idea that the public is ignorant about risk and that experts only need to explain and justify already made decisions through public meetings (Powell et al., 2001). According to (McComas, 2003), the organization of public meeting and forums minimizes public inputs and participation in decision making during the risk communication process. Heath and Palenchar (2000) advocate for a blend of community relations and risk communication as the surest way to increase citizen inputs in the risk communication process. This blend increases support and collaboration between the public and experts during decision making. Moreover, it enhances dialogue, conflict resolution, and consensus building. In addition, Chess (2001) suggests that a golden rule for experts to follow to ensure dialogue with the public is “hazard-plus-concern”. Furthermore, Horlick-Jones, Sime, and Pidgeon (2003) add that experts and communicators should be independent, honest and neutral during dialogue. Risk communication is characterized by dissemination of multiple risk messages, but the most important thing is for the public to understand the message.

Construing the multiple disseminated risk message by the public helps positively affect risk communication. The public evaluates and interprets risk messages at different and multiple levels. Evaluation of risk messages is done systematically or heuristically (Kahlor, Dunwoody, Griffin, Neuwirth, & Giese, 2003). While systematic evaluation of risk messages involves the use of cognitive effort in considering evidence of message and accuracy in competing claims, heuristic evaluation uses non-message content clues such as source identity for assessment. It is very difficult to comprehend the details of all issues surrounding a particular risk due to the complexity and advancement in technology (Sellnow, Ulmer, Seeger, & Littlefield, 2008). There is a sense of risk in the public and it erupts from the probability of risk occurrence and its varying devastating impacts on the environment (Palenchar, Heath, & Orberton, 2005). The sense of risk held by the public compels them to attend to and seek information on their perceived vulnerability. The public makes informed judgments on their perceived vulnerability and severity based on the information received. Another vital element of the public sense of risk is self-efficacy (Bakker et al., 2018; Wisner et al., 2018). Self-efficacy refers to the ability of an individual or group of persons to execute a behaviour to produce an outcome (Bandura, 1977; Schwarzer, 2014). Studies have shown that individuals who possess a strong sense of risk are more likely to respond to messages they believe will personally reduce their risk. Risk communication provides some level of self-efficacy to the public (Sakakibara, Miller, Routhier, Backman, & Eng, 2014).

2.6 Concept of Disaster Risk Communication: for Disaster Preparedness Behaviour

Risk as a concept is discussed in most scientific disciplines, however, there is no consensus in its definition and interpretation (Aven, 2011). The misunderstanding surrounding the definition of risk emanates from the lack of agreement about the meaning of the word. This assertion is confirmed by Aven and Renn (2009) positing that there has been a lack of conscious effort by scholars to arrive at a definition that cut across several disciplines. Existing literature indicates that the concept does not only differ from layman and professional perspectives, differences also exist within communities and even among professionals. Fischhoff (2012) deepens the argument by indicating that risk is inherently controversial and that the choice of definition has a propensity to affect policy outcome, resource allocation and distribution of political powers in the society. Going on further, Fischhoff broadly classifies risk into objective and subjective risk. While he defines objective risk as the outcome of scientific research, experimental studies and probabilistic analyses, subjective risk involves the public perception of risk research including other considerations that influence the public thoughts about risk. A review by Šotić

and Rajić (2015) summarises the definition and interpretation of risk in terms of probability of occurrence, expected values, uncertainty, and objective. They also opine that some scholars see risk as subjective and epistemic, based on available knowledge, aleatoric due to the probabilistic feature of its occurrence and independent from the person assessing it. From the perspective of health science, *razvoja poljoprivrede Srbije* (2005) sees risk as the likelihood of an injury, disease or damage to the health of employees due to hazards. Risk also encompasses the uncertainty and severity of an event and its consequences of activity on something of value to humans (Aven, 2011).

Scholars such as Haimes (2015) have criticized the probabilistic definition of risk indicating that events with low probability with potentially large consequences are equated with frequent events with lesser consequences. Aven (2011) also criticizes the definition of risk based on probability and consequences. To him, a risk is about uncertainty, however, his doubts surround whether a risk is about the consequences of uncertainty or the consequences of an existing hazard or exposure to the hazard. Rausand (2013) also indicates that there is nothing like “real risk” or “objective risk”.

The plethora of definition and interpretation of risk make it important for scholars to define risk to suit their professional domain and research. For the purpose of this research, a risk is viewed in terms of the probability and severity of a hazard. One of the major barriers in the study of risk in most scientific disciplines including disaster management has been the communication and acceptance of risk by the targeted audience (Fischhoff, 2012; Fischhoff, Watson, & Hope, 1984).

Risk communication, as a concept in disaster management, is known as public awareness or public education (Lin, McCloud, Bigman, & Viswanath, 2016; Reynolds & Seeger, 2005). It is an integral part of effective disaster management, as each stage of the disaster management cycle requires communication. The interpretation of scientific and technical information on disaster hazards into plain and simple language is used to persuade the public to change their perception regarding a hazard (Glik, 2007; Reynolds & Seeger, 2005; Wachinger et al., 2013; Yong, Lemyre, Pinsent, & Krewski, 2017). Initially, risk communication was seen to be a linear and unidirectional concept due to its reduced recognition of stakeholder concerns. As a result of its one-way flow of information, Heath (1995) presents it as simplistic and biased in nature. The top-down flow of information has been criticized mainly because the potential of risk communication to serve the public is lost (Barclay et al., 2008; Musacchio et al., 2017;

Scolobig, Prior, Schröter, Jörin, & Patt, 2015). The turning point from monologue to dialogue risk communication occurred when the National Research Council finished its extensive study of risk assessment by government agencies in 1983. Also, in practice, in many situations where the communication flow is unidirectional, acceptance of risk message by receivers is compromised (Sellnow et al., 2018; Sellnow et al., 2008; Ulmer et al., 2017)

Failure of a communicated risk message to achieve its intended purpose is classified as unsuccessful communication (Zahari & Ariffin, 2013). Sheppard, Janoske, and Liu (2012), on the other hand, claim that the inability of a communicated risk to achieve its intended purposes is greatly due to the approach taken in communicating risk. Communication of risk as a two-way directional phenomenon encompasses active involvement, interaction, and dialogue among all stakeholders. In other words, a communication approach that excludes the society in terms of participation is an indication of failure. Sound risk communication entails the active involvement of grassroots members through interactions to find out the perceived risk of individuals and groups. A risk is communicated effectively when the targeted audience participates, understands and acts on the message conveyed by experts.

Response to flood communication does not only depend on the best communicators and motivators (experts) but also exhaustively depends on the active involvement and participation of stakeholders. Sheppard et al. (2012) support this assertion by suggesting that some community members share their experiences about actions taken for protection against risk during stakeholder discussions, which in turn help shape the wrong perceptions held by other community members. The systematic planning for information sharing among stakeholders is also vital for the communication of risk.

According to Beretta and Bozzolan (2004) and Seeger et al. (2018), the end-product of risk communication is to establish trust in communication, raise awareness, build concession and motivate actions. To achieve the purpose of risk communication, Sellnow et al., in their writing in 2008, uncovered nine best and effective practices for risk communication. The paramount risk communication practices according to them are: active grassroots participation in risk dialogue, honest presentation of risk messages, open and accessible risk messages to people at risk, risk communication integration in policy decisions, treatment of risk communication as a process, accounting for the inherent uncertainty in risk, designing culturally sensitive

messages, acknowledge diverse risk tolerance at all levels and collaborating and coordinating with credible information sources.

The concept of risk communication to drive disaster preparedness behaviour can be underpinned by the Protection Motivation Theory.

2.6.1 Protection Motivation Theory (PMT): Contextualising Risk Communication

The PMT is a model initially introduced to explain the effect of fear on behavioural change (Rodríguez-Priego & Montoro-Ríos, 2018; Rogers, 1975; Wood et al., 2012). Subsequently, it was further expanded to include people's assessment of threat and coping factors on one spectrum and people's intention to protect them from danger on another continuum (See for example Adhikari, Paton, Johnston, Prasanna, & McColl, 2018; Bubeck, Wouter Botzen, Laudan, Aerts, & Thieken, 2018; Floyd, Prentice-Dunn, & Rogers, 2000). Additional variables, which sought to explain the factors that influence individuals' adoption of protective actions were introduced to make the theory intact and robust (Lindell & Perry, 2012).

According to the PMT, individuals and communities do not take up protective measures towards uncertainties in a vacuum but rather are motivated by a number of factors. In the case of flood hazards, threat vulnerability and severity as well as self-efficacy and response efficacy are the major catalysts to taking protective behaviour towards any form of harm or injury from flood hazards (Bubeck et al., 2018; Kellens et al., 2013; Maddux & Rogers, 1983; Tang & Feng, 2018). Simply put, the basis of PMT is that intentions to take precautionary measures towards flood hazard preparation are influenced by an appraisal of threats and coping measures (Hwang, Choi, Yum, & Jeong, 2017; Milne, Orbell, & Sheeran, 2002; Purchase, 2018). On one hand, the assessment of risk involves the consideration of an individual's vulnerability to flooding and its severity. On the other hand, self-efficacy and response efficacy are the basis for assessing coping effectiveness.

In accordance with the theory, high perception of individuals to threat vulnerability and severity facilitate an individual's evaluation of coping capabilities (self-efficacy and response efficacy). When people are confident in their capabilities of performing the recommended actions, they take protective actions towards the threat. The theory has contributed immensely towards motivating people and individuals to take up protective actions towards uncertainty. Several studies have found and confirmed consistency with four crucial components of

protection motivation theory (Brouwers & Sorrentino, 1993; Ho, 1998; Lindell & Perry, 2012; Mulilis & Lippa, 1990; Purchase, 2018; Schoenbachler & Whittler, 1996). However, threat vulnerability, severity, and fear, which are the main pillars of the theory, are not sufficient to explain what motivates people to take protective action (Lindell & Perry, 2012). Moreover, Rogers' PMT does not recognize or put emphasis on the importance of the emotional response to fear appeals (Friestad & Thorson, 1985; Purchase, 2018; Tanner Jr, Hunt, & Eppright, 1991). The inclusion of emotion into Rogers' PMT led to the introduction of a modified PMT.

The theoretical model developed for this study indicates that individuals taking up protective action towards flood hazard do not only appraise hazard threat (vulnerability and severity) and coping measures but also assess the sufficiency of hazard information, clarity of hazard information and credibility of a hazard information source. In addition, a positive assessment of hazard information and credibility of hazard information empowers them to assess their ability to utilize available hazard information to reduce risk by taking up protective action.

2.7 Disaster Risk Communication and Context-Specific Information

Historically, the concept of risk communication is an offshoot of an in-depth study on risk management (Plough & Krinsky, 1987; Sellnow et al., 2008). The areas of environmental management and public health predominantly made use of risk communication tools (Seeger, Sellnow, & Ulmer, 2003), thus it is a borrowed concept in disaster management. Before the emergence in disaster hazard management, experts and scholars attributed the growing devastating impacts of the disaster on the assumption that recognition was not given to risks (Seeger, 2006). The provision of timely and up-to-date information from reliable sources was envisaged as the most reliable and effective solution to the problem (Finch et al., 2016; Renn, Levine, Kasperson, & Stallen, 1991; Tzavella, Fekete, & Fiedrich, 2018). Nonetheless, the implementation of the perceived solution to avoid the increasing disaster impacts was critiqued (Lundgren & McMakin, 2018; Wachinger et al., 2013), which eventually brought forth the mental and social constructivism models (See for example Boase, White, Gaze, & Redshaw, 2017; Chess, 2001; Heath, Bradshaw, & Lee, 2002; Morgan, Fischhoff, Bostrom, & Atman, 2002). While the mental model investigates differences and harmonization between experts and non-professionals' perceptions to ensure effective response to risk messages, the social constructivist model looks to understand the cultural and social context in which risk is communicated.

The mental model or social constructivist model, and sometimes both, form the basis of all risk communication strategies. According to Morgan et al. (2002), several emergency management planning and communication strategies are dependent on the mental model and make use of the basic principle of bridging the gap between expert and public risk perception. Conveying complex scientific knowledge about risk to the public to tune their minds in accordance with scientific knowledge has been the cornerstone of the mental model. Though it has been justified on several grounds that risk communication, which takes into account the mental model of different groups of people and individuals, achieves its intended goals (Glik, 2007; Renn, 2017) yet it is inadequate to achieve the overall goal of motivating receivers of risk messages (Shi, Kapucu, Zhu, Guo, & Haupt, 2017; Tansey & Rayner, 2009). Similarly, Beck (2013) and Douglas (2013) indicate that the mental model explicitly relegates the social and cultural context in which the risk is perceived to the background, making it insufficient to achieve the overall goal of risk communication. In addition, failure of most risk communicated messages rooted on the mental model principles stems from the heterogeneous nature of communities and how people understand and respond to information (Tapsell, Burton, Parker, & Oakes, 2004; Thrush, Burningham, & Fielding, 2005).

The social constructivist model was introduced to take care of the weaknesses underlying the mental model as well as strongly build the basis of risk communication theories and strategies (Beck, 2013). This model took into account the social and cultural settings in which risk is perceived and communicated (Douglas, 2013; Reynolds & Seeger, 2005). The employment of the theoretical models in mitigating disaster impacts has been portrayed extensively in both literature and practice. However, the critical purpose of motivating people to take up proactive, protective and preparedness behaviour is still lingering (Ballantyne, 2000; Paton, 2006).

Disaster risk communication in informal settlements presents a context-specific case as its vulnerability to all forms of disaster hazards have made it imperative for all countries in the world to find a sustainable way to manage it. As noted by Fekade (2000), causes for informal settlement formation range from political and historical factors, to social segregation in income, ethnicity, skills, and profession. Another factor that has a direct link with the formation of informal settlements is the failure of housing policies, laws and urban planning authorities to function effectively (Habitat, 2016).

One of the most used theories to support the dissemination of risk information has been the information deficit theory. The next sub-sections present details of the theory and its importance with respect to this study.

2.7.1 Information Deficit Model (IDM)

The (IDM) also known in the literature as deficit model, knowledge gap model, knowledge deficit model, deficit theory and information deficit theory was propounded by Brian Wynne in the 1980s (Dickson, 2005). According to Dickson (2005), the original purpose of the model was not to describe the “mode of science communication” but rather to characterize and elaborate on widely held belief and norm that existed between experts and non-expert public. The model is anchored on two basic theoretical assumptions. Firstly, the model assumes that public skepticism about the communication of scientific findings is principally due to a lack of public knowledge about the topic and issues communicated. Secondly, the proponent of the model believes that the provision of sufficient information about the topic to fill the knowledge gap is the ideal approach to alleviate public skepticism (Kearnes, Macnaghten, & Wilsdon, 2006; McDivitt, 2016; Miller, 2001; Nyhan & Reifler, 2018). With respect to these assumptions, the public at risk of flood does not prepare towards flood primarily because they lack requisite knowledge required to prepare. Therefore, it implies that providing the public with adequate preparedness information on flood hazard is central to their preparedness.

Since the model’s introduction, it has been criticized on several grounds and in many disciplines. For example, Gross (1994) indicates that the model relegates local or public knowledge to the background and privileges scientific knowledge, which it holds in high esteem. He proposes a new model called a “contextual model” that combines both expert/scientific and public knowledge as the solution to eradicate public skepticism. Boykoff (2012) also specifies and links the fiasco of IDM to the privileging of scientific knowledge over public knowledge. In addition, Boykoff states that the provision of information and filling knowledge gaps is important but insufficient to create active behavioural engagement. Similarly, the model has been described by Miller (2001) as a one-way, top-down communication model that embraces autocracy rather than democracy. Increased public skepticism about scientific facts by laypersons is not because of their ignorance on issues, but rather the failure of experts to take into consideration their cultural, social and value systems (Kahan, Jenkins-Smith, & Braman, 2011; Scheufele, Corley, Shih, Dalrymple, & Ho, 2009).

The flaws of IDM have not only been identified in public health communication, climate change communication, and science communication but also in the field of disaster management. In disaster management, IDM has also been discredited by a wealth of literature (see for example Manandhar, Varughese, Howitt, & Kelly, 2017; O'Sullivan et al., 2012; Paton, Millar, & Johnston, 2001; Paton et al., 2008). The model has been criticized on grounds that increased expenditure on awareness creation through the provision of knowledge has not yielded much in terms of preparedness (Ballantyne, 2000; Paton, Smith, & Violanti, 2000).

The constructions from IDT inform the model by indicating that the provision of adequate information to relevant audiences is necessary but inadequate to motivate preparedness intention. The model suggests that provision of sufficient hazard/risk information can motivate preparedness intention when the information disseminated is clear and in simple language (message clarity), emanates from a credible source (source credibility) and an audience can utilize the disseminated information (self-efficacy) through enhanced skills and abilities.

2.8 Disaster Risk Communication Factors Influencing Intentions to Prepare

The timely and accurate relay of information regarding a disaster hazard among stakeholders is a major tool for effective flood management. Flood risk information given out at the right time and accurately provides at-risk individuals and communities the opportunity to employ measures and structures to mitigate the magnitude of its impacts. However, risk communication on disaster risk has not been able to achieve its intended purposes in recent periods and Kuhn (2000) and Van Dijk et al. (2008) attribute the perception of people to disaster hazard as one of the key barriers influencing the status and effectiveness of risk communication. Miscommunication, which arises from one or all components of risk communication (communication source, communication channel and communication message) is also another factor that leads to failure in risk communication purposes (Breakwell, 2000; Lindell, 2018; Slovic, 2000; Ulmer et al., 2017).

Risk is context specific so is its communication (Fischhoff, 2012; Fischhoff et al., 1984). The uncontrolled growth and agglomeration of cities especially in developing world have resulted in differences in the extent of disaster exposure and vulnerability among urban inhabitants. Differences exist in the planning and management of disaster between formal and informal settlements. Unlike the formal settlements, disaster management in informal settlement are mostly spearheaded by inhabitants and sometimes supported by government agencies due to

the illegality of their location. In some instances, the occurrence of disasters has been used as the basis for their eviction (Diagne, 2007; Napier, 2007). In terms of resource mobilization towards disaster management, informal settlements mostly rely on social capital and self-help initiatives to deal with hazard events (Napier, 2007). However, in the formal settlements, government initiatives and policies argument individual efforts. Pelling and Wisner (2012) indicate that factors influencing the intentions of people to prepare towards disaster hazards differ from location to location and time to time. However, little has been done to investigate how these factors differ from formal and informal settlements.

Contextualizing the influence of disaster risk communication on the intention to prepare for disasters through PMT and IDT identified six key constructs. These constructs include community participation, information sufficiency, message clarity, source credibility, empowerment, and self-efficacy. The next sub-section defines the six key constructs, including intentions to prepare, in relation to this research. It also provides sources for the scales adopted to measure each of the constructs employed in the study.

2.8.1 Community Participation

This refers to two-way regular discussions of flood preparedness issues among community members as well as the continuous exchange of flood preparedness information between experts and community members. Community participation as a construct in this study adopted the measurement scale of Eng and Parker (1994).

2.8.2 Information Sufficiency

The study defines information sufficiency as the quantity and quality of risk information possessed by an individual together with additional information on risk needed to cope with hazard events. The information sufficiency measurement scale was partly adapted from Griffin et al. (2004) and improved upon by the researcher. This was mainly because the measurement scale from Griffin and colleague had a satisfactory Cronbach reliability.

2.8.3 Message Clarity

Message clarity from this study is the clear articulation of the content of flood messages (severity of the flood, expected time and the recommended protective actions to prevent or mitigate the impacts) in simple and plain language to audiences. The message clarity measurement scale used in this study was adapted from Sidelinger and McCroskey (1997).

2.8.4 Source Credibility

Source credibility according to this research encompasses the trust and belief flood message recipients perceive for the communication source. Source credibility construct was measured in this study with the help of a measurement scale adapted from McCroskey (1966).

2.8.5 Empowerment

Empowerment means equipping people at risk to flood with adequate resources to motivate them to take actions to prepare towards a flood hazard. Speer and Peterson (2000) measurement scale was adapted to measure empowerment construct.

2.8.6 Self-Efficacy

Self-efficacy means the extent to which receivers of flood message have the ability and resources to perform the recommended protective actions. The self-efficacy construct was measured with a questionnaire adapted from Lee, Hwang, Hawkins, and Pingree (2008).

2.8.7 Intentions to Prepare

Intention to prepare for flood hazard is the probability of at-risk individuals and communities to perceive precautionary measures to reduce flood impacts. Ajzen's questionnaire on intentions to prepare in (2002) was adapted to measure intentions to prepare.

Perceptions about the probability and magnitude of a disaster event happening differ greatly between people and societies. While some people (fatalists) perceive the non-existence of disaster hazard, others also have a low or high perception about the existence of disaster hazard. Wachinger et al. (2013) classify all the factors influencing risk perception into four categories. These categories are risk factors, informational factors, personal factors, and contextual factors. Literature has shown that strong linkages exist between risk perception and risk communication (Siegrist, Cvetkovich, & Roth, 2000; Sjöberg, 2000). Individuals and societies who lack direct experiences of a hazard manifestation perceive risk based on what they hear and read from the media as well as what they hear from experts and authorities.

The source of communication encompasses all people, entities, and institutions that initiate a communication to the public (Lindell & Perry, 2004, 2012). It includes government authorities, disaster managers, media personalities, friends, family members, and neighbours. Receivers of flood risk information first examine the credibility of the source to determine whether or not a

disaster is likely to happen (Basher, 2006). The credibility or otherwise of a source of a communication is an indication to ascertain how readily people will accept a risk. Research by Kreuter and McClure (2004) and Lundgren and McMakin (2013) showed that a communicated risk from an unbelievable source raises questions and gives an opportunity for recipients to consult other people for clarification. Clarification and confirmation of risk at other sources have a high tendency to influence the perceptions of some message recipients negatively, which implies refusing to take precautionary measures. Spence, Lachlan, and Griffin (2007) classify the behaviour of confirming a communicated risk message from other sources as warning confirmation. The credibility of the source varies from one individual to the other. With respect to these variations, Aldoory and Van Dyke (2006) suggest that communication of disaster risk should emanate from a team made of experts, credible government officials, reputable organizations and familiar and respected personalities. Credibility is linked to building trust and Pinto et al. (2005), Andrulis, Siddiqui, and Gantner (2007) and Klaiman et al. (2010) claim that active community engagement and fruitful collaboration between communities on one side and authorities (experts) on the other side as the best avenue to clear off incredibility and build trust from recipients of risk messages.

The medium through which risk is communicated is known as a communication channel. Channels of flood communication are also as important as the source of communication. Channels of communication include face-to-face contact, telephone, siren, radio, newspaper, television, and the Internet. Each channel of communication has its strengths and weaknesses (DE SWAEF, 2016) and a combination of the channels is key to ensuring precision in communication. Wogalter and Mayhorn (2008) challenge the precision of communication through television or radio, though they are fast and have wide coverage area. They further elaborate that receivers of disaster risk messages from television and radio sources include those who are not at risk and may sometimes mistakenly accept that they are also at risk. Face-to-face contacts and telephone are precise (Basher (2006) yet they are the slowest. Sirens also give prior notice by alerting people but fail to present the extent and severity of the risk.

The assessments made by experts and recommended actions for preparation towards a disaster constitute message communication. Certainty and clarity of the communicated message is an essential tool for influencing the perception of mass audiences (Lindell & Perry, 2004). As noted by McCallum and Heming (2006), clarity and specificity of a flood communicated message enhance credibility and acceptance of risk. The content of a risk message should

incorporate the type of hazard, expected time and the recommended protective actions to prevent or mitigate the impacts (Glik, 2007; Renn, 2017). This propagates the acceptance of risk and adherence to recommended actions for evacuation.

2.9 Risk Awareness, Experience and Perception Influence on Preparedness

The belief that people hold about disaster hazards in terms of negative consequences and actions that can be taken to manage them is formed and maintained in several ways. Risk experience and hazard awareness through public education are the two main avenues that usually inform people about the hazard risk, measures and actions to adopt to mitigate hazard risk (Esteban et al., 2017; Onuma, Shin, & Managi, 2017; Paton et al., 2008). Similarly, risk experience and hazards awareness influence people's perception of preparedness towards disaster hazards (Jamir & Khan, 2018; Johnston et al., 1999; Rohr, 2018).

Disaster hazard awareness and knowledge of various protective behaviours have been shown to have a positive impact on risk perception (Drabek, 2012; Lindell & Whitney, 2000; Ronan, Crellin, & Johnston, 2010). Education campaigns and programs have been the main avenue of awareness creation and present types of hazard awareness and knowledge. Hazard awareness and knowledge of hazard genesis, awareness, and knowledge of the mechanisms of hazard exposure and awareness and knowledge of hazard adjustments avenues are critical (Lindell & Perry, 2004). Education on disaster hazard to create awareness is categorized into self-education, school education, family education, and community education. School education is most useful and forms a formidable basis in providing awareness and knowledge on disaster hazards (Shaw, Shiwaku Hirohide Kobayashi, & Kobayashi, 2004). They further posit that intensive and effective education in the four sub-sections increases awareness, thus a positive influence on risk perception, which invariably impacts positively on disaster preparedness. On another hand, people with little or no hazard awareness and knowledge tend to have low-risk perception, hence a low level of disaster preparedness (Botzen, Aerts, & Van Den Bergh, 2009; Grothmann & Reusswig, 2006). However, several studies such as the ones embarked upon by scholars such as Ballantyne (2000), Johnston et al. (1999) and Paton (2006) state that awareness creation does not necessarily translate into disaster preparedness. This confirms the claim that awareness creation alone and singly does not facilitate disaster preparation but that other factors such as disaster experience complement it.

Disaster experience, both direct and indirect, influence the perceptions people to hold about a natural hazard (Barnett & Breakwell, 2001; Siegrist & Gutscher, 2006). According to (Johnston et al., 1999), there is a positive correlation between direct experience and increased risk perception. They further indicate that increased risk perception also impacts positively on perceived preparedness yet does not necessarily translate into actual preparedness. Individuals and societies who lack direct experiences of hazard manifestation perceive risk based on what they hear and read from the media as well as what they hear from experts and authorities. Conversely, indirect experience impact on perception has provided mixed findings. For instance, Siegrist and Gutscher (2006) conclude that indirect disaster experiences do not affect risk perception of people and societies. However, studies by Paton et al. (2008) show that indirect experiences have positive impacts on risk perception. Sjöberg (2000) supports Paton et al.'s findings by stressing that the efficacy and persuasiveness of the channels of communication reinforce the positive change in perception by people with indirect experience.

2.10 Risk Communication Processes and Disaster Preparedness

The human environment has a component of natural and man-made hazard threats such as flood, earthquake, tsunamis and chemical explosion. Hazard risk preparedness as a major branch of disaster management has been and is an important task. According to Rohrmann (2008), people susceptible to disaster hazards need adequate information on the characteristics of risk, preventive and protective measures, expected behaviour during emergencies and their responsibilities regarding hazard management. Also, Covello et al. (2012) indicate that the aim of equipping people with relevant hazard knowledge and preventive measures is more likely to be achieved when receivers of risk messages are seen as partners and involved adequately in the risk communication process. In addition, scholars such as Adams, Prelip, Glik, Donatello, and Eisenman (2018), Earle (2004) and Lion, Meertens, and Bot (2002) buttress this assertion by advocating that community participation is a catalyst to people's understanding of risk, responsibilities and adherence to recommended risk protective measures.

Risk communication is a process and does not happen on its own. Certain systems need to be in place before risk communication as a risk management tool commences. Before a risk is communicated, a thorough risk assessment is embarked upon to identify the types of hazards and the probability and consequences of the identified hazards (Aerts et al., 2018; Bin Wan Abdul Majid et al., 2017; Slovic, Monahan, & MacGregor, 2000). Risk assessment encompasses hazard identification, hazard characterization, exposure evaluation, and risk

characterization. The mitigation and preparatory strategies to cope with disaster hazards are also assessed and the best alternative is chosen (Paton & Johnston, 2017). The means and channel of communication is an important component of hazard awareness and education (Beggs, 2018; Slovic, 2000; Taibah, Arlikatti, & Andrew, 2018). The most used means and channels for risk awareness are printed materials, warning sirens, public information services, educational video and expert presentation (Covello et al., 2012; Lovejoy, 2018).

Awareness and education of people about hazard risk is not sufficient to ensure the achievement of risk communication goals. Efforts are needed to motivate people to convert awareness and knowledge into preparedness behaviour. The risk communication process is said to be bankrupt when it fails to motivate and persuade people to take proactive and preparedness actions (Meredith et al., 2009; Murakami & Tsubokura, 2017; Okada & Matsuda, 2005). On this basis, risk communication policies and strategies, as well as models, must have a motivation component (Paton, Smith, & Johnston, 2005). Other predictors of behavioural intentions to prepare towards disaster hazards are self-efficacy and response efficacy (Babcicky & Seebauer, 2017; Heath et al., 2018; Paton et al., 2005), perceived vulnerability and severity (Bourque et al., 2013; Lam, 2015; Paul & Bhuiyan, 2010; Weinstein, Lyon, Rothman, & Cuite, 2000) and social, cultural and demographic factors (Donner & Rodríguez, 2008; Eisenman et al., 2006; Mileti & Darlington, 1997; Rohli, Collins, Ersing, Lunsford, & Ludwig, 2018).

2.11 Community Participation and Disaster Risk Preparedness

Disaster risk governance in the nineteenth and early twentieth centuries was narrowly seen as the sole function and responsibility of state governments and its established central institutions (Coppola, 2006; Ikeda & Nagasaka, 2011; Oldham & Astbury, 2018). Over the past few decades, the notion of disaster risk governance being the sole responsibility of state government and established public institutions has changed significantly. In recent times, the governance of risk has included international agencies, the private sector, civil society organizations and community members (Castree, 2008; Pal & Shaw, 2018). Governance of disaster is currently viewed as a collaborative and participatory effort among societies, disciplines, and institutions.

The new paradigm of active community engagement has also changed the one-way risk communication approach where scientific ideas are injected into the lay public. The top-down unidirectional risk communication approach made experts the interpreter, conveyer, clarifier and translator of technical knowledge to the audiences. Currently, the widely accepted

approach to communicating risk involves the continuous engagement, interaction and dialogue between experts and all stakeholders especially the receivers of the message (Glik, 2007; Prashar & Shaw, 2018). In addition, experts embrace the concerns of the lay public, respond to opinions and sympathize with their emotions and reactions (Gutteling & Wiegman, 2013). The vigorous involvement of the community in risk communication enhances cordial community-expert relationships, credibility and trusts in experts, clarity, and adequacy in hazard knowledge, raises awareness level, changes wrong perceptions and motivates actions towards prevention and protection (Mercer et al., 2012; Tuler, Golding, & Kasperson, 2012). Though community engagement ensures the provision of collective knowledge and expertise, yet all questions about hazard issues may not be fully answered. Uncertainty about disaster hazard decisions coupled with a lack of direct experience to tackle hazard consequences means that the community relies on experts for clarity and solutions (Paton et al., 2008). According to Earle (2004), doubt about the efficacy of protective strategies crops up when messages from experts are inconsistent with their needs and expectations. Lion et al. (2002) indicate that regular and continuous interaction clear all doubt and enhance community empowerment. Community empowerment is a recipe for flood risk preparedness.

2.12 Development of Theoretical Framework.

The theoretical framework (refer to Figure 2.2) for this research is built as a structural equation model hypothesizing relationships between six ‘risk communication’ constructs influencing ‘intention to prepare for floods’. The thesis is underpinned by the view, widely held in the literature, that conveying risk information to people prior to the occurrence of a disaster is generally not adequate to achieve the purpose of DRR (Duval & Mulilis, 1999; Ha & Duong, 2018; Lindell & Whitney, 2000; Oktari, Shiwaku, Munadi, & Shaw, 2018; Paton, 2003; Scolobig, De Marchi, & Borga, 2012). Lemyre, Gibson, Zlepnig, Meyer-Macleod, and Boutette (2009) reinforced this by emphasizing that the assessment and response to risk messages are necessary for achieving the goals of DRR, yet there has been little attention to this in the academic research. Apart from communicating risk through credible communicators and recognized channels, more effort is necessary to ensure that message recipients act on the recommended instructions (Paton et al., 2005). Sjöberg (2000) stresses that persuasiveness from the communication source reinforces the audience of the risk message to implement information received. Active participation of the public in the risk communication process according to Hinyard and Kreuter (2007) and Alluhaidan, Chatterjee, Drew, and Stibe (2018) is one of the avenues used to persuade the message audience.

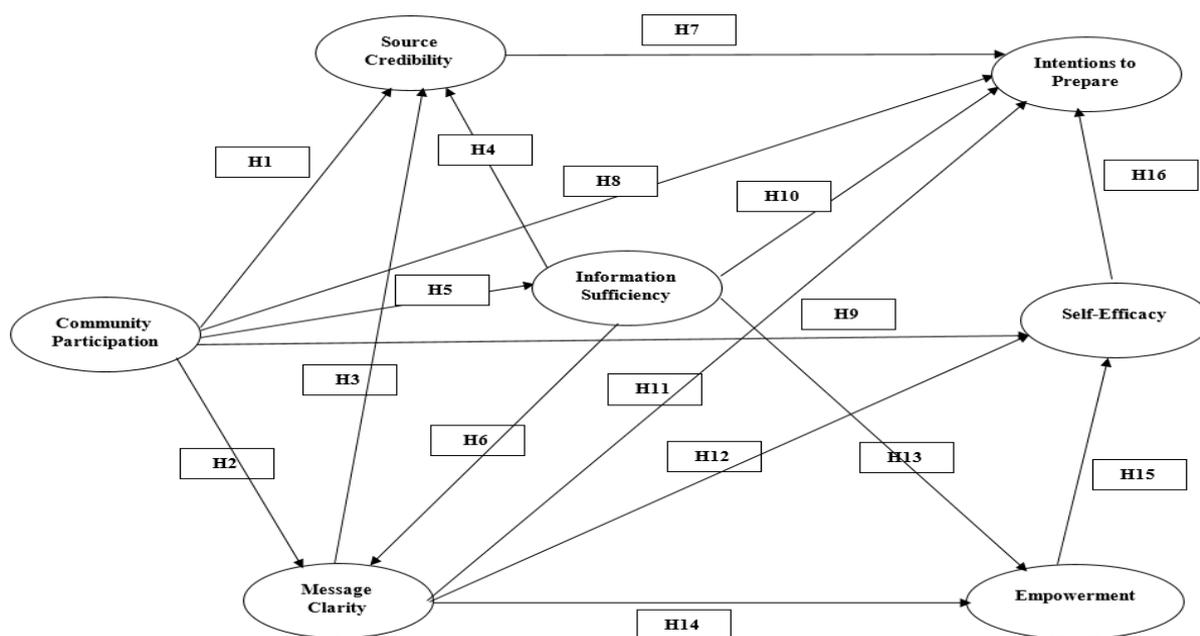


Figure 2. 1: Theoretical Framework of the Study

In Figure 2.2, the framework provides an illustration of the theoretical basis for this research. Within the framework, community participation serves as a platform for fostering relationships and building trust between community members, which invariably enhances source credibility (**H1**) (Andrulis et al., 2007; Arlikatti, Lindell, & Prater, 2007; Habibi, Laroche, & Richard, 2014; Jennings & Stoker, 2004; Klaiman et al., 2010; Sloan & Oliver, 2013; Yoon, Pinkleton, & Ko, 2005), information sufficiency (**H5**) (Trombetta & Rogers, 1988; Vuong & Nguyen, 2015; Zaman, Ashraf, & Martines, 2008) and self-efficacy (**H9**) (Fan & Williams, 2010; Ohmer, 2007; Sakakibara et al., 2014).

Continuous engagements encourage community members to ask questions about flood hazards knowledge gaps, uncertainty and protective measure to meet their needs and expectation (Geaves & Penning-Rowsell, 2016). The information sharing and response to enquiries among stakeholders during community participation reduces message ambiguity, improves flood message clarity and clears all doubt regarding flood hazard preparedness (**H2 and H8**) (Bolkan, Goodboy, & Kelsey, 2016; Broeckelman-Post et al., 2016; Sidelinger & McCroskey, 1997; Tang, Zhang, Xu, & Vo, 2015; Umansky & Fuhrberg, 2018). In addition, the provision of more information to answer issues raised during community participation forums increases the clarity of flood information (Trombetta & Rogers, 1988; Veach, Bartels, & LeRoy, 2007; Vuong & Nguyen, 2015; Zaman et al., 2008), which in turn helps to enhance self-efficacy

(H12) (Ahn, Bong, & Kim, 2017; Andresen, 2018; Garcia-Marques & Loureiro, 2016; Wang & Kuo, 2017). Sufficiency of flood information received by the public increases the trust they have in the source (H4) (Sako, 2006; Tomkins, 2001) and improves clarity of flood information (H6) (Hsu, 2017; Johnson, 2005; Mai, 2016; Mishra, Allen, & Pearman, 2015) for preparedness. Empirical studies by Curnin, Owen, Paton, Trist, and Parsons (2015), Metzger, Flanagan, Eyal, Lemus, and McCann (2003) and Schrodt et al. (2009) found that the public trust in the source of a communication increases when they continuously receive information that is clear (H3).

Sufficiency of flood hazard knowledge and clarity of flood message content obtained through community participation empowers the public towards flood hazard preparedness (H13 and H14) (Bolkan et al., 2016; Camerini & Schulz, 2016; Lawler et al., 2018; Lion et al., 2002; Thevissen, De Bruyn, & Koole, 2017). Empowerment of the public does not directly translate into flood hazard preparedness but through other variables such as trust (Adhikari et al., 2018) and self-efficacy (H15) (Kim & Beehr, 2017; Moein, Aghajani, Ajorpaz, & Khorasanifar, 2017). Resources are needed to increase the ability of the public to act on the information received that increases the public intentions to prepare towards flood hazard. Other factors that predict the public intentions to prepare are message clarity (H11) (Bolkan et al., 2016; Furner & Zinko, 2017; Lindell, Huang, Wei, & Samuelson, 2016), self-efficacy (H16) (Newnham et al., 2017; Ronan, Alisic, Towers, Johnson, & Johnston, 2015; Wirtz & Rohrbeck, 2018), source credibility (H7) (De Meulenaer, De Pelsmacker, & Dens, 2018; Jin & Phua, 2014; Nunes, Ferreira, de Freitas, & Ramos, 2018; Yoon et al., 2005) and information sufficiency (H10) (Basolo et al., 2009; Becker, Paton, Johnston, & Ronan, 2012; Velez, Diaz, & Wall, 2017).

2.12.1 Research Hypotheses

Hypothesis 1

H₀: There is no relationship between community participation and source credibility

H₁: Community participation has a positive relationship with source credibility

Hypothesis 2

H₀: There is no relationship between community participation and message clarity

H₁: Community participation has a positive relationship with message clarity

Hypothesis 3

H₀: There is no relationship between message clarity and source credibility

H₁: Message clarity has a positive relationship with source credibility

Hypothesis 4

H₀: There is no relationship between information sufficiency and source credibility

H₁: Information sufficiency has a positive relationship with source credibility

Hypothesis 5

H₀: There is no relationship between community participation and information sufficiency

H₁: There is a positive relationship between community participation and information sufficiency

Hypothesis 6

H₀: There is no relationship between information sufficiency and message clarity

H₁: Information sufficiency has a positive relationship with message clarity

Hypothesis 7

H₀: There is no relationship between source credibility and intentions to prepare

H₁: Source credibility has a positive relationship with intentions to prepare

Hypothesis 8

H₀: There is no relationship between community participation and intentions to prepare

H₁: Community participation has a positive relationship with intentions to prepare

Hypothesis 9

H₀: There is no relationship between community participation and self-efficacy

H₁: Community participation has a positive relationship with self-efficacy

Hypothesis 10

H₀: There is no relationship between information sufficiency and intentions to prepare

H₁: There is a positive relationship between information sufficiency and intentions to prepare

Hypothesis 11

H₀: There is no relationship between message clarity and intentions to prepare

H₁: There is a relationship between message clarity and intentions to prepare

Hypothesis 12

H₀: There is no relationship between message clarity and self-efficacy

H₁: Message clarity has a positive relationship with self-efficacy

Hypothesis 13

H₀: There is no relationship between information sufficiency and empowerment

H₁: Information Sufficiency has a positive relationship with empowerment

Hypothesis 14

H₀: There is no relationship between message clarity and empowerment

H₁: Message clarity has a positive relationship with empowerment

Hypothesis 15

H₀: There is no relationship between empowerment and self-efficacy

H₁: Empowerment has a positive relationship with self-efficacy

Hypothesis 16

H₀: There is no relationship between self-efficacy and intentions to prepare

H₁: Self-efficacy has a positive relationship with intentions to prepare

2.13 Summary

Chapter Two presented literature on the current discourse in risk communication and preparedness intentions in informal settlements. The chapter provided an in-depth review of the academic literature, identifying two theories which form the basis of the conceptual model for this study. The outcome of the literature review was a theoretical model with sixteen (16) hypotheses which can be tested through structural equation modelling (SEM) in Chapter Four (4) and their relationships explained through narratives from the thematic analysis in Chapter Five (5). The next chapter presents a detailed explanation of the methodology to be employed in this study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

A research methodology is a systematic procedure of inquiry, which spans from the basic assumption of the research through to research design and data collection (Adams & Lawrence, 2018; Myers, 2013; Myers & Avison, 2002; Venkatesh, Brown, & Bala, 2013). Chapter Two reviewed literature on the relevant concepts of informal settlements and disaster vulnerability, risk communication and disaster preparedness. The outcome of the literature review helped to develop a theoretical model of how risk communication influences preparedness intention. Overall, the literature review gave a better understanding of disaster vulnerability in informal settlements and the influence of risk communication in preparedness intentions. The theoretical underpinnings of the study and subsequently a theoretical model were used to guide the research. The intent of Chapter Three (3) is to:

- Introduce and justify the philosophical position of pragmatism-positivism for the quantitative component and constructivism for the qualitative aspect that has guided the research.
- Introduce and justify the concurrent triangulation mixed research design that guided data collection and analysis
- Justify the significance of the single case study strategy as used in this research
- Justify the sample size determination, sampling technique, data collection tools and procedures for both the quantitative and qualitative components of the research.
- Illustrate both the quantitative and qualitative data analysis processes
- Illustrate the integration and synthesis of quantitative and qualitative results

3.2 The Philosophical Position

The Pragmatism philosophy derived from the work of Peirce, James, Mead, Rorty, and Dewey (Creswell, Plano Clark, Gutmann, & Hanson, 2003; Davis et al., 2018; Schwartz, 2018) guides this study. Contrary to positivism and post-positivism, the pragmatism paradigm comes out of actions, situations, and consequences rather than antecedent conditions. This philosophy assumes that research problems are important but complex and employing multiple methods approaches to understand the issue provides a detailed description of the study and increases its robustness (Biesta & Burbules, 2003; Putnam, 2017). Moreover, pragmatism does not only make use of a system of philosophy but rather combines a system of philosophy and reality. In

other words, it combines both quantitative and qualitative assumptions into a single study. In this manner, researchers who employ the pragmatism philosophy have the choice to select the methods, techniques, and procedures of research that best meet their needs and purposes (Creswell & Clark, 2017; Morgan, 2007; Tashakkori, Teddlie, & Teddlie, 1998). Pragmatism as a philosophy is applicable to this study due to the nature of the problem under investigation. In other words, the purpose of this study is to investigate the hypothetical relationship between risk communication and preparedness using the ideals of positivism (through quantitative methods) with a detailed explanation to the hypothetical relationships established using constructivism (through qualitative narratives). This made it imperative to employ the pragmatism philosophy as it provides an opportunity to consider the problem from both quantitative and qualitative perspectives in a single study, thus producing a richer understanding of the issue and robustness of the research outcome.

3.3 Methodological Considerations

Studies relating to flood risk communication and preparedness have often focused on either quantitative or qualitative methods. Only a handful of such studies adopt the mixed research methodology. Table 3.1 summarises the dominant research methods employed in risk communication and disaster preparedness. The outcome shows that most studies that coupled risk communication and preparedness with other concepts adopted the positivist world view. However, a few studies that coupled these concepts employed the pragmatism and interpretivism paradigm. With careful consideration and comparison of this study's research question with others such as Plapp and Werner (2006), it is argued that it is appropriate to employ the pragmatism perspective. The philosophical worldview of pragmatism adopted by this study is often aligned with the mixed research methods approach because they both investigate a problem from both quantitative and qualitative perspectives. The study found the concurrent triangulation mixed research method to be appropriate because the theoretical model developed in Chapter Two (2) was informed by quantitative constructs, thus a quantitative analysis to test it. Furthermore, because the study seeks to explain the quantitative relationships among variables in the theoretical model, a qualitative study was conducted to develop narratives that explain the hypothesized relationships. The use of only a quantitative method for this study would have only tested the hypothesized relationships without providing any significant evidence explaining the hypothesized relationships.

Table 3. 1: Previous Studies on Risk Communication, Preparedness Intentions and Behaviour

Author (s)/Year	Worldview	Research Variables	Key Findings
Risk Perception and Preparedness Intentions and Behaviour			
Grothmann and Reusswig (2006)	Positivism	Perceived probability, Perceived severity, fear, mitigation, preparedness, information seeking, non-protective responses, experience, trust in flood protection	Motivation of people towards flood hazards prevention; communication of risk should include the risk of flooding, potential consequences and possibility, effectiveness and cost of private precautionary measures.
Plapp and Werner, 2006	Pragmatism	Risk characteristics, attribution of causes, rating of risk	Natural hazards (flood, windstorm and earthquake) are not homogenous. Also, risk rating, evaluation of risk characteristics and causes attribution to vary.
Zaalberg et al. (2009)	Positivism	Affect, likelihood, impact; mitigation, preparedness, non-protective responses; OIV: Experience, demographics	Previous flood experience has some correlation with social support, worry, vulnerability, perceived flood consequences, and intentions to take adaptive actions.
Botzen et al. (2009)	Positivism	Likelihood, impact, cause; risk behaviour; experience, distance from the river, elevation relative to water level, demographics	Flood risk perceptions are generally found to be low. Four factors are identified for explaining risk perceptions: (1) actual risk levels, (2) dike protection, (3) knowledge of the flood cause, and (4) age and education.
Risk Communication and Risk Perception			
Terpstra et al, 2009	Positivism	Increasing risk, dread, known to science/exposed, controllability, trust, public support; demographics	Results recommend attitude polarization may cause people to confirm their pre-existing hazard beliefs. This information may have important implications for risk communication

Keller et al., 2006	Positivism	Likelihood, impact; experience	Risk perception is influenced by (1) length of time in risk information, (2) previous flood experience, and (3) affect (manipulated using photographs with flooded houses). The importance of evoking negative affect (fear) in risk communication in order to raise risk perception is stressed
Frewer, 2004	Interpretivism	Trust, risk communication	Clear message regarding risks and associated uncertainties is needed by the public during risk communication. Awareness and understanding of public concerns must be the basis for an effective risk management strategy.
Paton et al, 2005	Positivism	Critical awareness, risk perception, outcome expectancy, self-efficacy, action coping, intention to prepare, intention to seek information, preparation	Preparation towards earthquake hazard needs to be conceptualized in three phases namely: motivation to prepare, the formation of intentions, and the conversion of intentions into actions.

3.4 Research Design

A mixed research methodology combines both quantitative and qualitative approaches in a single study to achieve a research aim (Creswell & Clark, 2017; Denzin, 2017; Walliman, 2017). Creswell (2014) defines mixed method research as an approach that collects and integrates both quantitative and qualitative data and uses two distinct designs that may involve philosophical assumptions and theoretical frameworks. Furthermore, the mixed research approach is recommended when the combination of both quantitative and qualitative approaches provides a better understanding of the problem than the use of a single method. The mixed method design involves the collection and analysis of data and the integration and drawing of inferences using both quantitative and qualitative methods in a single study of inquiry (Dörnyei, 2007; Tashakkori & Creswell, 2007; Terrell, 2012).

There is a plethora of mixed method research design discussed within the literature (Creswell & Clark, 2017; Greene, 2007; Morse, 2016; Öhlén, 2011; Onwuegbuzie & Collins, 2017). According to Tashakkori and Teddie (2003), about forty different types of mixed research

design exist, and all of these typologies emanate from i) level of mixing (partially mixed versus fully mixed); (b) time orientation (concurrent versus sequential), and (c) emphasis of approaches (equal status versus dominant status). Similarly, Leech and Onwuegbuzie (2009) identify and group mixed method research designs into eight main types, namely: partially mixed concurrent equal status designs, partially mixed concurrent dominant designs, partially mixed sequential equal status designs, partially mixed sequential dominant designs, fully mixed concurrent equal status designs, fully mixed concurrent dominant designs, fully mixed sequential equal status designs and fully mixed sequential dominant designs.

However, Creswell et al. (2003) conceptualize mixed method research designs into sequential explanatory, sequential exploratory, sequential transformative, concurrent triangulation, concurrent transformative and concurrent nested. Furthermore, Creswell and Clark (2017) present four types of mixed method designs, namely; embedded, exploratory, triangulated, and explanatory mixed method designs. The choice of the type of mixed method design is dependent on several factors. Leech, Onwuegbuzie, and Combs (2011) outline five main questions that guide the choice of a typology of mixed design. These questions include (a) rationale/purpose for conducting the mixed analysis, (b) the number of data types analysed, (c) the time sequence of the mixed analysis, (d) priority of analytical components, and e) number of analytical phases. The purpose of employing the mixed research methodology is to triangulate the findings from each of the components. With respect to this study, both quantitative and qualitative data were analyzed simultaneously. The outcome of the quantitative results did not inform the collection of the qualitative data, and vice versa. The quantitative and qualitative studies were prioritized equally, hence this study is premised on the concurrent triangulation research approach.

This study adopted the concurrent triangulation mixed method research design involving quantitative and qualitative data collection on flood risk communication and preparedness. This is because the use of the concurrent triangulation research design will first help to test the hypothesized relationships between communication constructs and societal governance constructs employed in the theoretical model. In addition, this method will provide narratives that provide a detailed explanation of the tested hypothesized relationships in three informal settlements in Ghana.

3.5 Research Strategy

A case study strategy was adopted for this research. According to Yin (2013), a case study is an empirical inquiry that investigates a current phenomenon within a real-life context, especially when the boundaries between phenomenon and context are not clearly defined. Gillham (2000) also defines a case study as an investigation to provide answers to specific research questions that seek a range of different pieces of evidence from the case settings. Case studies have multiple perspectives, which are rooted in a specific context. Ritchie, Lewis, Nicholls, and Ormston (2013) typically describe a case study as a program or intervention put in a specific place to address a problem. Therefore, the case study is relevant to this research as it aims to explore flood vulnerability in informal settlements in Accra and how risk communication may enhance preparedness intentions of residents.

Yin (2003) and Yin (2017) identify three basic principles that underpin case studies. First and foremost is the use of “how” and “why” questions. However, “what” questions are used when the case study is for exploratory purposes. Secondly, a case study requires no control over behavioural events and thirdly, the case study focuses on contemporary events. In view of the above principles, the case study has been selected for this research since it fulfils all of them. Furthermore, the use of a case study provides much detailed information about the phenomenon and the context (Neale, Thapa, & Boyce, 2006). Therefore, the use of this design provides extensive and up to date information on how risk communication can influence intentions to prepare towards flood hazards in informal settlements. The selected design encourages a combination of multiple data collection methods such as interviews, document reviews, archival records, and direct and participant observations to give a clearer and complete understanding of the event studied (Merriam, 1988; Yin, 2013). However, with respect to this study, survey and in-depth interviews were employed to gather data on how risk communication influence preparedness intentions. Neuman and Kreuger (2003) support the use of the mixed method in research because it gives an opportunity to have a better look at a situation from several directions. The study selected the single case study research strategy in order to better understand flood risk communication and preparedness issues in the context of three informal settlements (Old Fadama, Kotobabi, and Nima) in the Greater Accra Region (GAR).

Generalization of research findings from one case to another is a limitation of the case study research design (Creswell & Clark, 2017; Creswell et al., 2003; Neale et al., 2006; Soy, 2015).

However, case studies can be generalized, especially if the study employs multiple actors in multiple settings (Denzin & Lincoln, 2000). To ensure generalization, the research made use of single case study design whereby three (3) informal settlements were selected and used during data collection. Similarly, case studies are used for analytical generalizations, especially where the researcher’s aim is to generalize a set of results to some broader theoretical propositions (Yin, 2013). However, this study first conducted a survey to test the theoretical relationship between risk communication and other social variables to ensure statistical generalization. In addition, findings from the quantitative study were supported by rigorous in-depth qualitative results collected in the same case study communities.

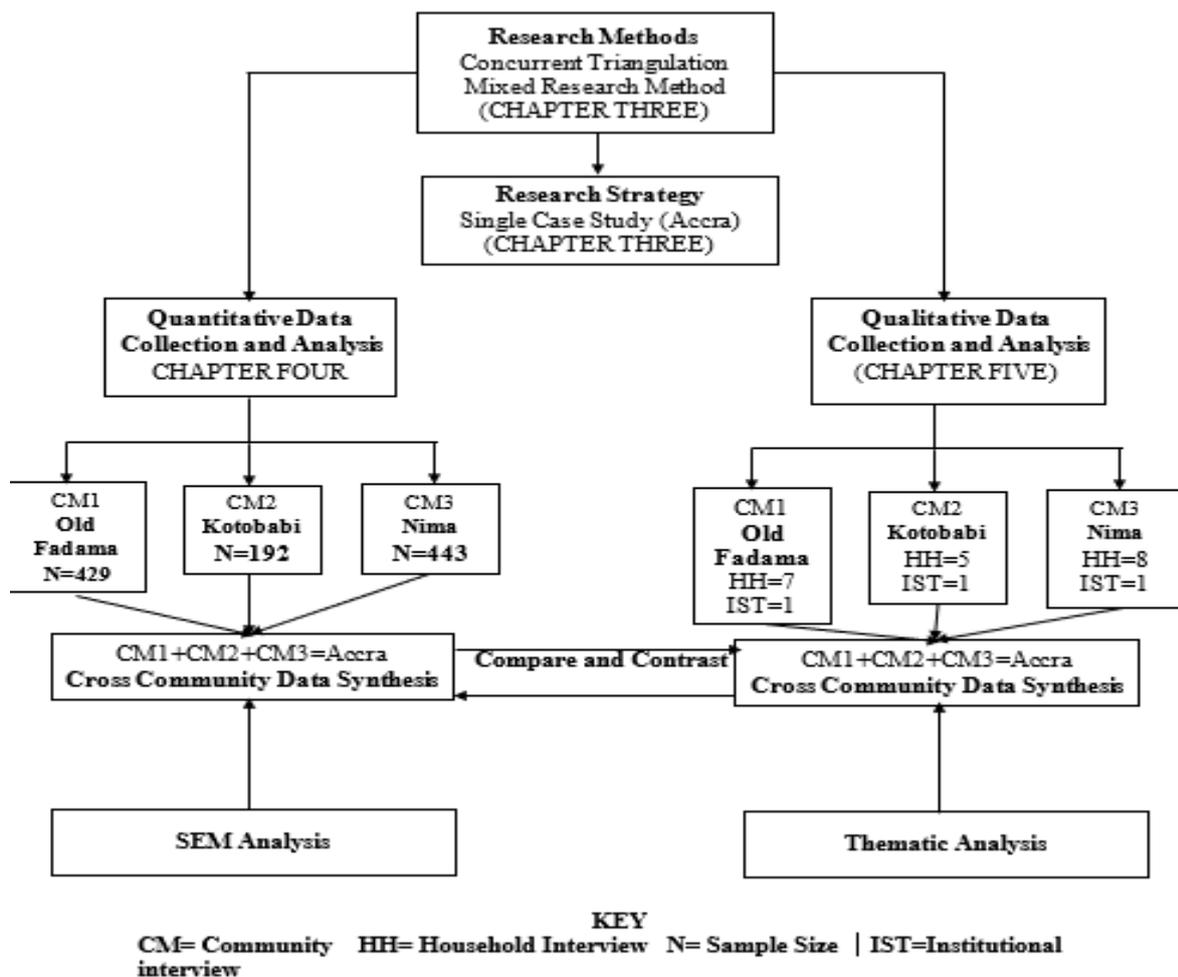


Figure 3. 1: Research Design and Strategy

3.5.1 Description of Case Study Region

Flooding in Accra, Ghana, is an annual phenomenon and a major challenge to the sustainable development of the region and the country as a whole. Flooding in Ghana started in the colonial eras of the early 1930s, with major flooding events occurring in 1955, 1960, 1963, 1973, 1986, 1991, 1995, 1999, 2001, 2002, 2010 and 2011 (Karley, 2009; Rain, Engstrom, Ludlow, & Antos, 2011). Also, Okyere, Yacouba, and Gilgenbach (2013) posit that a total number of 90 flood events impacted Accra between 1960 and 2007 with different levels of devastation. Correspondingly, flood reports compiled by National Disaster Management organizations (NADMO), Hydrological Service Department (HSD) and the media between 2000 and 2012 further indicate that flood has killed 83 people, displaced 178,750 people and inflicted a total damage cost of US\$43.7 million. The impact of flooding on human life, injury and property have been increasing over the years, though several flood prevention and mitigation programs have been implemented (Amoako & Frimpong Boamah, 2015). Research to investigate into the perennial incidence of flooding and its associated impacts has revealed that flood causes are complex and multi-dimensional in nature (Amoako, 2016; Frick-Trzebitzky et al., 2017; Gyekye, 2013; KORDIE, CODJOE, & DE GRAFT, 2018; Nyarko, 2002).

Scholars such as Rain et al. (2011) and Appeaning Addo, Larbi, Amisigo, and Ofori-Danson (2011) attribute the region's vulnerability to flooding to climate change and variability. They believe that high rainfall, temperature, and coastal inundation and erosion are the fundamental bases of flooding in the Greater Accra Region (GAR). Other studies in Accra have also attributed the increased flooding occurrences and damages to poor physical planning and flaws in the drainage network (Erman et al., 2018; Karley, 2009), massive growth of the city, preventing infiltration by impervious surfaces (Afeku, 2005; Arnold Jr & Gibbons, 1996; Korah & Cobbinah, 2017), informal housing development practices (Aryeetey-Attoh, 1998; Okyere et al., 2013) and poor physical development control and waste management practices (Amoako & Frimpong Boamah, 2015; Karley, 2009; Rain et al., 2011). In addition, increased exposure to flood hazard which is directly linked to urbanization has also been identified as a major catalyst for increasing the devastating impact of flooding in GAR (Amoako & Boamah, 2017; Twumasi & Asomani-Boateng, 2002). Urbanization in Accra is one of the fastest growing and the most uncoordinated urban areas in Africa (Yankson & Bertrand, 2012).

The NADMO in Ghana cited in Amoako and Frimpong Boamah (2015) categorizes flood vulnerability in GAR into i) areas lacking drainage facilities, blocked drainages and overflow

of water bodies ii) areas of low elevation with no flood disaster history and iii) wet and marshy areas. In addition, Nyarko (2002) indicates that approximately 42 percent of the main metropolis (Accra Metropolitan Area) is classified as a highly flood-prone area. Correspondingly, the Accra Metropolitan Assembly (2010) cited by Nyarko (2002) also reveals that a total of 152,143 people are residing in flood-prone areas such as floodplains in the main metropolis. Table 3.3 presents the trend of flooding in GAR between 2000 and 2012.

Table 3. 2: Trends and Impacts of Flooding in GAR, Ghana (2000-2012)

Date	Communities Affected	Displaced People	Casualties	Estimated Cost of damages (US\$ Million)
7 May and 5 June 2000	49	6584	12	5.65
1 June 2001	65	41450	13	10.00
6 January, 9 and 13 June 2003	25	2787	3	2.54
18 June 2003	30	3140	5	1.71
13 April 2004	9	250	-	0.61
12 March 2005	22	2370	3	7.35
13 June 2007	40	13140	5	1.14
27 March 2008	12	1456	-	0.91
19 June 2009	33	15616	7	4.12
20 June 2010	42	19833	17	2.78
25 and 26 Oct 2011	149	65236	14	4.72
June and October 2012	157	6888	4	2.18

Source: National Disaster Management Organization, Hydrological Services Department and Media Reports (2000–2012).

Several projects and programmes have been implemented in Accra to avert the devastating impact of flooding, yet the problem persists with ever-increasing impacts. Examples of such programmes include the Korle-Lagoon Ecological Restoration Program (KLERP) and the Odaw drainage improvement works under the Urban Environmental Sanitation Project (USP) that sought to structurally mitigate flooding in Accra (Amoako & Frimpong Boamah, 2015). These projects did not achieve their intended purposes because of financial difficulties and the inability of urban authorities to actively involve the people in the planning and implementation of the projects.

3.5.2 Description of Selected Informal Settlements

- Old Fadama

Old Fadama was originally an unused marshy area that was deemed inhabitable for humans by city authorities. It became a known settlement following the 1983 famine in Ghana, where migrants from northern Ghana searching for jobs settled. The settlement's population grew significantly when the area became a temporary place to accommodate conflict-induced migrants during and after the Konkomba-Nanumba war in 1994. It is currently Ghana's most famous and largest informal settlement, with a total population and land area of approximately 80,000 and 0.313 square kilometers respectively (Masses, 2010). The settlement is cosmopolitan in nature constituting people from almost all ethnic groups and regions of Ghana as well as foreigners from neighbouring West African countries. It is believed that the community's closeness to one of Accra's biggest markets (Agbobloshie market) and housing affordability are the main catalyst to increased population growth over the years (Masses, 2010). Due to the settlement's surface resemblance in terms of social vices to the ancient city of Sodom and Gomorrah in the Bible, Old Fadama has been nicknamed as so. Geographically, the area lies between latitude 5° 33' 25.44" and 5° 33' 17.28" north and longitude 0° 13' 10.56" and 0° 13' 36.48" west (Monney, Buamah, Odai, Awuah, & Nyenje, 2013). It is located at the heart of Accra, northwest of the city's central business district and between the Odaw and Agbobloshie drains at the upper reaches of the Korle-Lagoon.

- Kotobabi

Kotobabi is one of the matured informal settlements with legal land tenure. It lies on latitude: 5° 35' 24" (5.59°) north and longitude: 0° 12' 23.7" (0.2066°) west (GSS, 2012). Kotobabi is inhabited by a population of 33,628 based on the 2010 Population and Housing

Census of Ghana. It is also a low-lying area with an elevation of 44 meters (144 feet). History has shown that Kotobabi together with Alajo, Kpehe, Avenor, Kokomlemle, Nima and the whole of Korle Dudor, Ussher, James Towns and Glefe are the most vulnerable areas within the GAR (Amoako & Frimpong Boamah, 2015). Frimpong (2013) indicates that a heavy downpour of an hour and over may result in the flooding of Kotobabi. Further indications also show that areas along the Kotobabi-Alajo road are the most heavily affected areas in case of flooding.

- Nima

Nima was initially a small portion of land from the royal family of Osu used for farming purposes. However, in the 1930s, one Malam Amadu Futa got the barking from the Osu Royal Family to settle strangers, mostly from the northern part of Ghana. The name Nima was coined out of an Arabic word 'Ni'ima', which means blessing. Nima is one of the impoverished localities within the AMA and lies on the geographical coordinates of 5° 35' 0" North, 0° 12' 0" west (GSS, 2012). It is characterized by the inadequate provision of basic facilities such as housing, potable water, electricity, and drainage facilities. According to the 2010 Population and Housing Census of Ghana, Nima holds a total population of about 80843. Large numbers of migrants from all parts of Ghana and other neighbouring West African countries settle and make Nima their home due to its closeness to the central business district (CBD) (GSS, 2012). Nima is also cosmopolitan in nature with diverse cultures and religions. It is separated from Kotobabi and Alejo by a big drain. Flooding is intense at places closer to the drain and less at the inner town. The intensity of flooding is high during the rainy season when water received from the mountains together with rainwater in the drain overflows it banks. It causes severe damage to property and sometimes claims human lives.

3.6 Study Population, Sampling and Participants

3.6.1 Study Population, Participants and Recruitment

The study population refers to a group of individuals who are a subset of the general population on which a study is focused (Hanlon & Larget, 2011; Murphy, 2016). Study participants are members of the study population whom data were collected from (Barreiro & Albandoz, 2001; Moser & Kalton, 2017). In this study, the populations under study are informal settlement dwellers within the selected case studies. A total informal settlement population of 194471 comprises 80000, 80843 and 33628 respectively for Old Fadama, Nima and Kotobabi.

In this study, a total of 1064 questionnaires were administered to residents in the three case study communities – Old Fadama, Nima and Kotobabi. Ten (10) research assistants were engaged, briefed and trained to understand the purpose of the study. The training involved the discussion and clarification of questions where necessary to ensure that the right data was collected. It was anticipated that participants would understand English and could respond to questions either in English, “Pidgin English” or Akan. The research assistants were fluent in all the languages and had a level of education equivalent to a degree or teacher training to administer the survey. They were also briefed about the ethical protocols before the data collection event. Recruitment of survey and household participants for the study was based upon the following criteria:

- Participants should be 18 years and above
- Participants should have lived in one of the informal settlement for not less than three years
- No two people from the same household were interviewed
- Participants should understand English and respond to questions either in English, “Pidgin English” or Akan

The qualitative aspect of the study involved semi-structured interviews with eight (8), seven (7) and five (5) residents respectively from Nima, Old Fadama and Kotobabi. In addition, three (3) staff members from NADMO were interviewed by the researcher. Participants for the resident interview were also selected based on the criteria set for the survey. However, staff from NADMO were selected based on their involvement in flood communication and preparedness programs in the metropolis.

3.6.2 Sample Determination and Techniques

Sampling is an important issue to consider since complete coverage of the entire population is not possible. Factors such as time, funds and available staffing make sampling necessary (Sarantakos, 2012). Apart from the economic and time effective benefits of a sample survey, these surveys also present more detailed information and a high degree of accuracy due to the relatively smaller numbers of participants (Selltiz, Wrightsman, & Cook, 1976; Stockwell & Peterson, 2002). Similarly, Bourke (2018) posits that a complete survey may not offer an undue advantage over a sample survey. While a sample survey has many advantages over a complete survey, yet the procedures involved in sample surveys require more planning (Sarantakos,

2012). Also, according to Selltiz et al. (1976), sample surveys that do not take into consideration sound methodological codes make them unrepresentative. This makes generalization difficult and in most cases invalidates findings. In order to ensure representativeness based on sound methodological principle, the study clearly defined the sample units and made use of sound selection criteria as well as avoiding bias.

3.6.3 Quantitative Study Sampling

The debate surrounding the adequacy and representativeness of sample size for structural equation modelling (SEM) has grown strongly since Nunnally's article in 1967 (Goodhue, Lewis, & Thompson, 2006; Singla, Ahuja, & Sethi, 2018). This has led to the proliferation of several indicators and criteria for assessing sample size representativeness in SEM. One of the most widely employed bases for justification for sample size in SEM is the ad hoc rule of thumb, which requires selecting 10 observations per indicator (Barclay, Higgins, & Thompson, 1995; Chin, Marcolin, & Newsted, 2003). The basic limitation of the ad hoc rule of thumb is its failure to provide concrete evidence to support the original rule that a good rule in SEM estimation must have a minimum of ten times as many subjects as the variable (Westland, 2010). The rule of 10 is also another standard, which determines sample size adequacy for SEM as the ratio of observations to free parameters (Bollen 1989 cited in Kline, 2015). Bollen further states that no fast rule exists in the determination of representative sample size for SEM but suggests increasing cases of free parameters. Similarly, Ullman and Bentler (2012) and Bentler (1990) support Bollen's statement by suggesting that a ratio of 5:1 is the ideal standard for representativeness of samples in SEM. On another spectrum, the ratio of indicators to a latent variable is substantially a good basis for estimating representative sample size for SEM (Chin et al., 2003; Marsh & Hau, 1996; Westland, 2010). These rules have been confirmed in several studies as problematic (Marsh, Hau, & Wen, 2004; Wolf, Harrington, Clark, & Miller, 2013) because they tend to either over-estimate or under-estimate the size of the sample.

Due to the unclear and ambiguous nature of sample size representativeness in SEM, the choice of the number of questionnaires to be administered was guided by other similar studies. The total number of questionnaires administered for the study was 1064. This sample size is in accordance with the rule of thumb that a minimum sample size of 100-150 is required to run SEM (Bentler & Chou, 1987; Kline, 2005; Muthén & Muthén, 2002; Tabachnick & Fidell, 2001). In addition, the ratio of variable per case in this study is 96:1 which satisfies the basic

rule of 10 cases per parameter/variable (Markus, 2012) and that of 20-25 cases per variable (Bentler & Chou, 1987; Hancock & Freeman, 2001).

The research adopted the proportionate stratified sampling technique and used the respective population of the case study communities as the basis to administer the questionnaire survey. Each of the three case studies for the research was divided into strata that cut across all religious and ethnic lines. This is based on the widely held view in the literature that informal settlers live according to religious and ethnic groupings (Warah, 2004). This made it necessary to ensure that participants cut across ethnic and religious lines. The sample size for the quantitative study was distributed proportionately with their respective population as the major criterion. A simple random sampling of households followed the division of the case studies into appropriate strata. This technique is bias-free and ensured that all households in each stratum had an equal chance of being selected. Table 3.3 presents the case studies, population, and proportion of sample administered.

Table 3. 3: Selected Communities and Sample Proportion

Selected Communities	Population	Sample Proportion
Old Fadama	80,000	429
Nima	80843	443
Kotobabi	33628	192
Total	194471	1064

3.6.4 Qualitative Sampling

Sample sizes in qualitative studies are mostly small compared to quantitative studies (Bernard, 2017; Crouch & McKenzie, 2006; Ritchie, 2003). However, Onwuegbuzie and Collins (2007) posit that this statement is simplistic and misleading. They further elaborate that certain quantitative studies require small samples while some qualitative studies use a large sample size. As a result, it has been recommended by many that qualitative studies should be guided by the concept of saturation rather than guess sample (Dworkin, 2012; Ritchie, 2003; Saunders et al., 2018). Other qualitative methodologists have recommended 30-60 interviews for ethnographic studies (Bernard & Bernard, 2012; Morse, 1994), 15-50 interviews for grounded theory methodology (Creswell, 2002; Creswell & Clark, 2017; Morse, 1994) and 5-25 for phenomenology studies (Creswell, 2002; Morse, 1994). In addition, Guest, Bunce, and Johnson

(2006) indicate that a sample size of fifteen (15) is the minimum requirement for all qualitative studies. A total of 20 household interviews and three (3) institutional interviews with NADMO were conducted for the study. At the point where 20 household interviews and 3 institutional interviews were conducted, it was realized that the 18th-20th interviewee responses were deemed as “counterproductive” and that their responses were not adding new data to the already gathered data. The point at which no new information is added to already gathered data is referred to as saturation point (Fusch & Ness, 2015; Saunders et al., 2018; Strauss & Corbin, 1998). The selection of interviewee for the institutional data was based on the employees’ knowledge of the settlements and issues surrounding risk communication and disaster management in general.

For the purpose of deepening the credibility of responses from the interview, a meeting was organized between the research team and community leaders/traditional leaders, opinion leaders, local government representatives (Assembly members) and religious leaders in all the study communities. The purpose of the meeting was to introduce the research team, explain to them the purpose of the study and to assure them that the outcome of the study would be used purely for academic purposes. The community leaders assisted in the selection of participants with thorough experience about and involvement in flood disaster preparation, recovery and communication. A total of 67 respondents were selected and presented to the research team by the community leaders, out of which 20 respondents (Nima-8, Old Fadama-7 and Kotobabi-5) voluntarily opted to take part in the study. In addition to the 20 in-depth interviews, three staff members from NADMO were interviewed on issues surrounding flood risk communication. NADMO permission was provided to offer opportunities for staff to participate in the study. The purposive sampling method was employed for the selection of participants for both household and institutional interviews.

3.7 Data Collection Methods and Instruments

3.7.1 Quantitative Data Collection Method and Instrument

Questionnaires are a set of standardized or open-ended questions, printed or written and designed in a pre-determined sequence, to gather data to accomplish the aim and objectives of research (Nardi, 2018). The fundamental characteristics of respondents answering the same questions in the same order provide an efficient way of gathering data from a large sample (McDaniel, 1998). Questionnaires as a tool for data collection are less expensive, produce quick results and prevent bias (Neale et al., 2006; Selltiz et al., 1976). According to Brace

(2018), a questionnaire makes schedules for data collection official and provides standardization in the data collection process. Nevertheless, questionnaires do not offer an opportunity to motivate respondents or gather additional information after completion (Sarantakos, 2012).

This study made use of questionnaires to gather the opinions of respondents on flood risk communication in informal settlements. The questionnaire for the study encompassed two main components, which were the socio-demographic characteristics of respondents and predictors and motivational factors to facilitate intention to prepare towards flood hazards. The socio-demographic part of the questionnaire made evident the characteristics of respondents in terms of gender, age, level of education, marital status, employment status, and household size. The second component of the questionnaire was used to investigate the major predictors of preparation intentions towards flood hazard. Amongst these factors are hazard anxiety, perceived hazard severity, self-efficacy, empowerment, response efficacy, and hazard experience. A questionnaire was used for this study because of its ability to gather efficient information to explain how risk communication influences disaster preparedness. It is also less time consuming and more efficient, particularly in this research, because many of the respondents were accessible (Nardi, 2018; Sarantakos, 2012). Table 3.4 specifies the various constructs for the proposed model and studies from which the questionnaires were adopted.

Table 3. 4: Latent Measures and Questionnaire Sources

Measure	Authors from which questionnaires were adopted	Reliability of Questionnaire (Cronbach)
Message Clarity	Sidelinger and McCroskey, 1997	0.95
Source Credibility	McCrosky, 1966	0.93
Information sufficiency	Griffin et al., 2004	-
Community Participation	Eng and Parker, 1994	0.68
Empowerment	Speer and Peterson, 2000	0.81
Self-Efficacy	Lee et al., 2008	0.84
Preparation Intentions	Ajzen, 2002	0.97

Validity and reliability of questionnaires are two major concepts that need adequate attention, especially if the objective of the project is to be achieved. The validity of a questionnaire refers to the capacity of a questionnaire to gather relevant data necessary to achieve the purpose of a study (Csikszentmihalyi & Larson, 2014; Helmerhorst, Brage, Warren, Besson, & Ekelund, 2012). Four types of validity exist, namely: content, concurrent, predictive and constructive validities (Clark et al., 2010; Cohen, Manion, & Morrison, 2013). According to Henseler, Ringle, and Sarstedt (2015), a responsible and appropriate way to ensure that a questionnaire is valid is to make sure that the questionnaire adequately satisfies all the criteria of the types of validities. On the other hand, a questionnaire is said to be reliable if it is able to precisely measure the true score of a construct (Bortz & Döring, 2007; Liang, Lau, Huang, Maddison, & Baranowski, 2014). In other words, a reliable questionnaire is one that can replicate and reiterate the same results on repeated trials. Reliability serves to ensure internal consistency, stability, and equivalence (Tavakol & Dennick, 2011).

The questionnaire for this study was adopted from other similar studies because of its validity and reliability. The questionnaire for this study is valid and reliable. In terms of validity, some scholars in the same field and other related fields have adopted the questions for similar constructs to accomplish previous study aims. Notwithstanding this, the technique of pilot survey was again employed to re-check its validity. The reliability of the questionnaire is also assured as it has been used in different academic fields to produce similar results. Furthermore, the reliability of the questionnaire has been tested to check its internal consistency. The internal consistency of the adopted survey instruments using Cronbach ranges is displayed in Table 3.4. A major limitation of the adopted instrument on information sufficiency is the impossibility of the author to calculate its reliability because of the brief nature of the instrument. However, an additional item was developed to add up to the existing instrument.

3.7.2 *Qualitative Data Collection Methods and Tools*

Another data collection tool that was employed in the study is the interview. Interviews are a qualitative data collection method that involves the interaction between two or more people to obtain factual and meaningful data (Dworkin, 2012; McNamara, 1999). It is essentially classified into five (5) types, namely: one-on-one, group, telephone, online and photo elicitation interview (Quinlan, Babin, Carr, Griffin, & Zikmund, 2011). Segal, Coolidge, O'Riley, and Heinz (2006) also categorize interviews as structured, unstructured and semi-structured. Characteristically, interviews comprise of an interactional exchange between two

or more people; topic-centered and a social and potentially learning event for both the interviewer and the interviewee (Mason, 2002). Interviews as a qualitative tool have no specific strategy for data collection. The best strategy is one that is able to elicit responses that answer the research aim (Merton, 1987). Dick (2002) indicates that the use of interviews allows for more focused discussions and follow-up questions. One-to-one semi-structured interviews were used for this study because of their ability to unearth hidden information on why certain relationships between risk communication variables and preparedness exist which would not be obtained through the use of survey instruments (Quinlan et al., 2011). Also, this tool enabled further explanation as to the hypothetical relationship between risk communication and preparedness. A one-to-one interview was conducted with two groups; (a) Residents of three selected case study informal settlements (b) Selected employees of organizations responsible for communicating flood disaster (i.e. National Disaster Management Organisation (NADMO)).

Quality of research design is based on a logical set of statements being tested and presented. Yin (2017) identifies four (4) tests that need to be embarked upon to establish the quality of a qualitative study, namely: construct validity, internal validity, external validity, and reliability. To ensure credibility, trustworthiness, and dependability of the qualitative aspect of this study, a number of tactics were used during data collection and analysis. Yin (2013) suggests the use of multiple sources of evidence and establishment of a chain of evidence to ensure construct validity. Moreover, he suggests identification and drawing of patterns as a strategy to ensure the internal validity of the research. This study ensured construct validity by selecting three (3) informal settlements in Accra – Old Fadama, Kotobabi, and Nima – to collect multiple sources of evidence, and presenting a draft of the case study report to some NADMO officials, executives of Old Fadama Development Association (OFDA) and local government representatives within the communities to review the case study report. Drawing of patterns also helped to obtain internal validity of results. A case study database was also developed to ensure that results from the analysis are reliable. In addition, a detailed methodology was developed to guide both data collection and analysis.

3.7.3 Preliminary and Pilot Survey

The preliminary survey technique was employed in this study to ensure that the researcher was familiarized with the topography, boundaries and other physical characteristics of the selected case studies. Furthermore, it also gave a clue as to how the selected case studies should be stratified for representativeness in questionnaire administration. This was followed by a pilot

survey. Pilot surveys, also known as a pilot test or pre-test, is an important component of questionnaire administration (Van Teijlingen & Hundley, 2001). Piloting of questionnaires is an avenue that enables the researcher to check the understanding and ability of people to answer questions (Goodman, Meltzer, & Bailey, 1998). In addition, pre-testing also highlights areas of ambiguity, looks for errors and estimates an average time needed to complete a questionnaire. Ambiguities and errors identified in the piloted questionnaire were corrected and refined before the actual survey to ease the answering of questions. In this study, a total of 30 questionnaires (10 in each of the three case studies) were piloted. Also, the pilot test was self-administered and Bourque and Fielder (2003) indicate that a self-administered piloted survey would assist the researcher to identify additional information about difficulty relating to understanding the questionnaire.

3.7.4 Data Collection Sources

The type of data collected was based on the research questions set and the objectives formulated. This study used both primary and secondary data to answer the research question and achieve the research objectives. Secondary data sources are data that give a major insight into a research project and are collected by other researchers who are not related to a particular study. Particularly, secondary sources of data are available electronically and in hard copy. For this study, flood management and communication reports from NADMO were analyzed to have a generic view of flood risk communication in Ghana. In addition, risk communication brochures and a flyer were also collected from NADMO and analyzed as well.

Primary data are first-hand and original information directly related to the research collected by a researcher to answer research questions and achieve research objectives. For the purposes of this study, the primary data was collected from a household's members who satisfy the eligibility criteria in the selected case study locations, and employees of NADMO. Before the data collection, written consent was first gained from the traditional authorities of the case study areas. This is because traditional authorities in Ghana are highly respected and seen as the custodians of the land and their consent made data collection activity run smoothly. Furthermore, an information sheet detailing the purpose of the study and why the study has been done was also given to the traditional authorities. Traditional authorities distributed the information sheets about the survey and interview to the community members. Additionally, traditional authorities, with assistance from some community members, helped to paste posters that summarized the purpose of the study, contact details for researchers, benefits of

participating, where the data collection activity will take place as well as the time. A resident of informal settlements attending the data collection events is considered implied consent.

An announcement was made by the student researcher at the venue of the data collection to confirm that participants can opt out of the data collection if they wish to. Furthermore, before the commencement of the interview/survey, research assistants also reminded participants that participation is voluntary. NADMO was approached through their offices to distribute the organizational information sheet and consent form. NADMO consent to participate helped to distribute the employee information sheet and consent form to employees who voluntarily opted to take part in the study. The employees were asked to sign the consent form and return it to the researchers before they could participate in the interviews. The researchers made contact with the participants to organize a suitable time and location to conduct the interview.

3.7.5 Ethical Consideration

Ethical issues are critical for any research study as ethical clearance is required before data collection. Studies seek to involve organizations and individuals during the data collection, analysis and reporting phases of the study. This makes it imperative and appropriate to ascertain the researcher's behaviour in relation to the rights of the institutions and the individuals who were involved in the study (Goodhue et al., 2006). According to Blumberg, Cooper, and Schindler (2005), ethics ensures that appropriate principles, morals, norms, and standards of behaviour guide the behaviour of researchers and others involved in a study. Furthermore, the application of research ethics helps to formulate and clarify a research topic, design research, collect data, process and store data, analyze data and write up research findings in a morally responsible way. This study before data collection was ethically considered with the following criteria:

- The selection of respondents is voluntary, and they have the right to withdraw partially or completely from the study.
- Respondents have the right to privacy and were not coerced into participating.
- Effects on participants to avoid embarrassment, stress, discomfort, pain, and harm

The Human Research Ethics Committee (HREC) of the University of Newcastle assessed the research project including the questionnaire and approval was granted which permitted data to be collected (Refer to appendix 1).

3.8 Data Analysis

With respect to this study, both quantitative and qualitative analysis were used to unravel the influence flood risk communication has on preparedness. These analyses are elaborated below:

3.8.1 Quantitative Data Analysis

Quantitative data were analyzed using SPSS Amos 24. Before the analysis, the survey instruments from the field were strictly vetted to check for errors. Questionnaires found to be inconsistent with expectations were sent back to the same respondents to complete areas not answered. The analysis of the quantitative data commenced with the screening of the data. Variable screening of data was first done followed by a case-by-case screening. Data screening helped to identify outliers and missing variables and ensured that data collected was clean for further analysis. Specifically, a confirmatory factor analysis (CFA), exploratory factor analysis (EFA) and structural equation modelling (SEM) analysis were run to test the proposed model for the study.

- **Exploratory Factor Analysis**

An exploratory factor analysis (EFA) is a multivariate statistical operation which is used to reduce a large set of variables to a smaller set. It also explores the theoretical structure of a set of interrelated constructs free from manipulation and imposition of preconceived structure on the outcome. (Hair, Black, Babin, Anderson, & Tatham, 2006, p. 104; Mazzocchi, 2008, p. 223). Steps involved in the use of EFA are basically two, namely: extraction and rotation. Extraction aims to explore the factors underlying a theoretical construct (Sophian, Tian, Taylor, & Rudlin, 2003). Principal component (PC), maximum likelihood (ML), unweighted least squares (ULS), generalized least squares (GLS), and principal axis factoring (PAF), alpha factoring and image factoring are all examples of extraction methods that are employed during EFA. Rotation, which is the second step in EFA, is the presentation of the factor loadings in a way that makes it easy for interpretation. Tabachnick and Fidell (2001) identify two approaches to rotation during EFA. These are orthogonal and oblique rotation methods. According to Bryman and Cramer (2005), while orthogonal rotation assumes the extracted factors are uncorrelated, oblique rotation assumes that extracted factors are correlated.

This study employed the maximum likelihood extraction and the orthogonal rotation method to perform the EFA. Specifically, it adopted the Promax Oblique Rotation Method because its results have a higher generalisability and replicability power (Tabachnick & Fidell, 2001).

Results from the EFA reduced the number of items from 43 to 29 because items with low factor loadings were eliminated from further analysis. This practice was to make the latent constructs more robust and improve upon the reliability and validity of the constructs. Also, items with low factor loadings were removed to improve the correlation among the constructs. The results from the EFA was used to run a CFA.

- **Confirmatory Factor Analysis (CFA)**

CFA is a multivariate statistical method which tests how well measured variables represent a latent construct. CFA undergoes the following processes: model specification, model identification, parameter estimation, model fit evaluation and model respecification (Kline, 2013; Silvia & MacCallum, 1988). In this study, the researcher specified the measurement model and made sure it was identified before the data collection. While the number of latent constructs used in the study was seven (community participation, message clarity, information sufficiency, source credibility, empowerment, self-efficacy and preparation intentions), observed variables measuring these latent constructs were 43. See Chapter 4 for details.

- **Structural Equation Modelling (SEM)**

Structural equation modelling is a multivariate statistical procedure that is used to examine the relationship between multiple latent variables. It also seeks to explain the interrelationships among multiple dependent and independent variables simultaneously. SEM has two major components, namely: measurement and a structural model (Byrne, 2016). In this study, the SEM model tests the statistical relationship between the seven latent variables. In the model, community participation, message clarity, information sufficiency, source credibility, empowerment, and self-efficacy are independent variables predicting dependent variable intentions to prepare. Before running the structural model, a CFA (measurement model) was run to explore and validate the relationships among the latent variables. See Chapter Four for details.

3.8.2 Qualitative Data Analysis

Qualitative data analysis is a step-by-step process of reducing data into a meaningful story to enable interpretation (Green & Thorogood, 2018; Patton, 1987; Schensul, Schensul, & LeCompte, 1999). Miles, Huberman, and Saldana (2013) categorize qualitative data analysis into data condensation, data display and drawing of conclusion. Similarly, Patton (1987) also specifies that the stages of qualitative data analysis are mainly three (3) namely; i) data

organization ii) data reduction through summarization and categorization and iii) identification of patterns and development of themes. With respect to qualitative data analysis, there are a plethora of techniques available in the literature, including ethnographic analysis, narrative analysis, phenomenological analysis and constant comparative analysis (Merriam, 1988). In addition, Ryan and Bernard (2000) suggest hermeneutic analysis, narrative and performance analysis, discourse analysis, grounded theory analysis, content analysis, and cross-cultural analysis. This study adopted a six-step thematic analysis technique proposed by Braun, Clarke and Terry (Braun & Clarke, 2006; Braun, Clarke, & Terry, 2014).

According to Braun et al. (2014) and Braun and Clarke (2006), the first stage of thematic analysis is the researcher's familiarisation with the data. According to Braun and Clarke, a quality and detailed analysis of data are highly dependent on the extent the researchers immerse themselves in the data. The researcher, through "repeated reading", making of notes and searching of patterns, are able to familiarise himself with the data. This stage is followed by the transcription of data. In relation to this study, qualitative data collected through interviews were transcribed verbatim and typed to present a summarized version of the field discussions. In addition, the summarised interview data was examined thoroughly to check for inconsistencies, errors, and omissions. Possible errors were corrected to make it ideal for data coding, classification, and tabulation as well as sound interpretation. A three-stage coding method was adopted for analysis, namely: primary, secondary and tertiary coding. Primary coding, which involves the classification of participants' responses into general groups, was embarked upon. Respondents in Kotobabi were coded as KO-R1, KO-R2...KO-R5. Whereas respondent in Nima was coded as NI-R1, NI-R2 ...NI-R8, respondents in Old Fadama were coded as OF-R1, OF-R2 ...OF-R7. The first stage primary code resulted in a total of 167 codes. Sequentially, a secondary coding which is used to categorize participants' responses into more specific types was also done. At this stage, codes that looked similar in meaning after the primary coding were merged. This reduced the number of codes into 47 codes. The last form of coding which involves the derivation of themes from the code categories helped to identify the main themes of the study. Themes developed from the data were reviewed, defined and named. The processes of coding helped to produce recognizable patterns in the interview responses. The analysis of qualitative interview data was done both with Nvivo 11 and manually. The Nvivo 11 software was used to code responses during the first stage coding process. The second stage and tertiary coding were done manually.

CFA and SEM analyses were run to test the hypotheses in the theoretical model developed in Chapter Two. On the other hand, the qualitative data were transcribed and typed to obtain a summarised version of the interviews. A three-stage coding was used as a basis to categorize responses from interviewees. Themes were finally derived from the categorized codes. Results from the quantitative and qualitative studies were merged. Qualitative results were used to complement findings from the quantitative study (see details in Chapter Six).

CHAPTER FOUR

RESULTS FROM QUANTITATIVE DATA ANALYSIS

4.1 Introduction

The previous chapter presented the detailed description underpinning the ontological and epistemological positions along with the research design, strategy and data analysis methods for the quantitative and qualitative components of the study. This chapter:

- Presents data screening measures to identify and manage missing variables and outliers
- Describes the demographic characteristics of the sampled population
- Presents descriptive statistics for various variables and constructs
- Presents results of Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) and evaluates the reliability and validity of the latent constructs
- Tests the proposed theoretical model and hypotheses using Structural Equation Modelling (SEM) techniques
- Present a modified theoretical model with supported hypotheses

4.2 Pre-Analysis of Data

In most instances, survey data will have missing data, outliers, and normality and collinearity issues (Allison, 2003; Belsley, Kuh, & Welsch, 2005; Garson, 2012). It is an established fact that the adoption of inappropriate methods for handling statistical problems such as missing data could lead to bias in parameter estimates (Little & Rubin, 2014; Schafer & Graham, 2002), bias in standard errors and test statistics (Glasser, 1964) and inefficient use of data (Faria, Gomes, Epstein, & White, 2014). Unlike other statistical methods, structural equation modelling is founded on the strict assumption that there cannot be missing cells during analysis (Enders & Bandalos, 2001). This has made it imperative to screen and clean up data before the commencement of SEM analysis. According to DeSimone, Harms, and DeSimone (2015), data screening helps to check consistencies in raw data, and identify outliers and missing data. In addition, Tabachnick and Fidell (2001) indicate that data screening is the most time-consuming part of data analysis, yet it presents a strong foundation for obtaining quality data for subsequent data analysis.

The screening of the data was done manually by checking the survey instruments one after the other to examine the inconsistencies and incompleteness of questionnaires. Data were entered

into the Statistical Package for Social Sciences (SPSS) for further screening. Data was again screened using both spreadsheet and SPSS to identify missing variables and outliers. With regard to this study, screening of the data helped to identify five missing items of data and twelve outliers. In order to correct missing values and outliers, the respective questionnaire cases were revisited, and it became evident that the missing data and outliers came about during the data entry. The removal of outliers in the data improved the normality of data.

4.3 Socio-Demographic Characteristics of Respondents

Sampled data from the survey were analysed using frequencies (Table 4.1). The sampled data gathered showed that 57.4 percent of the respondents were males and 42.6 percent were females, thus a ratio of males to females was approximately 6 to 4. The majority of the sampled population were between the ages 27-35 (35.5 percent) and 18-26 (24.9 percent). While 24.3 percent of the participants had no formal education, 25.6 percent, 11.7 percent and 18 percent of the sampled population had senior high school, primary and Middle/junior high school (JHS) education respectively. With respect to marital status, 48.5 percent and 43 percent of the respondents were married and single respectively. Also, with 53.2 percent of the sampled population gainfully employed, 32.7 percent were unemployed, 11.5 percent being students and 2.6 percent were in retirement. In addition, 92 percent of the employed participants were engaged in the provision of services, such as trading, head pottering, cleaning, tailoring, barbering, driving, carpentry and hairdressing. Monthly income of the sampled population was relatively low, with 50.4 percent receiving a monthly income between GHC 1-300. The median monthly income was between GHC 301-600.

Table 4. 1: Socio-Demographic Characteristics of Respondents

<i>Socio-Demographic Variable</i>	<i>Group/Category</i>	<i>Frequency</i>	<i>Percentage</i>
<i>Gender</i>	Male	611	57.4
	Female	453	42.6
<i>Age</i>	18-26	265	24.9
	27-35	378	35.5
	35-44	203	19.1
	45-53	128	12.0
	54-62	50	4.7
	63+	40	3.8
	<i>Marital Status</i>	Married	516
Widowed		35	3.3
Divorced		25	2.3
Separated		30	2.8
Single		458	43.0
<i>Educational Attainment</i>	Primary	124	11.7
	Middle/JHS	192	18.0
	Senior High School	272	25.6
	Vocational/Technical	72	6.8
	Polytechnic/Diploma	71	6.7
	University undergraduate	57	5.4
	Postgraduate	17	1.6
	No Formal education	259	24.3
<i>Employment Status</i>	Not Employed	348	32.7
	Retired	28	2.6
	Student	122	11.5
	Employed	566	53.2
<i>Monthly Income (GHC)</i>	No Income	6	0.6
	1-300	536	50.4
	301-600	318	29.9
	601-900	149	14.0
	901-1200	51	4.8

1201-1500	2	0.2
1500+	2	0.2

4.4 Descriptive Statistics Scores of Scales

This section presents the mean score and standard deviation for all the item scales that were employed in the study. The measurement scales for this study included community participation, information sufficiency, message clarity, source credibility, empowerment, self-efficacy, and intentions to prepare. Interpretation of mean scores for the measurement scales was based on the Oxford and Burry-Stock (1995) scale. According to this, mean scores of scales ranging between 1.0 and 2.4 are low, 2.5 and 3.4 are medium and 3.5 and 5.0 are high.

4.4.1 Community Participation

The community participation construct for this study was measured with five items on a five-point Likert scale. Mean score for each item measuring the community participation construct varied between 2.38 and 2.56, indicating moderate participation of respondents on flood preparedness discussions. Comparison between the means and standard deviations of all the items showed that responses from participants did not vary greatly from each other. Standard error for each item also showed that the sample means are reliable.

4.4.2 Information Sufficiency

The unobserved variable dubbed *information sufficiency* was measured on a five-point Likert scale with five items. Mean scores for items measuring information sufficiency was between 2.74 and 3.26 which suggests that respondents have a moderate amount and quality information to prepare towards flood. The closeness of the standard deviation to the sample mean shows that participants' responses are not dispersed widely from each other. Furthermore, the standard error of the mean illustrates the reliability of the sample mean.

4.4.3 Message Clarity

Message clarity was measured using six scaled items on a five-point Likert scale. Mean scores of observed items of message clarity ranged between 3.0 and 3.1, indicating moderate clarity in the flood preparedness information respondents receive. Analysis based on the comparison of the sample mean and standard deviation shows that responses obtained through the survey

do not vary extensively from each other. The standard error of mean for message clarity indicates that the sample mean and population are close.

4.4.4 Source Credibility

Source credibility for this study was measured with eight scaled items on a five-point Likert scale. Mean scores for observed items for the source credibility measurement scale varied between 2.83 and 3.0, signifying that respondents' trust in information sources is moderate. Participants' responses slightly vary from each other because the standard deviation does not depart entirely from the sample mean. Similarly, the standard error shows that the sampled mean is reliable.

4.4.5 Empowerment

The empowerment construct was measured on a five-point Likert scale using nine items. Mean score for items measuring empowerment was between 3.15 and 3.44, indicating a moderate level of respondent empowerment to take precautionary actions towards flood hazard. Data shows that participants' responses do not vary entirely from each other because standard deviation does not depart greatly from the sample mean.

4.4.6 Self-Efficacy

The self-efficacy construct was measured with five items on a five-point Likert scale. Mean score stretched between 2.55 and 3.07, which indicates that respondents' ability to react recommended flood message is moderate. The results showed that the sample mean is close to the standard deviation, thus showing a little variation in participants' responses. The standard error of the mean shows that it is reliable.

4.4.7 Intentions to Prepare

The intentions to prepare scale was measured with five items on a five-point Likert scale. The sample mean score of the intentions to prepare construct was between 2.34 and 2.47, suggesting respondents' lower intentions to prepare toward flood hazard. Standard error of the mean shows that the sample mean is reliable.

Table 4. 2: Descriptive Statistics of Measurement Scales

Scale Items	Item Symbols	Mean	Standard Deviation (SD)	Standard Error of the Mean
Community Participation				
I join others to discuss flood issues	CP1	2.507	1.462	0.045
My input is solicited in flood hazard planning	CP2	2.384	1.431	0.044
I am involved in taking flood hazard decisions that affect me	CP3	2.486	1.472	0.045
I take part in activities toward flood risk preparation	CP4	2.563	1.514	0.046
My ideas and inputs towards the planning of flood risk is valued	CP5	2.551	1.528	0.047
Information Sufficiency				
Access to flood risk information	IS1	2.744	1.434	0.044
Knowledge about flood risk	IS2	3.264	1.335	0.041
Quantity of flood information you receive from communicators	IS3	2.794	1.387	0.043
Quality of flood information you receive from communicators	IS4	2.874	1.428	0.044
Level of information needed to deal with flood hazard	IS5	3.155	1.489	0.046
Message Clarity				
Flood risk communicator's answers to questions are clear	MC1	3.001	1.330	0.041
Flood risk communicator is straightforward in his/her messages	MC2	3.075	1.349	0.041
Communicator of flood risk uses relevant and clear examples	MC3	3.104	1.382	0.042
Flood risk communicator is explicit in his/her instructions	MC4	3.003	1.343	0.041
Communicated flood risk messages have clear guidelines	MC5	3.064	1.404	0.043
In general, risk messages from main communicators are clear	MC6	3.097	1.433	0.044
Source Credibility				
How reliable is the main source of risk information?	SC1	2.867	1.488	0.046
How valuable is your main communication source to you?	SC2	2.924	1.476	0.045
How informed is the main source of risk information?	SC3	2.828	1.450	0.044
How popular is your main communication source?	SC4	3.027	1.523	0.047

How qualified is the main source of risk information?	SC5	2.965	1.537	0.047
How honest is your main communication source?	SC6	2.949	1.480	0.045
How friendly is your main communication source?	SC7	2.915	1.479	0.045
How expert is your main source of risk information?	SC8	2.979	1.514	0.046
Empowerment				
I have the freedom to decide on how to protect myself from flood hazard	EM1	3.435	1.320	0.040
I am creative in finding solutions to flood hazard	EM2	3.149	1.264	0.039
I have a lot of control in finding solutions to flood hazard	EM3	3.250	1.243	0.038
I make my own decisions about how to protect myself from flood hazard	EM4	3.325	1.318	0.040
I find my own solutions to flood hazard most of the time	EM5	3.250	1.306	0.040
I am personally responsible for flood hazard decisions	EM6	3.255	1.324	0.041
I am responsible for the results of flood hazard decisions	EM7	3.241	1.325	0.041
I take responsibility for the results of flood hazard protection	EM8	3.289	1.293	0.040
I have the freedom to decide on how to protect myself from flood hazard	EM9	3.435	1.320	0.040
Self-Efficacy				
I am confident that I could deal efficiently with unexpected flood events	SE1	2.871	1.284	0.039
I cannot do much to change the impacts of flood hazard on my life	SE2	2.704	1.238	0.038
When I am confronted with flood issues I can find several solutions	SE3	3.065	1.269	0.039
I can remain calm when told about an incoming flood	SE4	2.552	1.287	0.039
The impacts of flood hazard on my life get solved themselves	SE5	2.624	1.326	0.041

Intentions to Prepare				
How often do you check your level of preparedness?	IP1	2.338	1.476	0.045
How often do you increase your level of preparedness?	IP2	2.393	1.587	0.049
How often do you become involved with a local group to discuss how to reduce flood damage or losses?	IP3	2.330	1.497	0.046
How often do you seek information on flood risk?	IP4	2.427	1.545	0.047
How often do you seek information on things to do to prepare?	IP5	2.470	1.569	0.048

Note: CP = Community Participation; IS = Information Sufficiency; MC = Message Clarity; SC = Source Credibility; EM = Empowerment; SE = Self-Efficacy; IP= Intentions to Prepare

4.5 Exploratory Factor Analysis (EFA)

An exploratory factor analysis was performed using the Maximum Likelihood (ML) extraction method and Promax Rotation method using SPSS version 24.

4.5.1 Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity

The KMO statistic measures the suitability of data for factor analysis with values ranging between 0 and 1 (Kaiser, 1974). A value of 0 suggests that the sum of partial pattern correlation is larger compared to the sum of the correlation. In other words, a value of 0 indicates a diffusion in the pattern of correlation making the data unfit for factor analysis. Values close to 1 shows that the patterns of correlations are relatively compact, thus the data is suitable for factor analysis (Williams, Onsman, & Brown, 2010). Kaiser (1974) recommends values greater than 0.5 as acceptable. Hutcheson and Sofroniou (1999) categorize values between 0.5 and 0.7 as mediocre, values between 0.7 and 0.8 as good, values between 0.8 and 0.9 as great and values above 0.9 as superb. On the other hand, Bartlett's Test of Sphericity tests the null hypothesis that the correlation matrix is an identity matrix. For factor analysis to be performed, the correlation between variables should not be 0 (Dziuban & Shirkey, 1974). Values less than 0.05 indicate that the correlation between the variables is greater than zero, meaning the correlation matrix is not an identity matrix. Values greater than 0.05 show that the correlation matrix is an identity matrix. Results from this data as displayed in Table 4.3 shows a KMO of 0.974 and Bartlett's test of sphericity of $p < 0.001$ indicating the appropriateness and adequacy of the sample data for factor analysis.

Table 4. 3: KMO Statistic and Bartlett’s Test of Sphericity

KMO and Bartlett’s Test of Sphericity		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.974
Bartlett’s Test of Sphericity	Approx. Chi-Square	37119.062
	Df	406
	Sig.	.000

4.5.2 Communalities

Unlike principal component analysis, which operates on the assumption that all variance before extraction is 1, maximum likelihood (ML) does not. Loadings after extraction show the proportion of variance explained by the underlying factors. In Table 4.4, the columns labelled *initial* and *extraction* are variances before and after extraction. Communalities between the items that measured the latent constructs varied from each other. The smallest loaded item after extraction is SE2 explaining 53.2 percent of variance (0.532) and the highest loaded items (EM7 and SC5) explaining 88.8 percent of variance (0.888).

Table 4. 4: Communalities of Measured Items

Measured Item	Initial	Extraction
EM6	.815	.842
EM7	.849	.888
EM8	.832	.866
EM9	.820	.843
IS1	.735	.761
IS3	.773	.877
IS4	.801	.823
SC2	.844	.861
SC4	.839	.853
SC5	.865	.888
SC6	.855	.876
SC8	.815	.831
CP1	.709	.740
CP3	.721	.744

CP4	.735	.800
CP5	.730	.771
SE2	.466	.534
SE4	.425	.562
SE5	.474	.620
IP1	.748	.765
IP2	.793	.818
IP3	.775	.809
IP4	.809	.834
IP5	.772	.800
MC2	.821	.834
MC3	.839	.858
MC4	.840	.857
MC5	.861	.882
MC6	.837	.860

Extraction Method: Maximum Likelihood

4.5.3 Exploratory Factor Extraction Model

In total, 28 linear components were identified within the data. The eigenvalues of each factor showed the variances explained by each variable. The eigenvalues in terms of percentage of variance explained are also examined. While factor 1 in Table 4.5 explains 60.84 percent of the total variance, factor 28 explains 0.335 percent of the total variance. In summary, the first seven factors explain 85.597 percent of the total variance. Four factors are to be retained for further analysis base on the underlying assumption of considering eigenvalues greater than 1. However, the use of the scree plot showed that seven factors should be retained for further analysis. The study retained seven factors for factor analysis based on scree plot results and a prior factor structure. The Kaiser criterion was not employed in this study because eigenvalue greater than 1 has been criticized widely in the literature. The absence of a population correlation matrix in practice (de Winter*, Dodou*, & Wieringa, 2009; Preacher & MacCallum, 2003) and the over-estimation or under-estimation of the number of factors to retain for factor analysis (Cattell & Vogelmann, 1977; Hayton, Allen, & Scarpello, 2004; Humphreys, 1964; Yeomans & Golder, 1982; Zwick & Velicer, 1982) constitute its usage in some studies. Table 4.5 and Figure 4.1 displays the number of factors extracted based on eigenvalues greater than 1 and scree plot, respectively.

Table 4. 5: Number of Factors Extracted

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	17.035	60.840	60.840	16.775	59.912	59.912	14.388
2	2.231	7.966	68.807	1.965	7.016	66.929	12.274
3	1.532	5.473	74.280	1.299	4.638	71.567	11.137
4	1.104	3.944	78.224	.573	2.046	73.613	12.792
5	.810	2.895	81.119	.547	1.952	75.565	6.414
6	.655	2.340	83.459	.528	1.886	77.450	11.301
7	.599	2.139	85.597	.778	2.778	80.228	11.382
8	.439	1.569	87.167				
9	.381	1.361	88.528				
10	.290	1.037	89.565				
11	.261	.933	90.499				
28	.094	.335	100.000				

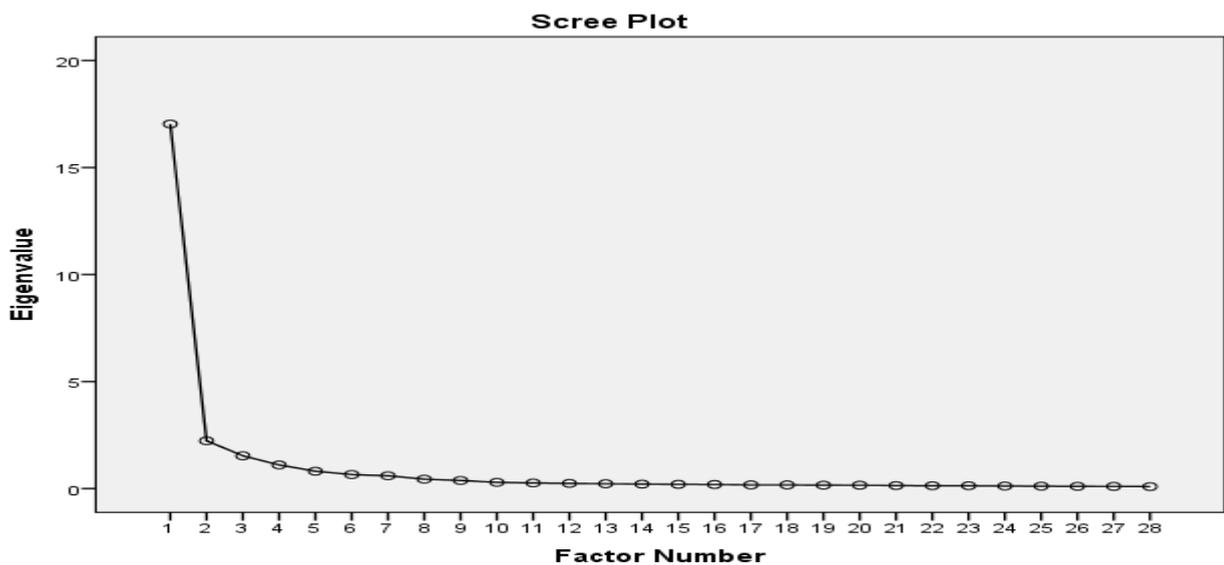


Figure 4. 1: Scree Plot

4.5.4 Factor Loadings of Measured Items on Latent Construct

The pattern matrix (Table 4.6) summarises the loadings of each observed item on the seven latent constructs. It is evidenced in the table that the measured variables have high loads on their respective hypothesized latent constructs. Further analysis from the table confirms both convergent and discriminant validity.

Table 4. 6: Factor Loadings on Pattern Matrix

Observed Variable	Components						
	1	2	3	4	5	6	7
SC5	.931						
SC6	.895						
SC4	.856						
SC8	.849						
SC2	.838						
IP4		.891					
IP3		.875					
IP1		.871					
IP5		.851					
IP2		.843					
EM7			.942				
EM8			.928				
EM6			.910				
EM9			.859				
CP4				.872			
CP5				.786			
CP1				.654			
CP3				.607			
SE4					.765		
SE5					.759		
SE2					.604		
MC5						.724	
MC3						.691	

MC2	.672
MC6	.664
MC4	.639
IS3	.817
IS1	.556
IS4	.545

4.6 Reliability and Validity Statistics of Measurement Scale

Reliability is a statistical index that measures the consistency or dependability of scores with values ranging from 0 to 1 (Cronbach & Shavelson, 2004; Nunnally, 1978). Reliability coefficients close to 1 are often considered to be more dependable for making decisions about individuals than values far away from 1. In this study, two types of reliabilities were assessed, namely internal and composite reliability. A Cronbach alpha reliability coefficient was used to measure the internal consistency of the factors. Whereas Hair et al. (2006) suggest a Cronbach coefficient of greater than point seven (>0.7) as the most recommended for internal consistency, Black and Porter (1996) and Peterson (1994) cited in Peterson and Kim (2013) recommend a cut-off of greater than or equal to point six (≥ 0.6). Results from EFA showed that seven latent constructs with 29 observed variables out of 43 were retained. Following this, the internal and composite reliability of the seven factors is presented in Table 4.7.

4.6.1 Community Participation

The number of observed variables measuring community participation before EFA were five items. Inter-item correlation of the observed variables showed a poor correlation of item 2 (my input is solicited in flood hazard planning) with other variables, hence its deletion. Internal reliability of community participation scale had a Cronbach alpha of 0.922 and composite reliability of 0.824. Internal and composite reliability values are above the recommended cut-offs which indicate that the community participation factor is sufficiently reliable to perform confirmatory factor analysis.

4.6.2 Information Sufficiency

Information sufficiency was measured initially with five items. Observation of inter-item correlation between observed variables measuring information sufficiency showed a weak correlation of item 2 (rate your knowledge about flood risk) and item 5 (rate your level of

information needed to deal with flood hazard) with other remaining variables, hence their deletion. Internal and composite reliability results revealed a Cronbach alpha of 0.924 and 0.681 respectively, thus a higher relationship among items.

4.6.3 Message Clarity

Item 1 (flood risk communicator's answers to questions are clear) was eliminated because of its low correlation with other variables. Thus, five out of six items were retained after EFA for confirmatory factor analysis. While internal reliability results of message clarity presented a Cronbach alpha of 0.967, composite reliability showed a value of 0.907. This result satisfies the recommended standard required to consider the construct a good scale.

4.6.4 Source Credibility

The source credibility construct was initially measured with eight items; however, three items were eliminated after the EFA. Inter-item correlation showed that item 1 (how reliable is the main source of risk information), item 3 (how informed is the main source of risk information) and item 7 (how friendly is your main communication source) have a poor correlation with the remaining construct, hence their elimination. Reliability analysis of the source credibility construct disclosed internal reliability of 0.968 and composite reliability of 0.942. This result shows that the source credibility scale is reliable enough to be considered a good scale.

4.6.5 Empowerment

The aftermath of the EFA resulted in the elimination of five items out of nine measuring empowerments. Items deleted after EFA included 1 (I have the freedom to decide on how to protect myself from flood hazard), 2 (I am creative in finding solutions to flood hazard), 3 (I have a lot of control in finding solutions to flood hazard), 4 (I make my own decisions about how to protect myself from flood hazard) and 5 (I find my own solutions to flood hazard most of the time). Deleted items were due to their weak correlation with the other observed variables. Internal reliability statistics revealed a Cronbach alpha of 0.959 and composite reliability of 0.951 which is above the recommended cut-off.

4.6.6 Self-Efficacy

Self-efficacy was initially measured with five observed variables. Inter-item correlation revealed that item 1 (I am confident that I could deal efficiently with unexpected flood events) and Item 3 (when I am confronted with flood issues I can find several solutions) have a poor

correlation with the other observed variable, hence their elimination after EFA. Results from the reliability analysis showed a Cronbach alpha of 0.774 and a composite reliability of 0.754. This implies a high reliability for self-efficacy to be considered as a scale.

4.6.7 *Intentions to Prepare*

Intentions to prepare was measured with five observed items before and after EFA. Results indicate a strong correlation among all the variables that measured intentions to prepare. Reliability statistical analysis showed a Cronbach alpha of 0.952 and composite reliability of 0.938, which indicate dependability of the scale. Table 4.7 summarises the reliability statistics of the seven constructs used in this research.

Table 4. 7: Reliability Statistics of Measurement Scale

Latent Factor	Number of Items	Internal Reliability Cronbach's Alpha	Composite Reliability
Community Participation	4	0.922	0.824
Information Sufficiency	3	0.924	0.681
Message Clarity	5	0.967	0.907
Source Credibility	5	0.968	0.942
Empowerment	4	0.959	0.951
Self-Efficacy	3	0.774	0.754
Intentions to prepare	5	0.952	0.938

4.7 **Validity Statistics of Measurement Scale**

Validity is the extent and capability of an instrument to measure what it is supposed to measure. The validity of an instrument is categorized into four main groups, namely: i) content validity ii) construct validity iii) face validity and iv) criterion validity (Pallant, 2011). This study only considers and computes the construct validity of the instrument used for the study because of its empirical importance for hypothesis testing and theoretical construction (Crocker & Algina, 1986; DeVellis, 2006; Kane, 2013). Westen and Rosenthal (2003) divide construct validity into two types: convergent validity and discriminant validity. According to Hair et al. (2006), average variance extracted (AVE) of 0.5 and above is an indication of convergent validity of a construct. Discriminant validity in this study was computed using Fornell and Larker (1981) suggestion of comparing the average variance extracted (AVE) and the squared correlation

between constructs. They indicate that when AVE is greater than the square correlation between constructs, then the discriminant validity criterion has been satisfied.

Results from the study indicate that the information sufficiency construct had the minimum AVE of 0.510 followed by self-efficacy recording an AVE of 0.509 (Table 4.8). Empowerment recorded the highest AVE of .8286. This is an indication that the instrument satisfies the convergent validity acceptable standard of 0.5. Furthermore, a comparison between AVE and the squared multiple correlations shows that AVE is greater than the squared correlation of the constructs. This is an indication that the instrument satisfies the discriminant validity criterion.

Table 4. 8: Validity Statistics of Measurement Scale

Latent Factor	Number of Items	Convergent Validity (Average Variance Extracted)
Community Participation	4	0.544
Information Sufficiency	3	0.510
Message Clarity	5	0.765
Source Credibility	5	0.765
Empowerment	4	0.829
Self-Efficacy	3	0.509
Intentions to prepare	5	0.751

4.8 Confirmatory Factor Analysis (CFA)

The result from EFA was used to develop the measurement model also known as CFA. CFA was first developed for each latent construct and assessed with model fit indices (absolute, incremental and parsimonious fit indices). In addition, the constructs were combined to develop the overall measurement model for the study, which was also assessed using the model fit indices, Pclose and significance levels. Model fits for all the measurement models were verified to enable the development of a structural model. The measure of fit indices for the structural model was assessed using Normed Fit Index (NFI), Tucker-Lewis Index (TLI), Comparative Fit Index (CFI), Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI) and Root Mean Square Error of Approximation (RMSEA). Literature suggests a cut-off less than 0.9 ($X < 0.9$) as terrible, greater than 0.9 but less 0.95 ($0.9 > X < 0.95$) as acceptable and greater than 0.95 ($> .95$) as excellent for NFI, TFI, CFI, GFI and AGFI (Arbuckle, 2010;

Bentler, 1990; Gaskin & Lim, 2016)(Bentler, 1990; Arbuckle, 2010; Gaskin and Lim, 2016). Furthermore, a minimum discrepancy to its degree of freedom (CMIN/df) greater than 5 (>5) is terrible, between 3 and 5 as acceptable and between 1 and 3 is considered excellent during the assessment (Hu and Bentler, 1999; Gaskin and Lim, 2016). Hu and Bentler (1999) recommend a cut-off less than 0.05 (<0.08) for RMSEA. Development and assessment of the measurement model precede this section.

4.8.1 Measurement Model of Community Participation

Confirmatory factor analysis was run for community participation with four items. Correlation coefficients of items measuring community participation were between 0.898 and 0.987. Results of the measurement model for community participation showed that each item's factor loading was higher than its standard error. The associated t-statistics or critical ratio (CR) for each item also exceeded the theoretically accepted standard of ± 1.96 at p-value of less than 0.05 ($p < 0.05$). However, some of the fit indices exceeded the accepted range ($\chi^2/df=19.94$, RMSEA=0.133, GFI=0.962, CFI=0.983, TLI=0.965, NFI=0.982, AGFI=0.886, PCLOSE=0.343). Inspection of the model misfit together with theory was used to improve upon the model fit until it met all the recommended ranges ($(\chi^2/df=0.002$, RMSEA=0.000, GFI=1.000, CFI=1.000, TLI=1.000, NFI=1.000, AGFI=1.000, PCLOSE=0.999).

4.8.2 Measurement Model of Information Sufficiency

Results from the CFA showed that all items measuring information sufficiency had correlation estimates ranging between 0.965 and 0.995. Factor loadings of each item were significantly higher than the standard errors with t-statistic above the recommended range of ± 1.96 at p-value of less than 0.05 ($p < 0.05$). Initial results showed that $\chi^2/df=N/A$, RMSEA=0.878, GFI=1.000, CFI=1.000, TLI=N/A, NFI=1.000, AGFI=N/A, PCLOSE=0.000. Inspection of the fit indices showed that RMSEA and PCLOSE failed to meet the recommended range. No modifications were suggested other than to embark on post-hoc model fitting. Information sufficiency was further used to run the overall measurement based on the a priori structure of the scale.

4.8.3 Measurement Model of Message Clarity

Five items were used to run CFA for source credibility with results of factor loadings ranging between 0.918 and 0.967. Comparison between factor loadings and standard error showed a larger factor loading with t-statistics satisfying the theoretically accepted range ± 1.96 at p value

of less than 0.05 ($p < 0.05$). Nonetheless, some fit indices failed to meet the theoretically accepted range ($\chi^2/df=9.91$, RMSEA=0.092, GFI=0.982, CFI=0.993, TLI=0.987, NFI=0.993, AGFI=0.945, PCLOSE=0.001), making it necessary to embark on post-hoc model fitting. Review of model misfit and post-hoc model fit was done with consideration to existing literature on message clarity scale to improve the model fit ($\chi^2/df=1.493$, RMSEA=0.022, GFI=0.999, CFI=1.000, TLI=0.999, NFI=1.000, AGFI=0.992, PCLOSE=0.800).

4.8.4 Measurement Model of Source Credibility

Five items were used to run CFA for source credibility with factor loadings ranging between 0.943 and 0.973. Results showed that correlation estimates for each item were significantly higher than its associated standard error. Also, t-statistics exceeded the recommended range of ± 1.96 at p-value of less than 0.05 ($p < 0.05$). Initial fit indices results did not meet the theoretically accepted range ($\chi^2/df=6.032$, RMSEA=0.069, GFI=0.989, CFI=0.996, TLI=0.993, NFI=0.996, AGFI=0.966, PCLOSE=0.081), making it necessary for a post-hoc model fit. The outcome of the post-hoc model fit using modification indices and existing theory improved the fit indices to the accepted standard ($\chi^2/df=2.878$, RMSEA=0.042, GFI=0.997, CFI=0.999, TLI=0.997, NFI=0.999, AGFI=0.984, PCLOSE=0.595).

4.8.5 Measurement Model of Empowerment

CFA was run for empowerment with four items with estimates of results ranging from 0.958 to 0.965. Results from the CFA for empowerment showed that each item's factor loadings were higher than its standard error. The associated t-statistics for each item also exceeded the accepted standard of ± 1.96 at p-value of less than 0.05 ($p < 0.05$). Some of the fit indices were below the required range ($\chi^2/df=14.934$, RMSEA=0.114, GFI=0.985, CFI=0.994, TLI=0.983, NFI=0.994, AGFI=0.927, PCLOSE=0.001) making it imperative to embark on post-hoc model fitting. Review of modification indices together with theory were used to improve model fit until it met all of the recommended ranges ($\chi^2/df=0.002$, RMSEA=0.000, GFI=1.000, CFI=1.000, TLI=1.000, NFI=1.000, AGFI=1.000, PCLOSE=0.999).

4.8.6 Measurement Model of Self-Efficacy

Results from the CFA showed that factor loadings of all the items measuring self-efficacy loaded significantly higher than the standard errors. In addition, the t-statistic for the construct was above the recommended range of ± 1.96 at p-value less than 0.05 ($p < 0.05$). Estimates for each item after CFA ranged between 0.868 and 0.877. Initial results showed that $\chi^2/df=N/A$,

RMSEA=0.878, GFI=1.000, CFI=1.000, TLI=N/A, NFI=1.000, AGFI=N/A, PCLOSE=0.000). Inspection of the fit indices shows that RMSEA and PCLOSE were below the recommended range. With no modifications suggested as well as existing literature on the construct, self-efficacy was used to run the overall measurement model.

4.8.7 Measurement Model of Intentions to Prepare

Five items were used to perform CFA for intentions to prepare with factor loadings ranging between 0.918 and 0.967. Factor loadings of the items were significantly larger than the standard error and t-statistics satisfying the theoretically accepted range ± 1.96 at p-value of less than 0.05 ($p < 0.05$). Nonetheless, some fit indices failed to meet the theoretically accepted range ($\chi^2/df=19.94$, RMSEA=0.133, GFI=0.962, CFI=0.983, TLI=0.965, NFI=0.982, AGFI=0.886, PCLOSE=0.000), making it necessary to embark on post-hoc model fit. On examination of modification indices with consideration of existing literature on the scale, the fit indices improved ($\chi^2/df=1.933$, RMSEA=0.030, GFI=0.999, CFI=1.000, TLI=0.998, NFI=0.999, AGFI=0.989, PCLOSE=0.720). Table 4.9 shows CFA results of all of the seven constructs.

Table 4. 9: Summary of CFA Results

Observed Item	Community Participation				
	Initial	Final	SMCC	Parameters T-test Statistics	P-Value
	β Unstandardized (Standardized)	β Unstandardized (Standardized)			
CP1	0.921 (0.845)	0.946 (0.860)	0.740	35.28	***
CP3	0.935 (0.852)	0.937 (0.847)	0.717	36.91	***
CP4	1.000 (0.886)	1.000 (0.878)	0.771		
CP5	0.994 (0.873)	1.019 (0.886)	0.786	37.36	***

Model Fit Indices Achieved

	Absolute Fit		Incremental Fit			Parsimonious Fit	
	CMIN/DF	RMSEA	GFI	CFI	TLI	NFI	AGFI
	χ^2/df						
Initial	4.231	0.055	0.996	0.998	0.994	0.997	0.981

Final	0.002	0.000	1.000	1.000	1.000	1.000	1.000
Information Sufficiency							
IS1	0.965 (0.866)	0.946 (0.860)	0.749		39.93		***
IS3	0.995 (0.923)	0.937 (0.847)	0.852		44.19		***
IS4	1.000 (0.900)	1.000 (0.878)	0.811				
Model Fit Indices Achieved							
	CMIN/DF	RMSEA	GFI	CFI	TLI	NFI	AGFI
	χ^2/df						
Initial	N/A	0.878	1.000	1.000	N/A	1.000	N/A
Final	N/A	0.878	1.000	1.000	N/A	1.000	N/A
Message Clarity							
MC2	0.918 (0.914)	0.897 (0.900)	0.835		54.73		***
MC3	0.953 (0.926)	0.938 (0.919)	0.858		57.39		***
MC4	0.925 (0.924)	0.913 (0.920)	0.855		57.01		***
MC5	0.967 (0.925)	0.964 (0.929)	0.855		57.02		***
MC6	1.000 (0.937)	1.000 (0.944)	0.878				
Model Fit Indices Achieved							
	CMIN/DF	RMSEA	GFI	CFI	TLI	NFI	AGFI
	χ^2/df						
Initial	9.919	0.092	0.982	0.993	0.987	0.993	0.945
Final	1.493	0.022	0.999	1.000	0.999	1.000	0.992
Observed Item	Initial	Final		Parameters			
	β Unstandardized (Standardized)	β Unstandardized (Standardized)	SMCC	T-test Statistics	p-Value		
Source Credibility							
SC2	0.943 (0.925)	0.897 (0.900)	0.856		58.61		***
SC4	0.973 (0.925)	0.938 (0.919)	0.856		54.49		***
SC5	1.000 (0.943)	0.913 (0.943)	0.889				

SC6	0.951 (0.931)	0.964 (0.931)	0.867	59.99	***
SC8	0.952 (0.911)	1.000 (0.911)	0.830	55.28	***

Model Fit Indices Achieved

	CMIN/DF	RMSEA	GFI	CFI	TLI	NFI	AGFI
	χ^2/df						
Initial	6.032	0.069	0.989	0.996	0.993	0.996	0.966
Final	2.878	0.042	0.997	0.999	0.997	0.999	0.984

Empowerment

EM6	0.965 (0.912)	0.961 (0.916)	0.831	54.70	***
EM7	1.000 (0.943)	1.000 (0.952)	0.890		
EM8	0.958 (0.926)	0.912 (0.912)	0.858	55.76	***
EM9	0.960 (0.917)	0.902 (0.902)	0.840	59.99	***

Model Fit Indices Achieved

	CMIN/DF	RMSEA	GFI	CFI	TLI	NFI	AGFI
	χ^2/df						
Initial	14.934	0.114	0.985	0.994	0.983	0.994	0.927
Final	0.002	0.000	1.000	1.000	1.000	1.000	1.000

Self-Efficacy

SE2	0.877 (0.727)	0.877 (0.727)	0.528	18.04	***
SE4	0.868 (0.692)	0.868 (0.692)	0.479	17.87	***
SE5	1.000 (0.774)	1.000 (0.774)	0.599	55.76	

Model Fit Indices Achieved

	CMIN/DF	RMSEA	GFI	CFI	TLI	NFI	AGFI
	χ^2/df						
Initial	N/A	0.517	1.000	1.000	N/A	1.000	1.000
Final	N/A	0.517	1.000	1.000	N/A	1.000	1.000
Observed Item	Initial	Final		Parameters			
	β Unstandardized (Standardized)	β Unstandardized (Standardized)	SMCC	T-test Statistics	p-Value		

Intentions to Prepare					
IP1	0.898 (0.869)	0.886 (0.845)	0.755	42.03	***
IP2	1.000 (0.900)	1.000 (0.887)	0.810		
IP3	0.940 (0.897)	0.966 (0.909)	0.805	45.41	***
IP4	0.987 (0.912)	1.001 (0.912)	0.832	47.31	***
IP5	0.979 (0.892)	0.980 (0.879)	0.795	44.69	***

Model Fit Indices Achieved							
	CMIN/DF	RMSEA	GFI	CFI	TLI	NFI	AGFI
	χ^2/df						
Initial	19.94	0.133	0.962	0.983	0.965	0.982	0.886
Final	1.933	0.030	0.999	1.000	0.998	0.999	0.989

4.9 Overall Measurement Model

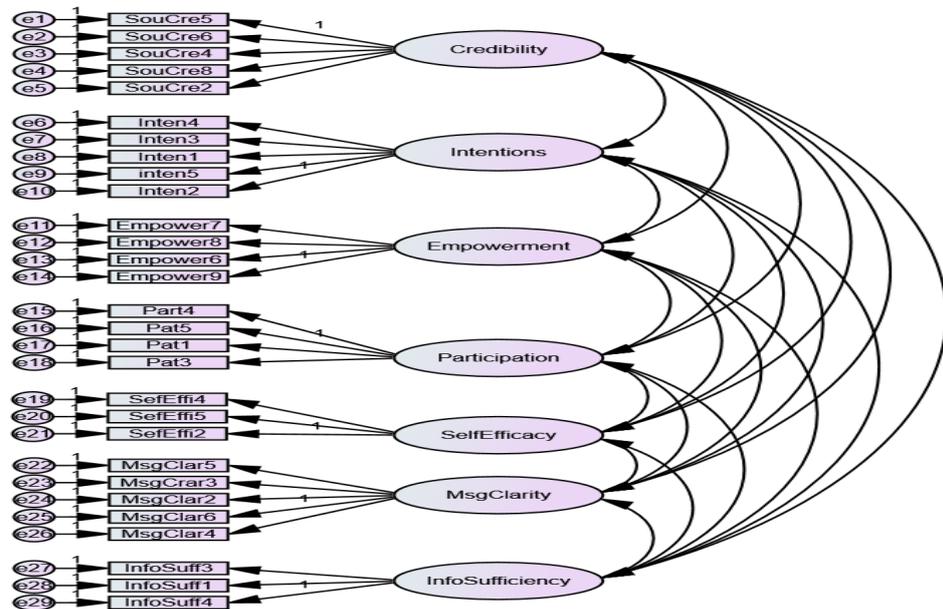


Figure 4. 2: Overall Measurement Model

In Figure 4.2, seven latent constructs measured with twenty-nine observed items were used to run the overall CFA. Results from the CFA with all the latent constructs together revealed that correlation coefficients for each factor were significantly larger than its requisite standard error.

Also, t-statistics for each item far exceeded the accepted range of ± 1.96 at p-value less than 0.05 ($p < 0.05$). Some of the goodness of fit indices for the overall CFA were initially not within the theoretically recommended levels. Results revealed that $\chi^2/df=3.786$, RMSEA=0.051, GFI=0.918, CFI=0.973, TLI=0.969, NFI=0.964, AGFI=0.900, PCLOSE=0.245. Standardized residuals were all above the recommended range (above 2.58 or below -2.58). A detailed evaluation was made to further improve the fit indices for the CFA model. Modification indices together with existing literature were used to re-specify the model. CFA was re-run and assessed to ensure that fit indices satisfied the recommended ranges. Results of the model showed improved goodness of fit indices ($\chi^2/df=3.001$, RMSEA=0.044, GFI=0.937, CFI=0.981, TLI=0.977, NFI=0.973, AGFI=0.918, PCLOSE=0.999). Summary of the overall CFA results are shown in Table 4.10

Table 4. 10: Summary of Overall CFA Results

	Absolute Fit			Incremental Fit			Parsimonious Fit
	CMIN/DF χ^2/df	RMSEA	GFI	CFI	TLI	NFI	AGFI
Initial	3.786	0.051	0.918	0.973	0.969	0.964	0.900
Final	3.001	0.044	0.937	0.981	0.977	0.973	0.918

4.10 Structural Model

This section presents the results of hypothesis testing. Figure 4.1 illustrates all the sixteen hypotheses that the study aimed to test. These hypotheses are denoted by causal paths (H1, H2, H3, H4, H5, H6, H7, H8, H9, H10, H11, H12, H13, H14, H15, and H16). The latent variables in the model were categorized into two, namely endogenous and exogenous. The exogenous variable in the study is community participation. Information sufficiency, message clarity, source credibility, empowerment, self-efficacy, and intentions to prepare were endogenous variables. The goodness of fit indices and other parameter estimates were examined to evaluate the hypothesized structural model. Assessment of parameter estimates results suggested that fifteen out of sixteen hypothesized paths were significant.

The estimation of the parameters of the structural model helped in the derivation of the estimated population covariance matrix. The seven latent variables were together measured

with twenty-nine items. The covariant matrix of the constructs was applied to test the model with the underlying assumption of critical ratio higher than ± 1.96 at p-value less than 0.05 (Hair et al. 2006). The use of the path estimates and CR value indicated that fifteen out of the sixteen were within the range ± 1.96 at p-value less than 0.05. The path information sufficiency to intentions to prepare (IS \rightarrow IP) was not statistically significant with critical ratio= 0.611, p= 0.541. Initial structural model results satisfied all the recommended cut-off ($\chi^2/df=3.001$, RMSEA=0.044, GFI=0.936, CFI=0.981, TLI=0.977, NFI=0.972, AGFI=0.917, PCLOSE=0.999). The use of modification indices as well as consideration of existing theory slightly improved the results of the model ($\chi^2/df=2.969$, RMSEA=0.044, GFI=0.937, CFI=0.982, TLI= 0.978, NFI= 0.973, AGFI= 0.918, PCLOSE=0.999). Table 4.11 illustrates the results of the structural model.

Table 4. 11: Assessment of Structural Model

Code	Hypothesis	Estimate		T-test Statistics	P-Value		
	Relationship	β Unstandardized	(Standardized)				
H1	CP \rightarrow SC	0.162	(0.148)	4.525	***		
H2	CP \rightarrow MC	0.424	(0.411)	10.551	***		
H3	MC \rightarrow SC	0.469	(0.441)	13.977	***		
H4	IS \rightarrow SC	0.408	(0.383)	11.408	***		
H5	CP \rightarrow IS	0.841	(0.816)	29.396	***		
H6	IS \rightarrow MC	0.488	(0.487)	12.810	***		
H7	SC \rightarrow IP	0.263	(0.262)	4.857	***		
H8	CP \rightarrow IP	0.603	(0.547)	10.045	***		
H9	CP \rightarrow SE	0.621	(0.572)	9.623	***		
H10	IS \rightarrow IP	0.031	(0.029)	0.611	0.541		
H11	MC \rightarrow IP	-0.148	(-0.138)	-2.899	***		
H12	MC \rightarrow SE	0.207	(0.203)	3.981	***		
H13	IS \rightarrow EM	0.195	(0.211)	5.353	***		
H14	MC \rightarrow EM	0.593	(0.548)	14.669	***		
H15	EM \rightarrow SE	0.119	(0.124)	3.051	***		
H16	SE \rightarrow IP	0.342	(0.236)	6.959	***		
		Absolute Fit		Incremental Fit			Parsimonious Fit
		CMIN/DF	RMSEA	GFI	CFI	TLI	NFI
		χ^2/df					AGFI

Initial	3.001	0.044	0.936	0.981	0.977	0.972	0.917
Final	2.969	0.044	0.937	0.982	0.978	0.973	0.918

4.11 Testing of Hypothesis

Results from the structural model as displayed in table 4.11 show that fifteen out of sixteen hypotheses were supported by the data. In other words, the critical ratio for each hypothesis as well as the mathematical signs (+ and -) supported the formulated hypothesis. This section highlights the hypotheses in the study.

4.11.1 Community Participation has a Positive Relationship with Source Credibility

Results from the study showed that the null hypothesis does not support the data, hence its rejection. Correlation coefficient and the critical ratio between community participation and source credibility path are respectively 0.162 and 4.525 and statistically significant at p-value less than 0.0001 (p=***). This indicates that the creation of platforms to increase expert and public interactions about flood issues helps to sustain trust. Similarly, continuous interactions between experts and community increase stakeholders familiarisation with each other and gradually help to build trust among them.

4.11.2 Community Participation has a Positive Relationship with Message Clarity

As the data demonstrates, community participation and clarity of the message relates positively. Regression weight recorded between community participation and message clarity path is 0.424. Moreover, the path between community participation and message clarity produced a critical ratio of 10.551 statistically significant at p-value less than 0.0001 (p=***). This means that regular and continuous interaction between experts and the public and among members of the public help to clarify ambiguities surrounding flood messages and communication. The study rejects the null hypothesis in favour of the alternative hypothesis.

4.11.3 Message Clarity has a Positive Relationship with Source Credibility

Results revealed that estimated correlation coefficient for the path message clarity and source credibility is 0.469. The critical ratio for the path between message clarity and source credibility is 13.977 and statistically significant at p-value less than 0.0001 (p=***). This implies that the public perception about the credibility of the message source increases when disseminated risk information is articulated clearly for the understanding of the audience. This reinforces the acceptance of the alternative hypothesis.

4.11.4 Information Sufficiency has a Positive Relationship with Source Credibility

The estimated regression weight for the path information sufficiency and source credibility is 0.408. Also, the results revealed that the critical ratio for the path between information sufficiency and source credibility is 11.408 and statistically significant at p-value less than 0.0001 (p=***). This denotes that the provision of adequate and up-to-date information about flood preparedness increased public trust in the message source.

4.11.5 Community Participation has a Positive Relationship with Information Sufficiency

The results of the data showed a correlation coefficient and critical ratio of 0.841 and 29.396 for participation to information sufficiency path respectively. Correlation coefficient and critical ratio for the path is statistically significant at p-value less than 0.0001 (p=***). It implies that continuous interactions and communication between experts and the public as well as among members of the public increase the adequacy of information necessary to enhance flood preparedness. In addition, the adequacy of flood preparedness information is enhanced through questioning and answering among stakeholders.

4.11.6 Information Sufficiency has a Positive Relationship with Message Clarity

The estimated regression weight for the path information sufficiency and message clarity is 0.488 and a critical ratio of 12.810. Information sufficiency and message clarity path are statistically significant at p-value less than 0.0001 (p=***). The implication is that the provision of adequate information on flood preparedness to answer questions during stakeholder interactions reduces public doubts and clarifies disseminated messages.

4.11.7 Source Credibility has a Positive Relationship with Intentions to Prepare

Results revealed a correlation coefficient of 0.263 and a critical ratio of 4.857 between the path source credibility and intentions to prepare. Source credibility and intentions to prepare path is statistically significant at p-value less than 0.0001 (p=***). This shows that public preparation towards flood is influenced by the credibility of the source disseminating the information. In other words, the recipients of flood messages uphold in high esteem and embark on preparedness initiatives when the source of the information is credible.

4.11.8 Community Participation has a Positive Relationship with Intentions to Prepare

Regression weight estimated for community participation and intentions to prepare path is 0.603. In addition, the critical ratio between community participation and intentions to prepare path is 10.045 and a statistical significance of p-value less than 0.001 (p=***). This implies that continuous interaction between experts and the public provide an avenue where experts can positively influence the perception of messages by the audience to prepare towards flood hazard.

4.11.9 Community Participation has a Positive Relationship with Self-Efficacy

Estimated regression weight for the path between information sufficiency and self-efficacy is 0.621. Moreover, the information sufficiency and self-efficacy path revealed a critical ratio of 9.623 at a statistical significance of p-value less than 0.001 (p=***). It means that continuous interaction among stakeholders that gives room for exemplification of recommended actions increases the public ability to embark on recommended actions.

4.11.10 Information Sufficiency has a Positive Relationship with Intentions to Prepare

The results of the data showed a correlation coefficient of 0.031 and a critical ratio of 0.611 for information sufficiency to intentions to prepare path. Information sufficiency and intentions to prepare path have a significance level of 0.541, hence statistically insignificant. This implies that the provision of adequate information about flood preparedness to the public does not guarantee their intentions to prepare.

4.11.11 Relationship Exists between Message Clarity and Intentions to Prepare

Message clarity and intentions to prepare path correlates negatively with correlation coefficient of -0.180. Results for the path message clarity and intentions to prepare path revealed a critical ratio of -2.899 at a statistically significant level of 0.0001 (p=***). This suggests that clarity of the flood does not encourage the public to take up precautionary actions towards disaster.

4.11.12 Message Clarity has a Positive Relationship with Self-Efficacy

Estimated regression weight and critical ratio for the path message clarity and self-efficacy is 0.207 and 3.981 respectively. In addition, information sufficiency and message clarity path are statistically significant at p-value less than 0.0001 (p=***). This implies that to increase the public ability to embark on recommended actions towards flood preparedness, risk messages disseminated need to be simple and clear.

4.11.13 Information Sufficiency has a Positive Relationship with Empowerment

The path between information sufficiency and empowerment is statistically significant at p-value less than 0.0001 (p=***). Furthermore, correlation coefficient and the critical ratio between information sufficiency and empowerment path are 0.195 and 5.353 respectively. This indicates a rejection of the null hypothesis in favour of the alternative hypothesis suggesting that the provision of adequate flood information to the public empowers them to take up actions towards flood preparedness.

4.11.14 Message Clarity has a Positive Relationship with Empowerment

The data indicates that the path clarity of the message and empowerment are positively related with a correlation coefficient of 0.548 and a critical ratio of 14.669. Results recorded for the path between message clarity and empowerment path is statistically significant at p-value less than 0.0001 (p=***). It is inferred that clarity of flood risk messages to the public empowers them to take up precautionary measures towards flood preparedness.

4.11.15 Empowerment has a Positive Relationship with Self-Efficacy

The estimated correlation coefficient between empowerment and self-efficacy path is 0.119. In addition, the critical ratio for the empowerment and self-efficacy path is 3.051 at the statistical significance of less than 0.0001 (p=***). This means that the public is empowered through the provision of sufficient and clear messages to improve the skills and abilities of the audience to take up preparatory initiatives.

4.11.16 Self-Efficacy has a Positive Relationship with Intentions to Prepare

Estimated regression weight and critical ratio for the path between self-efficacy and intentions to prepare is 0.342 and 6.959 respectively. In addition, the path between self-efficacy and intentions to prepare is statistically significant at p-value less than 0.0001 (p=***). The ease with which the public is able to embark on recommended actions motivates them to take up actions to prepare towards flood hazard. Table 4.12 presents a summary of the hypotheses.

Table 4. 12: Summary of Hypothesis Testing (Structural Model)

Hypothesis	Code	Relationship	Correlation Coefficient	Hypothesis Outcome
Participation → Credibility	H1	Positive	0.162	Supported
Participation → Clarity	H2	Positive	0.424	Supported
Clarity → Credibility	H3	Positive	0.469	Supported
Sufficiency → Credibility	H4	Positive	0.408	Supported
Participation → Sufficiency	H5	Positive	0.841	Supported
Sufficiency → Clarity	H6	Positive	0.488	Supported
Credibility → Intentions	H7	Positive	0.263	Supported
Participation → Intentions	H8	Positive	0.603	Supported
Participation → Self-Efficacy	H9	Positive	0.621	Supported
Sufficiency → Intentions	H10	Positive	0.031	Not Supported
Clarity → Intentions	H11	Negative	-0.148	Supported
Clarity → Self-Efficacy	H12	Positive	0.207	Supported
Sufficiency → Empowerment	H13	Positive	0.195	Supported
Clarity → Empowerment	H14	Positive	0.548	Supported
Empowerment → Self-Efficacy	H15	Positive	0.119	Supported
Self-Efficacy → Intentions	H16	Positive	0.342	Supported

4.12 Modifying the Structural Model by Removing Non-Significant Path

One out of the sixteen hypotheses was not statistically significant as discussed in the previous section. The statistically non-significant hypothesis was rejected. In order to re-specify the model, the non-significant path was removed from the model to achieve the parsimonious model that fitted the data well. The modified structural model showed that source credibility, community participation, message clarity, information sufficiency, and self-efficacy explain 72.4 percent of variance in intentions to prepare towards flood. While community participation, message clarity, and information sufficiency account for 83.8 percent of variance in source credibility, community participation and information sufficiency explain 73.2 percent of variance in message clarity. Figure 4.3 summarises the estimates of the re-specified SEM model and hypotheses supported by the data.

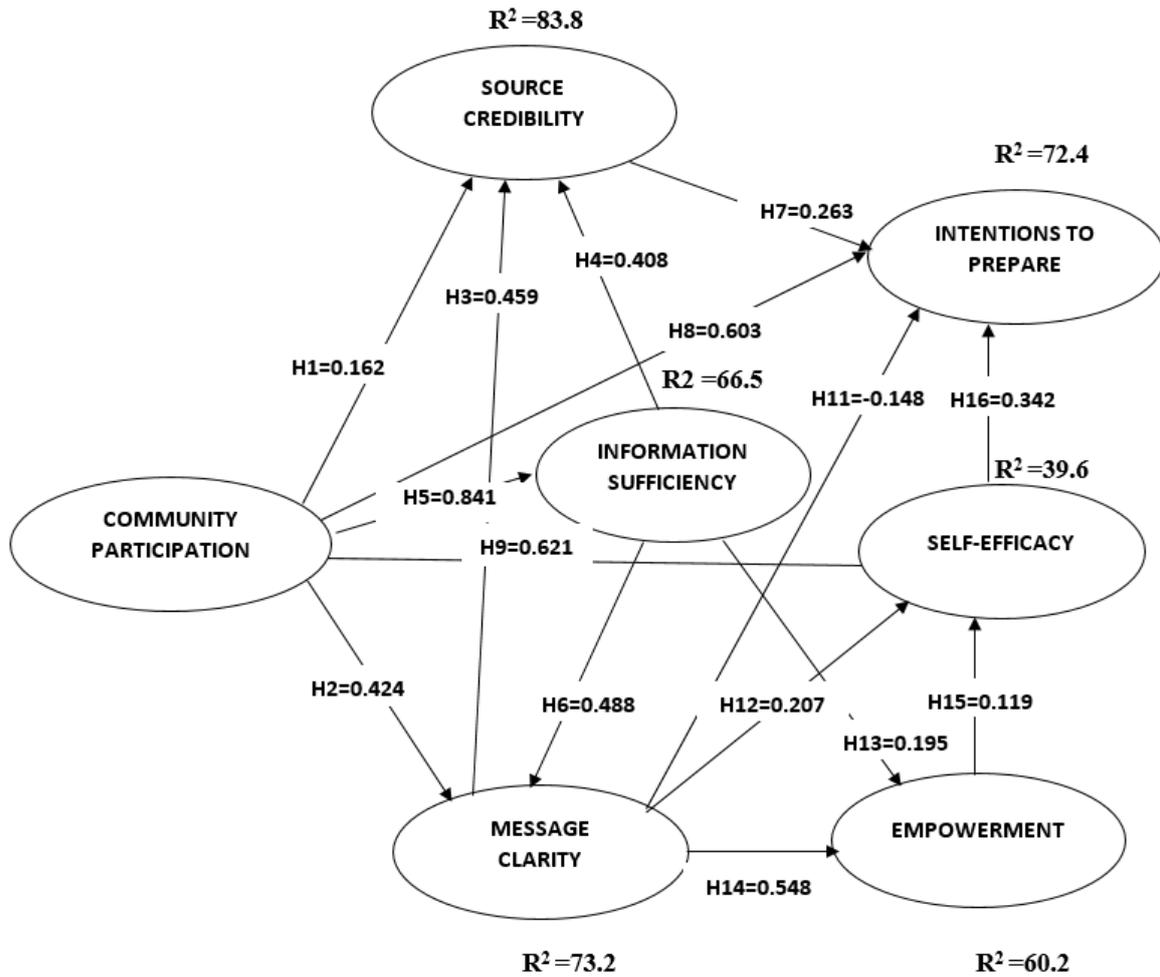


Figure 4. 3: Modified SEM Model

The tested structural model indicates that community participation forms the basis of all paths leading to intentions to prepare. While the most powerful path to intentions to prepare is CP → IS → MC → EM → SE → IP, the least powerful of all the paths is CP → SC → IP using total correlation estimates as the major criterion. Table 6.2 presents the various paths predicting audience preparatory intentions towards flood hazards.

Table 4. 13: Preparation Intentions Towards Flood Paths

Number	Paths	Total Path Estimates	Ranking
1	CP → SC → IP	0.406	10 th
2	CP → IP	0.702	8 th
3.	CP → IS → SC → IP	1.504	5 th
4.	CP → IS → IP	0.808	7 th
5.	CP → IS → EM → SE → IP	1.706	3 rd
6.	CP → IS → MC → SC → IP	2.012	2 nd
7.	CP → IS → MC → EM → SE → IP	2.487	1 st
8.	CP → SE → IP	0.534	9 th
9.	CP → MC → EM → SE → IP	1.572	4 th
10.	CP → MC → SE → IP	0.871	6 th

4.13 Summary

Quantitative data for the study was initially cleaned to avoid bias and enable further analysis. An EFA was conducted to explore the theoretical structure of the set of constructs used for the study. EFA was followed with a CFA to test how well-observed variables measure the latent variable. Structural equation analysis was run to test the hypothesised relationship among the constructs. Results from the analysis supported fifteen out of sixteen hypotheses as summarised below:

- Community participation has a positive relationship with source credibility
- Community participation has a positive relationship with message clarity
- Message clarity has a positive relationship with source credibility
- Information sufficiency has a positive relationship with source credibility
- Community participation and information sufficiency relates positively
- Information sufficiency has a positive relationship with message clarity
- Source credibility has a positive relationship with intentions to prepare
- Community participation has a positive relationship with intentions to prepare
- Community participation has a positive relationship with self-efficacy
- Message clarity has a negative relationship with intentions to prepare
- Message clarity has a positive relationship with self-efficacy
- Information sufficiency has a positive relationship with empowerment
- Message clarity has a positive relationship with empowerment

- Empowerment has a positive relationship with self-efficacy
- Self-efficacy has a positive relationship with intentions to prepare

However, the relationship between information sufficiency and intentions to prepare was statistically insignificant, thus not supported. The study also found that source credibility, community participation, message clarity, information sufficiency, and self-efficacy explain 72.4 percent of variance in intentions to prepare towards flood. While community participation, message clarity, and information sufficiency account for 83.8 percent of variance in source credibility, community participation and information sufficiency explain 73.2 percent of variance in message clarity. In addition, information sufficiency and message clarity, and message clarity and empowerment contributed 60.2 and 39.6 percent respectively of variance in empowerment and self-efficacy. The study also found that the most powerful path to intentions to prepare is CP → IS → MC → EM → SE → IP; the least powerful of all the paths is CP → SC → IP using total correlation estimates as the major criterion.

CHAPTER FIVE

RESULTS OF QUALITATIVE DATA ANALYSIS

5.1 Introduction

Chapter Four elaborated on the quantitative analysis of data to test hypothesized relationships between variables. The aim of this chapter is to analyze case studies to develop context-specific cross-case narratives on how risk communication influences preparation intentions towards flood hazard. This chapter:

- Contextualizes flood vulnerability in the case study areas
- Identifies how people respond, cope with and adapt to flooding
- Identifies the modes, mediums, and sources of flood risk communication
- Identifies the challenges of flood risk communications
- Develops themes on context-specific flood risk communication's influence on intention to prepare for floods

5.2 Demographic Characteristics of Respondents

Data collection was carried out across two primary groups: households and institutions. The data analysis was conducted on two groups of participants; i) household and ii) institutional interviews. The household interviews were made up of twenty (20) interviewees, and three (3) institutional interviews were conducted. A total of twenty (20) household interviewees, eleven (11) female respondents, representing 55 percent and nine (9) males representing 45 percent participated. On average, a majority (40%) of the respondents were between the ages of 54-62 years. Also, 25 percent and 20 percent of participants were in the age cohort 45-53 and 36-44 years respectively. While study findings indicate that 80 percent of the respondents had at least middle school education, 20 percent had no formal education. Exploring the number of years respondents have been residents of the study communities, 85 percent have stayed in the community for more than 10 years, while 15 percent of the residents have been in their respective communities for more than three (3) years. This provided a wide range of participant demographics and ensured that the evidence of this research cut across religious, ethnic and economic lines

5.3 Vulnerability and Impacts of Flood Disaster

5.3.1 Frequency and Periods of Flooding

According to the respondents, the rate of flood occurrence in the case study communities ranges between 3-5 times in a year. In all of these floods, mostly the impacts on human lives and property are minimal. The study found that frequency of flood occurrence is dependent on four (4) main factors, namely: i) the amount of rainfall received; ii) duration of rainfall; iii) period of the season; and iv) the amount of debris in the drain at the time of rain (refer to Table 5.1). In other words, when the movement of floodwaters is impeded by debris or rubbish, floodwaters overflow its banks to cause havoc to residents' property and other infrastructure.

Flooding in the case study communities occurs between April to July and September to November. The collection of data on the periods and frequency of rainfall was to garner an understanding of how they contribute towards flood vulnerability in the study area. The extent and magnitude of the flood were seen to have impacts on the lives of people, infrastructure and livelihood that depends on the period of the rainy season. Most respondents (85%) indicated that flooding is extensive and more devastating between April-July than September-November. The study found that September-November rainy season has no or less devastating impact. Residents indicated that the rainfall amount during September-November is less and the tendency of a flood to occur is less. This is because the duration and amount of rainfall received during that period of the rainy season are below the capacity that may lead to flooding. Conversely, the April to July rainy season is more devastating due to the increased amount of rainfall received and other factors including the impervious nature of some places and attitudes of residents towards waste management (see details in 5.3.3). This perhaps explains why all of the most devastating flood disasters in the environs of Accra are recorded in the April-July rainy season. Common responses around flood-related questions included:

“In this community, we experience between 3-5 floods annually which usually occur around April-July rainy season.” [KO-R1]

“I know that in the April-July rainy season, there is a higher probability of the community flooding because we receive some torrential rainfall and this area is marshy...” [NI-R6]

“...this community and its neighbouring community suffer from flood impacts usually during the April-July rainy season as compared to the September-November rainy season.” [NM-OF]

5.3.2 Variability in Flood Vulnerability and Location of Residents

Flooding is the most devastating and recurring natural disaster hazard in the study communities. Vulnerability to flooding varies and highly depends on the section of the community in which a resident is located. A typical case in this point was observed in all the three (3) communities under study, where some residents lived along the main Greater Accra drain (Korle-Lagoon). Residents who live close to the main drains are more susceptible to flood and its associated impacts than their counterparts residing in the elevated section of the community. The magnitude of flood disaster impacts is dependent on having hazard mitigation and emergency preparedness practices in place and the locations of the community. The locations of the study communities make residents highly vulnerable and exposed to flood impacts due to their closeness to the main Greater Accra drain (Korle-lagoon). In addition, during the rainy seasons, rainwater from the Akuapem Ranges in the Eastern Region of Ghana adds to an increased volume of water flowing through the drain. This results in the floodwaters overflowing its banks to enter residents' homes. Some participants indicated that:

"I have witnessed close to 10 devastating flood disasters within my 17 years' stay in Nima. Almost the whole community are impacted by flood disaster every year, nonetheless, those residing close to the drains are affected more than those of us who live at the upper and inner sections of the community." [NI-R4]

"Vulnerability to flooding hazard is not uniform in the community but very high at places closer to the main drains that separate NIMA and Alejo from Kotobabi and slightly low in the middle section of Kotobabi." [KO-R4]

"Exposure and vulnerability to flooding hazard are not the same throughout the community but very high at places closer to the main drain (lower grounds) and very low at the highly elevated areas." [NI-R7]

"Residents closer to the main drain suffer greatly from the impacts of flood especially during prolonged hours of rainfall." [OF-R3]

5.3.3 Causes of Increased Flood Impacts

Data collected portrayed that flooding is a perennial problem in the study communities, with increasing impacts facilitated by a myriad of factors. The study classifies the facilitating factors of flooding and its impacts into i) rainfall and temperature changes; ii) flood exposure and population growth; iii) lack of political will and institutional weakness and inefficiencies; iv) poor waste management practices, and v) inadequate drainage infrastructure.

- Rainfall and Temperature Changes

Changes in rainfall and temperature patterns are one of the causes of flooding and its associated impacts within the case study communities. Respondents, based on their observations and experiences, confirmed their receipt of more rainfall and higher temperature in recent times. According to them, increases have been witnessed in the number of times they receive rainfall and the more scorching the sun has been with time. An increase in the frequency and amount of rainfall is more than the capacity the soils can contain, hence rainwater entering the homes of others. Also, the high evaporation of rainwater raises humidity levels, which invariably increases the amount and frequency of rainfall received. Examples of participants' responses include:

“Nowadays, the intensity and frequency of rainfall have increased such that it can rain for days continuously. Also, after the rains have stopped, it only takes a while for the stagnant waters to evaporate.” [NI-R6]

“Whenever it rains heavily for more than three hours, the high proportion of the rainwaters do not drain through the sand. I am not surprised because this place used to be a marshy area before people settled here.” [OF-R3]

- Flood Exposure and Population Growth

The number of people residing in the case study communities has increased over time. Cheaper cost of accommodation and the closeness of the communities to the central business district (CBD) of Accra have been the pull factors drawing migrants to the study communities. Increased exposure of residents to flood hazards has been one of the underlying factors of rising flood occurrence and impacts. An example is a practice of extending housing units to accommodate new residents in a way that results in physical development in flood-prone areas (an example is along river courses or water channels). Physical development according to residents does not comply with the construction standards and developers often do not have a building permit. This situation, coupled with housing acquisition and other physical developments without the requisite building permits, is a major concern to both the local government administration (AMA) and NADMO. Thus, the increased flood exposure in the study communities is mainly attributed to increased population growth and density, uncontrolled physical development by residents and the greedy attitude of house owners to increase monthly income from rent. Responses from the study supporting this include:

“During the dry season, residents tend to build on river courses, forgetting that in the rainy season when it floods, they would be affected. For instance, in 2014, a little over twenty

structures were demolished by AMA in Old Fadama, purposively because victims filled portions of the river courses with sawdust and concrete waste and built their structures.” [NI-OF]

“Here in Nima, the quest of some house owners to increase income from rents, expand the size of their houses by building more rooms. Sometimes, these house expansions extend to river courses.” [NI-R5]

“The high vulnerability and increased impacts of the flood in Kotobabi and its environs have caused increased demand for land for residential purposes due to high population growth. This increases pressure on land such that other residents revert to building in unauthorized areas.” [KO-R4]

- Lack of Political Will and Institutional Weakness and Inefficiencies

Respondents attributed the perennial problem of flood and its impacts to lack of political will and institutional inefficiencies and weaknesses. The AMA and NADMO are headed by a metropolitan chief executive and coordinator respectively, which are political appointments. Their appointments are automatically terminated when the tenure of office of the president who appointed them ends or there is a change of government. Thus, these political appointees first and foremost exercise their allegiance to the president who appointed them. Moreover, these appointees representing the president at the metropolitan level mostly take decisions that will help them win favour from the president and political party they are affiliated to rather than to benefit the communities under their jurisdiction. Strangely, the study found that the appointment of a local government head by the president easily influenced and permitted political interference in the work of technical staff (AMA and NADMO) at the local level. For instance, in 2016, an order by a joint team of AMA and NADMO to demolish unauthorized structures along river courses in Old Fadama and Nima was reversed through the intervention of a politician. According to NADMO, the intervention from the politician was as a result of the fact that 2016 was an election year and that the decision was considered not politically feasible for election purposes. In other words, participants from NADMO acknowledged that the politician who intervened confirmed that the decision to remove structures built along the pathways of floodwaters was a good initiative to reduce flood exposure levels and impacts, however, the order to prevent the demolition was to influence residents to vote for the president who appointed them. Political interference has made state institutions such as AMA, NADMO and Lands Commission incapacitated to effectively perform their constitutionally mandated responsibilities. In effect, some residents perceive that staff from these local government institutions lack the requisite skills and abilities to perform their legally established duties. Systematic inefficiencies such as inaccurate weather forecasts, according to respondents,

represented a high point of institutional inefficiencies and weakness. Respondents trace these institutional inefficiencies and weaknesses to the lack of sophisticated technologies to meet modern-day meteorological analysis and forecasting needs. Evidence from the study includes:

“NADMO, Lands Commission and AMA are agents and facilitators of the perennial issue of flooding in this community because they do not enforce laws on land acquisition and development.” [KO-R1]

“To me, the increased frequency and high vulnerability to flood around Nima are caused by unwillingness and lack of political will by city authorities to respond to the root causes of flooding. This is because the construction of the main drains to absorb flood waters has been abandoned. Also, it is pathetic to see city authorities being aware of unauthorized structures, however, they do nothing to ask victims to remove them due to pressure from the head of AMA [political appointee]. This is especially true during election years.” [NI-R1]

“I don’t know the kind of technology Ghana Metrological Agency uses because whenever there are no rains, they predict rainfall and whenever there is rain, they do not predict. If we were to have accurate rainfall prediction from them, we would have done something to reduce flood impacts or found a safer place to go if it is beyond our control.” [OF-R6]

- **Poor Waste Management Practices**

Residents believe that flooding is not only attributed to climate change but also indiscriminate disposal and management of solid waste. The study found that the amount of waste generated by the case study communities is more than the capacity of refuse containers. For instance, Kotobabi and Nima with their respective total population of 33628 and 80843 (2010 Population and Housing Census) have two (2) and three (3) refuse containers respectively, mostly emptied on weekly basis. The 2014-2017 Medium-Term Development Plan of Accra metropolis indicates that the metropolis has an average waste generation rate of 0.63kg/person/day which means that the refuse containers will be filled up before the stipulated weekly emptying. The study found that when the refuse containers get filled up, residents resort to refuse disposal at inappropriate places. Moreover, some residents indicated that city authorities sometimes have, on successive occasions, left the refuse containers unemptied. When the refuse containers are not emptied at the scheduled times, some residents together with the local government representative at the community level would have to follow it up with calls to remind city authorities. The delay in neighbourhood garbage collection by responsible institutions and persons also contributes to poor waste management. On economic grounds, some respondents stated that fees charged on refuse disposal also account for indiscriminate disposal and management of solid waste. In that, some residents indicated their inability to afford the fees charged on refuse disposal on a daily basis and as such the decision to dispose of refuse in

places that are deemed inappropriate. The disposal of refuse at unauthorized places such as drains is more visible during the rainy season. An account by some residents showed that neighbours intentionally dispose of solid waste into drains during the rainy season. In addition, storms during the rainy season blow away and scatter solid waste from uncovered refuse containers in the communities. Most of these solid wastes end up in drains, eventually blocking the smooth flow of floodwaters. Indiscriminate disposal of solid waste contributes to flooding by blocking drains and increasing debris. Responses from participants backing this include:

“Indiscriminate disposal of solid waste, which is also due to some residents’ negative attitudes and some community members’ inability to pay for the fee charged on disposing of rubbish, is the main cause of flooding. For instance, Last year I saw with my naked eyes that someone has disposed into the main drain a used mattress when the rains started.” [NI-R5]

“The increased flooding at the lower section is as a result of indiscriminate dumping of solid waste. For instance, some people wake up early in the morning around 3 am and throw their rubbish into the main drain because they do not have the money to pay GHC 0.50 fee for disposing of it. Again, some people also go around to collect other people’s rubbish to dispose of them for a fee but end up leaving it close to the main drain. With this, when it rains the rubbish is washed into the drains, hence impeding floodwaters flow.” [NI-R3]

“I have been a petty trader at the Agbobloshie Market for close to seven years. Most of the solid waste generated in this market far exceeds what can be contained in the available refuse skips. As a result, large quantities of the waste end up in the drains, choking it and preventing the free flow of floodwaters during rainfall.” [OF-R7]

“The refuse skip in Nima is so small to contain the solid waste of the growing population. This phenomenon has forced residents to throw solid waste indiscriminately into drains and open spaces.” [NI-R8]

- Inadequate Drainage Infrastructure

The case study communities especially Old Fadama lack organized drainage facilities to receive wastewater. Some residents reported that wastewater from households is thrown in open spaces because there are no drains connecting their houses. Other houses with drains are not constructed to link to the main drains which end up in the open spaces as well. With the increased amount and frequency of rainfall, rainwater does not have channels to move through, hence entering residents’ houses. Some respondents from Old Fadama believe their community has been neglected by city authorities and, worse, that residents being perceived as illegal migrants explains the reason for the inadequate infrastructure and poor environmental conditions.

“...due to the unavailability of organized drains to link liquid waste from the houses to the main drain, when it rains, the rainwater does not have directed paths and sometimes ends up into residents’ room.” [OF-R7]

“...we make small drains to help us dispose of our liquid waste. However, these drains are not sustainable and are not connected to the main drain. Rainwater enters homes of people because there are no organized drains.” [NI-R4].

Table 5. 1: Causes of Flood Vulnerability and Increased Impacts

Themes	Contributing/Influencing Aspect
Variability of flood vulnerability	Frequency and Intensity of the hazard <ul style="list-style-type: none"> i) the amount of rainfall received ii) duration of rain iii) period of the season iv) the amount of debris in the drain at the time of rain v) the proximity of residence to the main drain vi) Location/Elevation of the house
Case of increased impact	<ul style="list-style-type: none"> i.) Rainfall and temperature changes ii.) Flood exposure due to non-compliance with construction standards iii.) Population growth iv.) Lack of political will v.) Lack of investment in infrastructure vi.) Institutional inefficiencies and weaknesses

5.4 Impacts of Flooding

The study categorizes the impacts of flood hazards into physical, social, economic and environmental and health impacts as shown in Table 5.2.

5.4.1 Physical Impacts

Flood causes damages to homes and property. Properties destroyed through flood include houses, furniture, electronic devices, and vehicles. During flooding times, the foundations of some houses are exposed gradually and consequently collapse with time. The collapse in building for the purposes of this study is classified into partial and total collapse. While partial collapse occurs when sections or part of a building is destroyed, total collapse is the overall destruction of the entire structure in the process of flooding. The study found that partial collapse of buildings and other structures serves as a death trap for residents. For example, in Nima some respondents reported an instance where a building that was partially collapsed

during a previous flood accidentally fell after some days, causing severe injuries to some people. Flood also erodes road surfaces to create potholes which consequently deteriorate vehicles that use the road. The consequences of these destructions are the reduction in the standard of living of victims. Moreover, some residents are injured during flood and in some cases die. The study classifies the physical impacts of the flood to include injuries, deaths and property damages. Data from the study revealed the physical impact of the flood is evident during the April-July rainy season when torrential rainfalls are received. Responses from participants supporting this include:

“Infrastructure and individual properties are mostly at risk to flood hazards. The impact of the flood on some of the surrounding communities have not been high over the past years but the recent flood disaster on June 3rd, 2015 destroyed property valued in thousands of Ghana Cedis and killed others.” [OF-R1]

“Houses, vehicles, motorbikes, electronic devices, and room furniture are mostly destroyed and carried away by flood as debris.” [OF-R3]

“Property and infrastructure are at risk to flooding. For instance, during the June 3 disaster, we had more than ten houses having their foundations exposed. The exposed foundation serves as death traps for residents residing in it.” [NI-R4]

“Infrastructure and individual properties are mostly at risk to flood hazards. Floods inundate houses, make some residents homeless and destroys bridges when the intensity of flood is increased.” [KO-R1]

“Property and infrastructure are mostly affected by the impact of the flood. Floodwater erodes and exposes foundations of houses, which serves as a death trap for animals and humans whenever there is the sudden collapse of such buildings.” [KO-R5]

5.4.2 Social Impacts

The social impacts of flood encompass psychological and emotional trauma for victims of the flood. It also includes the disruption of daily activities of residents. The study showed that the breakdown of social ties, depression, anxiety, and grief are examples of psychological and emotional pain experienced by flood victims. While people at the elevated section of the communities, especially Old Fadama, remain indoors during flood times, others in the low-lying areas migrate to neighbouring communities to seek refuge. Flooding makes affected residents worried because plans and normal daily activities are forfeited to remain indoors. Also, some residents indicated that the fear of being carried away by floodwaters gives them sleepless nights, hence affecting their health, punctuality, and efficiency at work and school. Situations become worse when the resultant flood damages electricity poles, leading to power

outages. This was evident when most of the study respondents in Old Fadama and Kotobabi reported frequent electricity power cuts during the rainy seasons. This makes the communities quiet and boring because residents cannot follow and enjoy their favourite programs on television and radio. In addition, most residents in Old Fadama reiterated the difficulty in evacuating from their flooded houses to safer points when there is no electricity. In the course of their migration, they leave behind friends and other social ties to people who serve as companions and empathizers during times of difficulty and sorrow. The study also showed that flooding sometimes disrupts scheduled social gatherings, such as naming ceremonies, marriage ceremonies and funerals. This is mainly because the fear of being carried away by flood forces people to remain indoors or migrate to neighbouring communities, leaving few others in the communities. Also, the devastating impact on lives, property, and livelihood during flood times leaves victims depressed and stressed. For instance, during the June 3, 2016 twin disaster, a respondent in Nima recounts an incident where a friend died from depression and anxiety after the family lost two members. The following are responses from some participants supporting this:

“I am unable to sleep when it starts raining at night. This is because when the rain results in flooding, my family and I can’t find our way out to safer grounds due to the poor lighting system in the community.” [OF-R1]

“Am so worried about the impact of the flood, though this community has not experienced any severe flooding but the ones I have observed indirectly put lot of fears in me.” [OF-R7]

“Flooding disrupts social gatherings and arrangements such as funeral, marriage and funeral ceremonies. For instance, last two years June, a funeral was postponed because the community had experienced flooding two days before the ceremony.” [NI-R2]

“Any time, I hear the word “flood” I am grieved and it reminds me of loneliness. In June 2015, my friends and relatives relocated to the village due to the devastating impact of the recent flood. During that time, I became lonely and didn’t have anyone to share my problems with.” [NI-R6]

“Mostly, there are friendly conversations and discussions among neighbours and relatives around here at night. However, all these conversations cease because many neighbours relocate to other places due to fear of flooding during April-July rainy season.” [KO-R2]

“Heavy rainfall in this community mostly results in a flood. When it floods, we usually experience hours or days without electricity [due to] power outage. This makes the home so boring because we can’t enjoy our favorite radio and television programs.” [KO-R5]

5.4.3 Economic Impacts

During flood times some people remain indoors while others migrate to other communities that are deemed “safe havens”. Migration of residents due to the fear that flood hazards impose on them causes business and petty trading activities to consequently come to a halt. One significant economic impact posed by a flood on business and shop owners is the reduction in demand for products, damage to products and reduction in daily sales from trading activities during times of flood. For example, in Old Fadama and Nima, where the presence of a market is the source of livelihood for most residents, the study found that some traders, especially those dealing in perishable goods, lost their business capital due to low demand for goods. Disaster victims incur costs to replace damaged goods, furniture and electronic devices destroyed by the flood. Flooding in the communities also affected punctuality at work, leading to loss of productive hours, sometimes for days. Workers affected by flood resume when they are able to settle down by cleaning their houses and replacing damaged properties. In addition, infrastructure damage from floods exerts significant costs for repairs and construction, which is a heavy burden for a local government that is already financially constrained and highly dependent on central government transfers (District Assemblies Common Fund). This makes it difficult for AMA to implement its medium-term development plan. Examples of responses to this include:

“People’s job or businesses are impacted by the flood. For instance, the June 3 flood made me jobless for almost three months, as my goods were destroyed and carried away by flood waters.” [OF-R2].

“I am a banker by profession. The June 2015 flood disaster saw me not going to work for two days because the roads were all filled with floodwaters. Also, authorities of the bank sent emails and text messages to remind workers residing in flood-affected communities not to come to work until the flood subsides.” [OF-R6]

“Daily targets for sales are not achieved because many people tend to stay indoors due to the fear of being carried away by the flood. For instance, my wife and I make an average daily sale of GHC 250 on any normal day. However, during the week of 2015 June 3 flood, we made about GHC75 daily.” [KO-R3]

“...flood halts all economic activities that take place in the market. For instance, last year during the June 3rd flooding, I could not go to the market to sell my goods for almost a week because customers feared of being carried away by floodwater and as a result stayed in their homes. Also, I needed time to clear the odour, replace spoilt electronic gadgets, property and re-decorate my house after the floods.” [NI-R8]

5.4.4 Health and Environmental Impacts

Health and environmental impacts of the flood are widespread throughout the three (3) selected communities. Floodwaters with high velocity carry a lot of debris and deposit within the communities. Debris is carried from the high grounds to the low-lying areas of the study areas. After a heavy downpour and flooding, the deposited debris makes the communities unclean and unhealthy to reside in. The study found that rainwater accumulated in potholes and open spaces breed mosquitoes and flies, which spread malaria and cholera respectively. Some respondents complained of waiting times at the health centers – usually double that of the dry season because of the higher incidence of illness. This is because stagnant waters from floods breeds mosquitoes and flies that are transmitters of malaria, cholera, and diarrhoea. Furthermore, some respondents complained of offensive smells from deposited remains of animals and plants which pollute the air, making breathing difficult. The improper deposition of solid waste within the communities makes them untidy and unappealing to the eyes.

“When it rains between 2-5 hours, the community gets flooded. The floodwaters carry sediments and debris which eventually blocks the entrances of minor drains connecting the main drain. This phenomenon results in stagnant waters which breed mosquitoes and houseflies, resulting in widespread malaria and cholera outbreak respectively here.” [KO-R3]

“...stagnant waters from flooding breed mosquitoes and this increases the outbreak of malaria especially among children, which sometimes kills people who fail to seek early medical treatment.” [NI-R4]

“Flooding makes the community untidy since the transported waste materials are deposited along the roads and sometimes [in the] center of the community. This breeds flies and mosquitoes that eventually increases the spread of diseases such as malaria and cholera.” [NI-R6]

Flooding sometimes disrupts water supply through the damage of machinery for the distribution of water supply. This situation leads Ghana Water Company Limited to ration the supply of water during such occasions. Interaction with residents revealed that the rationing of water leads some residents to resort to other water sources such as well and rainwater for domestic and industrial purposes. This eventually leads to an increased outbreak of water-related diseases such as diarrhoea. The health and environmental impacts of flood varied across the case study areas and was dependent on the magnitude of flood and its location in the communities. Residents residing in the low-lying areas of the communities (close to the main drain) usually received higher health and environmental impacts. Responses from participants supporting this include:

“In each April-July rainy season, at least, we experience a disruption in clean water supplies from Ghana Water Company Limited (GWCL). This usually happens when floodwaters erode and dismantle some major machineries of GWCL that help in the supply of water to this community. As a result of this, residents depend on rainwater for cooking, drinking and other domestic purposes, which brings about an outbreak of water-related diseases like diarrhoea.”
[OF-R4]

Table 5. 2: Types of Flood Impacts

Themes	Contributing/Influencing Aspect
Physical Impact	i) Amount of property damage
	ii) Extent of property damage
	iii) Number of injuries and severity of injuries
	iv) Number of deaths
Social Impact	i) Depression in flood victims
	ii) Anxiety
	iii) Breakdown of social ties
Economic Impacts	i) Breakdown in business activities
	ii) Reduction in daily sales
	iii) Cost of replacing damaged property
Health and Environmental Impact	i) Amount and nature of debris deposition
	ii) Incidence and prevalence of malaria
	iii) Waiting time in health facilities

5.5 Periods of Flood Risk Communication

Communication of flood risk to residents of the study area involved stakeholders such as community members, media outlets, Ghana Meteorological Agency (GMA) and NADMO. The study revealed that communication of flood risk occurs in all stages of the disaster management cycle. As a result, the study grouped flood risk communication periods into i) pre-flooding communication ii) communication during flood response and iii) post-flooding communication. Table 5.3 summarizes the periods of communication and their significance

5.5.1 Pre-Flooding Communication

Pre-flooding period of communication is the period where residents get the opportunity to acquire knowledge about flood, mitigation and preparedness strategies to reduce flood impact. In addition, it provides a platform for stakeholders to ask questions about flood issues, know

each other and build trust. At this period of communication, flood risk information is received by residents before the rainy season and is geared towards inciting the community to undertake mitigation and preparedness activities to reduce flood impact. Information received includes areas within the communities vulnerable to flood and strategies to help mitigate flood impact and quickly recover from the devastating impact of the flood. Some of the mitigation strategies that residents indicate have been received from NADMO officials, include the use of sandbags to fill low-lying areas, strengthening the foundation of houses and constructing drains to connect houses to link up to the main drain. Officials from NADMO also indicate that residents after the June 2016 flood were enlightened about disaster insurance and how it can help victims to bounce back quickly without any external intervention.

Stakeholders (NADMO) also use the pre-flooding communication period to train residents to evacuate to safer areas within and outside the communities. Role-playing, for example, was one of the strategies that were used in training sessions to help residents learn flood impact mitigation, preparedness, and evacuation techniques. Participants' responses to support this include:

"Flood information received before the rainy season includes de-silting of drains, community clean-up exercise, and removal of structures along watercourses." [OF-R1]

"Recommended actions on NADMO flyers include keeping precious items in a safe place and avoiding driving in flood waters." [KO-R2]

"...also, experts recommend that we consider the flood history of a plot and house we intend to rent or buy..... as well as opting for disaster insurance..." [NI-R4]

5.5.2 Communication During Flood Response

The dissemination of flood risk messages during the rainy season is geared towards the implementation of evacuation plans and strategies to reduce injuries and property damage. According to interview respondents, initial stages of communication for evacuation are led by community members. This is because the rescuing team from NADMO (Urban Search and Rescue Unit) are always late during emergencies, which may sometimes lead to loss of lives. Some respondents in Nima attributed the loss of lives in the community during the June 3, 2015 flooding to the late response from the NADMO rescuing team. Contents of risk messages at the response stage include the routes for evacuation to muster points. Moreover, residents at

elevated sections of the communities are advised to stay indoors with their families. Some responses from the study supporting this are:

“In one community meeting, a resource person from NADMO suggested that when it rains for more than 2-5 hours, residents should be vigilant of the community being flooded and as such should evacuate to the respective muster points.” [OF-R3]

“It has been recommended by experts on the radio that people in the elevated section of the community should stay indoors when raining. Also, residents who live close to the main drain are told to evacuate to safe places when it rains for a longer time.” [KO-R4]

5.5.3 Post-Flooding Communication

The content of flood risk information received by residents after the rainy season is geared towards the assessment of resident understanding and the effectiveness of strategies implemented during the response stage. Also, mistakes and errors made by residents during mitigation, preparedness, and evacuation are addressed after flooding. The study revealed that this stage of communication helps residents to appreciate the importance of embarking on mitigation and preparedness strategies.

Moreover, post-flooding communication helps to build the capacity of residents towards the next flood, especially when the shortfalls observed during the pre-flooding and response stages are adequately addressed. An official from NADMO also stated that resident trust in them increases in scenarios where the assessment of the mitigation and evacuation strategies was positive and vice versa. Increased trust in NADMO helps residents to easily accept and implement recommended actions to manage flood. Some responses stated the following to support this:

“Flood information received after the rainy season are centered on corrections of errors that were made by residents during rescuing and evacuation during flooding in the rainy season.” [NI-R2]

“After June 2015 flood, NADMO together with People Dialogue on Human Settlement showed us two short videos on the importance of disaster mitigation and preparedness of certain communities in Asia. The video reiterated to us as a community that investment towards disaster mitigation and preparedness is the tool for preventing and reducing disaster risk.” [OF-R4]

Table 5. 3: Periods of Communication and Significance

Themes	Significance
Pre-Flooding Communication	<ul style="list-style-type: none">i) Inculcate mitigation and preparedness attitude in individualsii) Disseminate and clarify flood informationiii) Trust building among stakeholdersiv) Building capacity of individuals to embark on recommended actions
Communication during Flooding	<ul style="list-style-type: none">i) Implementation of evacuation plansii) Implementation of strategies to reduce injuries and property damages
Post-Flooding Communication	<ul style="list-style-type: none">i) Assessment of residents' understanding and effectiveness of strategies implemented during the response stageii) Correction of mistakes and errors made by stakeholders at the response stagesiii) Trust building among stakeholders

5.6 Mode of Flood Risk Communication

The technique in which messages about risk are communicated is termed a mode of communication. The study summarizes the mode of flood communication into oral, written and audio-visual modes. Whereas oral communication involves the dissemination of information by word of mouth, written communication is the relay of flood messages to the public by the written word. Audio-visual communication mode refers to the transmission of flood messages to the audiences using recorded audio or video or both. The study showed that the most common mode of flood communication is oral (65 %) and audio-visual (25 %) communication modes. Each of these communication modes has its weaknesses and strengths, which are discussed in the next section.

5.6.1 Audio-Visuals

The study showed that respondents preferred an audio-visual mode of communication because audio-visuals deepen residents' understanding of flood management. Audio-visuals help residents to remember strategies and information about flood reduction easily by linking knowledge obtained to reality during the rainy season. The study revealed that residents easily remember messages that were conveyed by videos and are better able to explain to others who were not present during the showcase of the video or had difficulty understanding flood mitigation and preparedness messages.

“...the videos NADMO shows are very educative and can easily be remembered. For example, I remember, how floodwaters from the sea killed thousands of people, destroyed buildings and property worth millions of dollars in Japan in 2011. These scenes put me on my toes to engage in activities that reduce flood impacts.” [OF-R2]

“The videos shown have equipped me with a better understanding of issues about flood management. This has increased my confidence to the extent that I am able to explain to friends, neighbours, and relatives who were not around during [the] video show.” [OF-R6]

Some residents also indicated that flood mitigation and preparedness information received through audio-visuals presented an indirect activity of role-playing recommended actions. This increases residents' confidence, skills, and abilities to embark on recommended actions. In addition, the showcasing of video to the public instigates public discussions about flood disaster and better ways to reduce flood risks. Some respondents revealed that household and community discussions on flood reiterate the need for adopting flood reduction strategies. Moreover, continuous household and community discussions boost their confidence and encourage residents to embark on flood reduction strategies. Common responses from the study to support this include:

“Sometimes, I marvel over the extent of discussions about the flood in the community after we have watched the videos. These discussions amongst community members continue to the household level for days.” [OF-R7]

Respondents mostly preferred an oral and audio-visual mode of communication to the written mode of communication. However, the study found that records of messages communicated through oral and audio-visual modes cannot be kept. In other words, residents cannot make reference to flood mitigation and preparedness information when the need arises.

“...When NADMO officials come to the community to create awareness and educate us on flood hazards, they mostly show us videos of flood disasters and how people deal with it. I really like such videos, but we do not have any means to access it again after NADMO has shown the video.” [OF-R3]

Also, residents indicated that they lose focus of the videos due to the extent of noise from the audience. This makes it difficult for a thorough understanding and remembrance of the flood mitigation and preparedness information being disseminated.

“Videos on flood management are very educative and I love it. However, I miss some messages conveyed by the video sometimes. This mostly comes up when a horrifying scene is shown. For instance, during my first video, a scene of flood killing, and depositing hundreds of people saw

the audience shouting and discussing that scene for minutes, thus not hearing and understanding all the messages disseminated during those minutes.” [OF-R1]

Some respondents also revealed how scenes of the devastating impacts of flood shown in videos induce fears and give them nightmares for days. According to reports from some residents, some video scenes, such as flood waters destroying and carrying away people’s hard earned properties, causing injury and claiming lives, sometimes put fears in people and dampened their confidence level towards disaster management. Further enquiry showed that the fear experienced while watching devastating flood impact videos emanates from the fact that residents perceive that the buildings and infrastructure seen in the videos are stronger than the existing ones in their communities, yet these properties are destroyed and carried away. An account by some residents showed that their community’s susceptibility to flooding, coupled with poor planning, made them feel that a severe flood may claim thousands of lives and that they may be included. The following responses from the study support this:

“I have watched a number of videos on the impacts of flood showcased by NADMO. This has in fact put a lot of fears in me, especially whenever we enter the rainy season. I assist the community by engaging in mitigation and preparedness activities, but I sometimes compare what the community has done to some of the videos I have watched. My conclusion is that when it rains heavily, our property shall be destroyed.” [OF-R3]

5.6.2 Written

Other respondents who preferred the written mode of communication were mostly residents who have some form of education and as such can read and write. Some residents expressed their preference for written communication because they can keep records of it and refer to it in the future whenever the need arises.

“NADMO distributed flyers that contained issues on flood mitigation and preparedness in 2014. I have kept the flyer in a document file and whenever the rainy season is about [to start], I read to remind myself of the basic flood mitigation and preparedness activities to reduce impacts.” [KO-R4]

Written communication was the least preferred communication mode because it did not elicit conversations and discussions among residents. The study revealed that clarification of the contents of flood messages contained in written documents such as flyers are difficult because they do not present readers with the opportunity for discussions. Again, the use of the written mode of communication in the study area was seen to be biased towards residents who could read and write, thus relegating illiterates to the background. This explains why most residents

born during the pre-colonial era and immediately after independence, and usually illiterate, indicated their dislike for the written mode of communication.

“...reading flood documents is boring especially when it is done regularly. When reading the flyers distributed by NADMO, I sometimes feel like I can get someone to discuss the issues I read with. However, most of my friends and neighbours are illiterates.” [KO-R2]

“...I abhor reading from flyers because it is not interactive and makes it difficult for me to decipher the technical aspects of the message. Even though there are telephone contacts on the flyers, but they are inactive.” [NI-R4]

In addition, some respondents stated that the messages on the flyers were very basic and did not present any additional information to residents, even with the changing environment. By basic, residents meant that information contained in flyers is mostly general and not context specific. An account by some residents found that flyers distributed throughout the Greater Accra Region (27 districts) contained the same information, even though flood causes differed from community to community, thus requiring a different strategy to tackle and address the causes.

“I have stopped collecting flyers distributed by NADMO because the information contained in the flyers is too basic. To me, the information contained in the flyers is not persuasive and its implementation will not bring anything positive.” [NI-R8]

NADMO as an institution argues that written communication such as flyers is easy to refer to day after day. Nonetheless, participants from NADMO indicated that the cost involved in printing the flyers is high and takes a large amount of money from the budget. According to them, the cost of printing has nearly doubled due to residents' preference moving from non-coloured to coloured flyers.

“We usually receive 3000-5000 quantity of flyers from the NADMO head office. Initially, the flyers used to be in black and white but the public rejected the flyers on the basis of printout quality in terms of colour and paper used. We have currently heeded to the public concerns and this has almost doubled the cost. In order to cope with increased cost, NADMO head office has now reduced the number of flyers distributed significantly.” [NM-KO]

Moreover, participants from NADMO also indicated how decisions about approval for messages on the flyers and transportation of flyers to local offices were bureaucratic. For instance, the NADMO office in Old Fadama and Kotobabi presented a classical example where flyers meant for flood awareness creation before and during the rainy season arrived weeks

after the rainy season. This reinforces ongoing debate about the central office of NADMO presenting the decentralized offices with the power to perform certain functions. Participants from NADMO reinforce this by stating that the national office of NADMO should present the decentralized offices with guidelines for developing disaster management plans and strategies. This in effect may enable information on flyers to be context specific and reduce the bureaucracy involved in decision making.

“Last year around January, a memo was distributed to halt the distribution of old flyers to the public because the head office wanted to make changes to the messages on the flyers. Our office waited for months and never had the flyers when we needed most. The flyers were received after the rainy season. Delay in transportation arises from the time taken to approve messages and print out flyers.” [NM-OF]

5.7 Medium/Channels of Flood Risk Communication

The channel through which a message is conveyed is known as a medium or channel of communication. This study groups the channels of communication into face-to-face, mass media, internet/social media and mobile phone. The study further identified and categorized face-to-face communication into one-on-one and mass face-to-face communications. Whereas one-to-one, face-to-face communication refers to the dissemination of flood risk messages between an expert and an individual, mass face-to-face communication also involves the dissemination of information to a group of people by experts in a public meeting. Moreover, mass media encompasses the traditional channels of communication that are not mediated by the internet. It includes mediums such as television, telephone and newspaper. Also, social media refers to channels that are internet-mediated, thus also known as internet media. It includes flood messages received via WhatsApp, Facebook and Twitter. In addition, the mobile phone channel also makes use of no internet in order to access messages. Commonly, messages received are short message service (SMS) or text message. Each channel of communication has its strengths and weaknesses and the choice of channel contributes to message acceptance.

5.7.1 Community Participation and Face-to-Face Engagement

Face-to-face is the most predominant medium for communicating flood risk in the study communities. Face-to-face communication took different forms in the respective communities under study. In Kotobabi and Nima, the face-to-face medium of communication of flood mitigation messages took the form of NADMO officials going from house to house to engage

people through the distribution of flyers. In other instances, NADMO officials in Kotobabi and Nima made use of a community van, mostly with a megaphone, to disseminate flood information to community members.

Conversely, in Old Fadama, face-to-face communication took the form of NADMO official partnering with local leaders to convey flood messages through community meetings. Similarly, tribal leaders, upon getting information from NADMO and other credible sources, organise tribal meetings to disseminate flood information to their members. In other instances, NADMO conveys flood information to community leaders and they in turn delegate power to some people who volunteer to disseminate the information on a house to house basis. The study revealed that face-to-face flood risk communication helps to directly engage the audiences by giving them the opportunity to ask for clarification in technical and ambiguous messages. The process of questioning and answering of questions related to technicalities and ambiguities in flood messages enhances audience understanding and boosts their confidence towards flood preparedness.

“...community meetings involving NADMO officials provide residents with the podium to ask questions on the technical aspects of the messages delivered. The answering of questions by NADMO officials deepens my understanding and clarifies technical issues on flooding.” [OF-R1]

In addition, the study realised that face-to-face communication helps stakeholders to know one another better, which consequently builds up a cordial relationship between the audience and message source. In other words, face-to-face communication provides a platform where message audience and source come to know each other better, hence an increased trust and credibility is built between stakeholders.

“...Getting in touch to provide Old Fadama residents with important flood information was very difficult initially. However, with regular interactions through numerous community meetings, the community leaders and members now believe [and] trust us and have taken the stance to partner [with] us during our outreach programs.” [NM-OF]

Furthermore, the study found that face-to-face communication provides an immediate response to questions and minimizes the risk of miscommunication. It also helps to practically demonstrate recommended activities towards flood mitigation, preparation and response, either directly or indirectly (video).

“...Community meetings involving NADMO officials are accompanied by practical demonstrations of some recommended actions on preparedness...” [OF-R2]

“...community meetings involving NADMO provides an opportunity for residents to gain more insights on flood preparedness and reminds us of activities to mitigate flood impacts.” [OF-R6]

“...weeks before the rainy seasons and during the rainy seasons when flood education campaign is intensified, the topic of flooding is discussed at all corners of the community and this whets residents’ appetites to take up preparedness actions.” [NI-R1]

However, some residents expressed disappointment with the face-to-face communication channel because it provides a platform for residents who are vocal and have high societal status to monopolise discussions. Some respondents in Old Fadama revealed how leaders and NADMO officials leading face-to-face communications present the same group of people with the platform to make their views aired.

“I have raised my hands during public meetings to ask questions many times, but I have not been called before. I have observed that NADMO officials normally call community leaders when many hands are raised. Although, it is an expression of respect to the leaders, however, key issues from the ordinary residents’ perspective are left out.” [OF-R1]

Also, discussions during meetings sometimes result in heated arguments among residents or between residents and NADMO officials. This mostly happens during discussions related to the distribution of relief items over the years.

“Every year discussion about the distribution of relief items in times of flooding results in arguments between residents and NADMO officials.” [OF-R2]

Mass face-to-face communication was viewed by respondents as time-consuming because meetings mostly do not start and close on the scheduled time. Also, the further discussions of the agenda already deliberated on are also the cause of the extended time for meetings.

“Since the inception of community meetings, it has never started and finished on the scheduled times. Residents mostly come to the meeting 30-60 minutes after the scheduled times, which also pushes the closing time ahead” [OF-R4]

“...discussions of issues outside the agenda and further discussions of already deliberated issues increase the scheduled time for closing.” [OF-R7]

Similarly, participants from NADMO in Kotobabi and Nima also indicated the time-consuming and limited coverage of one-on-one face-to-face communication. For instance, the NADMO

official from Nima revealed that a maximum of two hundred (200) residents are covered by the team of communicators in a day using the one-on-one face-to-face medium of communication. This explains why officials from NADMO (Nima) cannot cover the entire population before and during the rainy season with one-on-one face-to-face as the most predominant medium of communication in Nima.

The study unveiled that, unlike the one-on-one face-to-face meeting which is regularly organised to distribute written documents on flooding to the public, mass face-to-face meetings are not regularly organised in Nima and Kotobabi. Respondents from NADMO stated that one-on-one face-to-face communication is easy to organise because it does not require a huge financial commitment. Moreover, other respondents in Kotobabi stated that there has not been regular mass face-to-face communication involving NADMO officials. This could partly be due to the fact that local leaders and institutions, who mostly champion the organisation of such meetings, are not as vibrant and strong as witnessed in Old Fadama.

“...there has not been any mass meeting between residents and officials from NADMO here in Nima to discuss flood issues.... NADMO only knows of distribution of flyers every year rather than a regular public meeting to discuss issues diligently.” [NI-R5]

5.7.2 Mass Media

Mass media has been one of the most penetrated channels of communication in Ghana due to the high number of people who rely on it for news and information. Mass media is also an important channel of communication before, during and after flood disaster. Findings from the study showed that the traditional mass media channels of communication, such as television and radio help to increase residents' awareness levels of rainfall patterns and vulnerable areas for flood. This is mostly through weather forecast news on television (TV) and radio early in the morning and evening on a daily basis. Residents indicated that the weather forecast news enabled them to know the extent of predicted rainfall and the likelihood of flooding in their communities and other neighbouring communities.

“...before migrating to Old Fadama, I had not experienced any form of flood directly. Radio programs organised by NADMO have enlightened me about flood risk reduction and management strategies over the years.” [OF-R2]

“...my active involvement in radio programs organized by NADMO has enhanced my understanding and knowledge on flood risk reduction...” [OF-R3]

“...whenever it is raining, I tune my radio to Peace FM in order to monitor proceedings about flood around the country....” [KO-R2]

The busy schedules of some residents at work means that they prefer to listen to the radio or watch television for up-to-date information on flooding and associated impacts. In addition, some residents indicated the wide coverage of flood communication on radio and TV channels. Some respondents gave an account of how friends and family members outside the Greater Accra Region informed them of flood information. Although according to some respondents, they do not have the opportunity to watch weather reports or listen to weather forecast news on the radio, the high coverage of TV and radio helps close friends and relatives convey the information to them. Elsewhere, the credibility of information from radio and TV also accounted for why some respondents preferred it. According to the study, some respondents saw news from radio and TV as credible because they perceive that flood messages disseminated by NADMO and GMA came through such sources.

“Radio and TV sources are very credible. It is credible because radio directly receives information from Ghana Metrological Agency (GMA) and NADMO.” [NI-R1]

“...an announcement was made on Peace FM and Adom FM of an impending torrential rainfall in June 2015. I did not hear of all the announcements made because there was no electricity. However, my brother called me from Tamale (Northern Ghana) that he has heard from radio that there was going to be a torrential rainfall in Accra.” [NI-R1]

“...I work seven times a week from 7 am to 8 pm daily. As a result, I cannot attend public meeting on flood. I have resorted to radio as my main source of information on flooding.” [NI-R5]

The mass media channel of flood communication has an inherent weakness. Findings from the study revealed that recipients of information on TV are not given the opportunity to ask questions for the clarification of technical issues. Unlike TV, which does not grant audiences the opportunity to ask questions for the clarification of technical and ambiguous issues, radio does that through phone-in calls. However, respondents stated that the time allotted to callers to call in is limited for an audience to succinctly articulate their thoughts.

“...jargon used in weather forecasts are technical for people with low level of formal education to understand. One annoying thing is, they do not provide [the] audience the platform to call in to ask for clarification.” [NI-R4]

With most respondents found to be illiterate (cannot read and write) in the study communities, the use of English language during weather forecast news was a major barrier to communication. The use of English language during weather forecasts also affected people's preference for TV as a medium of communication. Also, the use of jargon and technical language during weather reports also increased residents' dislike of weather news, especially those with a low level of formal education.

"...information from the TV, especially during weather forecast, is in English. I only understand it when my son is available to explain it to me in the local language." [KO-R3]

In addition, residents complained of the high cost for telephone units to contribute to programs. Others also stated that poor telecommunication reception was a reason for their inability to contribute to radio programs. According to residents, poor radio and television reception occurs during rainfall that is accompanied by lightning and thunderstorms.

"...several people including myself do not call in during radio programs on flooding because we can't afford the cost of telephone units." [OF-R1]

"...telecommunication reception is very poor and worst during the rainy season. Sometimes, when I get the chance to call in, the answering machine states that the number I am calling is out of coverage area, which is very irritating." [KO-R5]

Also, some residents indicated that they are not aware of the date, day and time for radio programs organised by NADMO, GMA or both. According to NADMO officials who participated in the study, the small budget for radio programs makes it impossible for them to intensify radio programs. This explains why awareness of radio programs organised by NADMO is low across all of the three selected communities.

"...radio phone-in calls give callers a maximum of 2 minutes to contribute towards discussions. With my observation, many of the callers are unable to fully communicate their thoughts." [KO-R4]

"I always hear flooding management programs organised by NADMO after the program has ended. I only hear that through discussions within the community." [OF-R3]

5.7.3 Internet-Mediated Channels/Social Media

Internet-mediated channels or social media were mostly the preferred option by the youth. Residents preferred social media because it is the modern form of communication. Also, others

stated that they are mostly online on either Facebook, WhatsApp or Twitter, thus making it easy to read and to keep abreast of flood risk information.

“...the use of social media is part of our everyday lives. I am on any of these social media in most hours of the day and I tend to receive information faster than on the radio or TV.” [NI-R5]

Other respondents see the social media as a platform for disseminating false information and as such, some residents do not trust the authenticity of some of the news they read. Also, the cost of internet bundles hinders some people’s preference for communication through social media. In addition, the inability of some elderly residents to read messages in English also hindered their preference to the social media channel.

“...information received on WhatsApp and Facebook lack credibility and as such I tend to attach little or no importance to such messages.” [NI-R6]

“...the cost to bundle internet is expensive and with my low income, I can’t afford to use the social media, so not the best communication channel for flood messages.” [NI-R8]

“...the only thing I can do with the phone is to make and receive calls due to my level of education. I have no formal education...” [KO-R2]

5.7.4 Mobile Phone

Another channel for receiving flood risk information is through the mobile phone in the form of text messages or SMS and voice calls. SMS has become an alternative for the internet-mediated channel of communication. Some respondents confirmed that flood risk information received from other sources is disseminated via mobile phone when the internet is slow.

“I do not regularly receive flood risk messages through SMS. I have only received flood risk messages through SMS once and it was all because my internet provider had problems that day.” [KO-R3]

“Days before June 2015 flood disaster, friends from the Central Region called me to inform me of the predicted torrential rainfall in Accra. I asked the friend his source of information and he responded he heard from the radio....” [OF-R5]

Residents do not prefer the mobile phone channel for receiving and sending flood risk messages because it is expensive to send SMS messages. Also, residents who could not read and write also indicated their dislike for this medium of communication.

“... It cost me almost GHC1 for sending flood risk messages to four other people. Meanwhile, GHC1 of telephone units will be able to make about 20-30 minutes voice calls.” [NI-R4]

5.8 Sources of Flood Risk Messages

The source of flood information refers to all people, entities and institutions who initiate flood communication. The study showed that the source of flood information emanates from three main sources, namely: NADMO, GMA and community members (neighbours, friends and relatives). All of these sources provided information before, during and after the rainy season. While some respondents indicated their credibility and trust for some of the sources, others also felt some of the sources were not credible.

5.8.1 NADMO

Some respondents indicated that NADMO is credible because it is the main government institution established to manage disasters in Ghana. Here, the credibility attached to NADMO appears to focus on their mission and function as a specialised organisation of the central government. There are those respondents whose view of the organisation is based on their experience of having benefitted from their core duties such as debriefing on flood hazards and management. The study also brought to the fore issues of broken promises which tended to make respondents distrust NADMO as an organisation. What is more, the study showed that for some respondents the feeling of distrust in NADMO is based on perceived manipulation of staff by political parties and corrupt practices among staff.

“...the NADMO officials who debrief us on flood management issues during community meetings have the requisite expertise and qualification, making me trust the flood information I receive from them.” [OF-R3]

“I trust NADMO because it is a government-owned institution and I know the government will not create an institution to relegate our welfare against the background...” [OF-R4]

“...information received from NADMO is credible because from my experience most of the information disseminated is practical.” [KO-R1]

“...I believe flood risk information messages I receive from NADMO because they will not disseminate any false information to the public.” [NI-R5]

Other respondents also indicated that NADMO is not trustworthy because they do not honour the promises they pledge. Furthermore, respondents pointed to reliability and honesty issues as a fundamental reason why NADMO lacks credibility and trust. By reliability, respondents

indicated the unavailability or untimely intervention of NADMO during emergency situations. For example, some respondents within all of the three selected communities reported the late arrival of the rescue team from NADMO during the June 3 disaster.

“NADMO staff are not credible because they have always not rendered their promises during the distribution of relief support. For instance, last year after the June 3 disaster, they promised to share relief items to affected neighbours, but they only came to distribute mattresses, which I think is not enough to cushion flood victims that have been made homeless.” [NI-R2].

“...NADMO is not reliable at all because they are not available on occasions where we needed them urgently. For instance, during the June 2015 flood, we called their contact telephone numbers on the flyers they distributed to us but didn't go through.” [NI-R6]

“...NADMO staff are liars and dishonest because one former staff of NADMO during a program on one of the radio stations talked about how relief items meant for disaster victims are shared among themselves...” [KO-R2]

“...flood risk information provided by NADMO on flyers and on radio programs are always the same. They are basic information that even children in this community know. Information normally includes the cause and impacts of flooding. This is because NADMO as an institution lacks the capacity to perform their duties.” [KO-R4]

“...most of NADMO staff do not have the required skills and expertise. This is because recruitment of staff is based on affiliation to the political party in power...” [KO-R5]

5.8.2 Ghana Meteorological Agency (GMA)

While some respondents trust information received from GMA, others also regarded flood information from GMA as untrue. Some participants believe that weather information received from GMA is credible because they have the technology to make such predictions. In addition, respondents believe that GMA prediction on rainfall is not done in a vacuum but with comparison with rainfall information from British Broadcasting Corporation (BBC) weather forecast reports.

“...weather forecast information given by GMA is based on the existing technology available to them. I believe and accept weather information from GMA because technology does not lie...” [KO-R3]

“Information about the weather from GMA is upheld in high esteem by my family because to our best of knowledge prediction is done with comparison with international weather forecast figures...” [NI-R7]

Others did not trust the credibility of GMA due to their failure in correctly predicting the weather over the years. Some respondents also hold the view that weather information from GMA lacks credibility because the technologies used for prediction are obsolete.

“...GMA predictions have failed many times. On days that GMA predict heavy rainfall, we receive no or little rainfall, and the same as days they predict no rainfall we receive heavy rainfall. Because of this, I don't really trust weather forecast news...” [OF-R4]

“...I ignore GMA weather predictions because the institution is less resourced by the government. This is visible in the old technologies used for weather prediction.” [NI-R1]

5.8.3 Community Source

Community source of risk information is categorized into two types. They are formal and informal sources. While the formal source of risk information emanated from community leaders, the informal sources are initiated by neighbours, relatives and family members. Receivers of risk messages from community leaders attached a lot of importance to it and held such messages in high esteem. This is mainly because community leaders command a lot of respect and message receivers who fail to act on messages relayed by leaders are considered to be disrespectful.

“Flood risk information from traditional authorities and Old Fadama Development Association (OFDA) is very credible and I uphold in high esteem any information that emanates from them.” [OF-R1]

“I believe that community leaders want the good of all residents and the community in general, because of this I positively respond to their message about flood risk.” [OF-R3]

“I trust the tribal leaders and OFDA executives so much because I believe they speak nothing but the truth.” [OF-R4]

“Tribal leaders and OFDA executives provide advice that will improve upon the quality of lives of community members, hence my implementation of messages received from them.” [OF-R5]

“...tribal leaders are our role models. They live exemplary lives free of lies and that makes them more credible.” [OF-R6]

However, risk information received from neighbours, relatives and friends had mixed findings. While some residents believed and trusted flood risk information from neighbours, relatives and friends, others also disregarded it. Respondents who attached a lot of importance to flood

risk messages from neighbours, relatives and friends based this on the educational background and the respect accorded to the information source in the community.

“...personally, I hardly believe flood risk information heard from neighbours. However, if the source of risk information is from a neighbour who is highly educated, I tend to attach a lot of importance to it...” [OF-R2]

“...I tend to accept flood risk information from people who are highly respected in the community. This is because such people are careful about their utterance as they do not want to lose their respect...” [OF-R7]

Conversely, some respondents indicated that they disregard flood risk information received from relatives, neighbours and friends because they are not experts. In addition, the inability of family, neighbours and friends to explain the technicalities of the information being disseminated accounts for its rejection. The attempts by family, friends and neighbours to explain the technicalities of flood information leads to risk information conflicting.

“...I downplay flood risk information received from some community members, friends and relatives because they lack the expertise to inform me of what to do during flooding...” [NI-R2]

“...information I receive through community discussions is clear except for some few ones, which are technically difficult to be explained by non-experts. Because of this, I fail to pay attention to informal discussions on flood risk.” [KO-R3]

“Yes, I receive conflicting information from neighbours and family members. Sometimes information received through discussions with neighbours has different message contents. Information conflict occurs in an attempt by them to explain the technical aspect of the message they received” [KO-R5]

5.9 Approaches to Flood Risk Communication

The study found out that the public receives flood risk information either directly from NADMO and GMA or indirectly from community leaders and members. NADMO, through their outreach programs on flood risk awareness, disseminates flood information on a house-to-house basis. This is done by NADMO staff distributing flyers and engaging the audience in discussions of the flood information on the flyers. In addition, NADMO staff accompany the flood awareness and education campaign with demonstrations of how some of the activities could be done.

“Staff from NADMO go around in a house-to-house education campaign before and during the rainy season.” [KO-R4]

“NADMO officials go around sharing flyers and demonstrating actions recommended to residents.” [NI-R7]

“...the house-to-house flood education campaign by NADMO is sometimes accompanied with demonstrations of recommended activities and actions.” [KO-R2]

In another stance, NADMO organizes radio programs to educate and create awareness of flood risk. The flood awareness programs are either spearheaded by experienced NADMO officials or journalists for a duration of 30-40 minutes. With respect to radio programs championed by NADMO officials, opportunities are granted to the audiences to call in to ask questions for clarification. Normally, the audience is provided 10-20 minutes to call in to ask questions. Conversely, flood risk messages disseminated by radio presenters do not give room for the audience to call in. Radio programs are organized weeks before the rainy seasons. However, due to the high cost of organizing such radio programs, it is not done regularly.

“...radio programs to create awareness on flood risk are organized [for a] few weeks in the rainy seasons. It is not done on a regular basis due to the pressure on the scarce resource NADMO has.” [NM-NI].

“...for instance, in 2016, NADMO organized three radio programs to create awareness on flood risk. Two of the radio programs were organized before the April-July rainy season and the other one before the September-November rainy season.” [NM-KO]

Also, GMA through their daily weather reports on radio and TV predict the amount of rainfall to be received by certain areas of the country. Based on the weather forecast information disseminated by GMA, the audience makes their own prediction on the probability of flooding. On one hand, NADMO disseminates flood risk messages to the public through community leaders. With this approach, NADMO provides flood risk information to community leaders and they, in turn, spread the information to the people during scheduled community development meetings. On the other, NADMO officials sometimes attend community meetings and use that platform to make short presentations on flood risk. Mostly, NADMO officials make use of audio-visuals to enhance understanding of the public.

“NADMO gives information to Old Fadama Development Association (OFDA) and they, in turn, spread the information to tribal leaders of each ethnic group. Tribal leaders then relay information to volunteer members who go around informing tribal members on time and agenda of the upcoming meeting using local languages. Alternatively, sometimes the volunteered tribal members also use the available information centres to distribute information about the agenda and time for the meeting.” [OF-R3]

“...I have attended many Old Fadama Community meetings organized [for a] few weeks to the rainy seasons or sometimes during the rainy season. In all these meetings I have attended, community leaders have acknowledged my presence and given me the platform to talk about

flood risk and NADMO as an organisation. Flood awareness during such programs is done using videos.” [NM-OF]

Residents who encounter NADMO through their house-to-house education campaign read flood awareness flyers, listen to NADMO radio programs and presentations at community meetings and usually relay information to relatives, neighbours and friends who were not present. This chain of information dissemination, in some cases, leads to distortions and conflicting information among residents in the study communities.

5.10 Response to Flood Risk Communication

The study classifies the strategies adopted by residents to respond and cope with flood during communication into reactive and proactive. While proactive strategies involve measures put in place to prevent the occurrence of flood or significantly reduce flood impacts after flood risk communication, reactive strategies involve activities implemented to immediately reduce flood impact and reclaim lost assets after communication. In other ways, proactive strategies encompass flood mitigation and preparedness activities heard about from communicators. Proactive approaches to flood disaster emanate from flood experience and risk information obtained from the variety of sources mentioned earlier before the rainy season commences. The study found that residents in the selected communities are aware that information is key to reducing flood hazard impacts. As such, they solicit for flood information from radio, television and other mediums and respond to flood risk information to stay updated on the expected happenings. While some residents solicit for flood information in order to undertake precautionary measures to protect lives and property, others also seek information to update themselves on flooding within and outside the community during torrential rainfall. Further analysis showed that residents who seek flood information just to update themselves of the happenings in other places reside in the elevated sections of the communities where flood rarely happens.

The study found that some residents allow their children to sleep on the floor and in circumstances in which floodwaters enter houses, children drown. This incident has been a perennial issue whenever there is flooding. However, communication about floods from experts has encouraged some residents to provide beds for their children. In addition, some residents have changed their attitude towards waste management and clean up exercises because of information received from experts and other sources. The study found that some residents who previously did not assist during clean up exercises have changed their ways such

that they actively take part in the first Saturday of every month cleanup exercises (National Sanitation Day) to improve sanitation conditions.

“Every year during the rainy season, I always tuned in to radio and television stations to follow updates on weather reports. I also interact with neighbours to get information on rainfall and flooding news. If it happens that our community is likely to receive heavy rainfall, I migrate with my family to friends and relatives who live in safer areas.” [KO-R2]

“This year many neighbours have adjusted the foundations and windows of their houses far above the flood level in June 2015 because experts from GMA have predicted increased rainfall amount and flooding. For instance, I have raised the foundation to my house and windows two metres above the flood level in the recent flood.” [KO-R4]

“When we enter into the rainy season, the community organize clean-up exercises on regular basis to de-silt drains to ensure the free flow of floodwaters. Personally, I also fill open spaces in front of my house with sandbags and concrete waste to increase the topography of my house.” [OF-R3]

“I stock my fridge with water, fruits and other foodstuffs to feed my family in a scenario where experts predict prolonged days of flooding. In addition, I also buy additional radio batteries to monitor information about floods on the radio during electrical power outages.” [NI-R7]

The study reveals that reactive responsive measures to flooding included rescuing and evacuation of people, adjustment in cost and standard of living of victims, informal borrowing from friends and relatives and temporary relocation to stay with friend and relatives. Also, NADMO distributes relief items to flood-affected victims. Rescuing and evacuation of residents whose homes are flooded are mostly done by neighbours, with guidance from experienced community members who have resided in the community for a longer time. In situations where the intensity of flood is more than the capacity of community members to deal with, NADMO, with the help of the interior ministry, rescue and evacuate flood victims. Also, residents affected by flood temporary relocate to stay with friends and relatives and return when flood disaster has subsided. Recovery of residents from flood takes the form of NADMO distributing relief items and informal borrowing from friends. Usually, information is communicated either on radio or through other communication outlets within the communities when relief items are to be shared

“Whenever I hear information of flooding in the community, I rush to the affected area to help community members to evacuate from their flooded houses and rooms. For instance, during the 3rd June 2015 flood disaster, I helped to evacuate a family of three who were stuck in their room due to the high level of flood.” [OF-R1]

“Last year after the June 3 flood disaster, NADMO promised to share relief items to affected neighbours on one of the radio programs but they only came to distribute mattresses, which I think is not enough to cushion flood victims made homeless.” [NI-R2]

“.....NADMO distributed a total of 70 mattresses and 100 blankets to victims of June 2015 flood disaster.” [NM-NI].

5.11 Characteristics of Effective Risk Communication

Communication of flood risk to facilitate preparedness should have certain characteristics and follow some principles. The study summarizes the characteristics of effective risk communication messages into information sufficiency, message clarity, source credibility, availability of resources and source motivation and self-assurance.

5.11.1 Information Sufficiency

Respondents who confirmed receipt of adequate information indicated that messages received included the causes and effects of flooding, preventive measures and evacuation procedures. The study revealed that adequacy of flood message content is important to create awareness and initiate public discussions and adequate response to proper flood risk management at the local level. According to respondents, one significant way of increasing awareness within the communities is the initiation of discussions about flood among families, neighbours and friends. This has the prospect of improving clarity and public understanding of flood messages, thus empowering the public to prepare towards flood hazard. Some residents also stated that the sufficiency of information received provides them with several options to deal with flooding.

“...the more flood information I receive increases my understanding and awareness ...” [KO-R2]

“...whenever I receive flood information that is practical and rich in content, I tend to trust and believe the information source.” [KO-R4]

“...sufficient information increases my understanding about flood risk and management...” [NI-R8]

“...the public trust in the source rises when they receive additional flood information rich in content through information seeking...” [NI-R8]

“...I am motivated to take actions towards flood preparation when I receive more information-rich in content ...” [OF-R7]

“...upon receiving additional flood information I lacked, it puts me on my toes to do something to reduce flood impacts...” [OF-R7]

Elsewhere, the data showed that the public in their quest to increase the sufficiency of information on flood risk combines different sources and channels of communication.

“... in order to increase my knowledge about flooding, I rely on a combination of radio, TV and NADMO face-to-face sources.” [KO-R3]

“...disseminated flood information rich in content encourages and increases my confidence and eagerness to undertake activities towards flood preparedness...” [OF-R4]

“...rich information content received through numerous sources eases understanding and clarity...” NI-R8

Conversely, some respondents opined to the contrary, asserting the insufficiency of information they received. The study identified inaccurate predictions on the day and time of torrential rainfall or projected floods.

“...the flood messages I receive from many sources are not sufficient because they do not have the actual predicted day and time to expect a flood, thus insufficient to prepare towards flood.” [OF-R6]

5.11.2 Message Clarity

The influence of message clarity on preparedness is mixed based on study findings. The study found that message clarity increases the public knowledge and understanding of flood as well as trust in a flood message source.

“...content of flood preparedness messages disseminated in simple and clear language serves as a guide to enhance my skills and abilities in flood preparedness...” [OF-R6]

“...clarity of flood messages increases the trust and believe I have in the source of the flood message.” [NI-R4]

Also, it empowers receivers of flood messages to disseminate information to other people who had not heard of the flood risk messages disseminated or asked for clarification of the disseminated flood information. Clarity of flood messages motivated people to take up precautionary measures towards flood hazard. The study found that a platform that allows

community members and experts to discuss issues about flood enhances clarity of information disseminated.

“Clarity of flood risk messages is a very important component of flood message content because if the information and recommendation to deal with flood impacts are unclear, I cannot prepare towards it.” [KO-R4]

“...flood information free of jargon and technicalities gives me the courage and eagerness to explain to other people who seek clarification on flood issues...” [NI-R8]

“...community meetings involving NADMO officials provide residents with the podium to ask questions on the technical aspects of the messages delivered. The answering of questions by NADMO officials deepens my understanding and clarifies technical issues on flood” [OF-R1]

“...when the message I receive on flood is clear, I am able to clarify people’s misunderstandings of flood messages disseminated...” [OF-R5]

The study also unravelled the main features of a clear flood message. It includes messages disseminated in the native or local languages of the targeted group, jargon-free, less technical and which can be repeatedly communicated. Surprisingly, the study also showed that in certain instances, low severity of flood impact may make respondents complacent to deal with flood. For example, some of the respondents in Kotobabi and Nima claimed flood information received from many sources is clear but refused to prepare because the probability and severity of flood based on their experience in the community is low.

“...flood messages received are clear, but I do nothing towards flood preparation because my house is located on safe land. In the past 17 years, this community has experienced a number of floods, but with all these occurrences my house was not flooded...” [NI-R7]

In addition, other respondents fail to embark on clear recommended actions to deal with flood because they do not have the necessary resources to do so. Moreover, in Old Fadama, some respondents also confirmed receipt of clear information about preparation but failed to utilize it due to persistent eviction threat due to the insecurity of tenure. Respondents believe that city authorities may destroy the hard-earned property and evict them in some time to come.

“...for the past years, I have come to understand that clean-up exercise reduces flood occurrence, however, I don’t have the zeal to participate in sanitation exercises ...” [OF-R1]

*“... I clearly understand flood preparedness recommendations from experts [**message clarity**] but my family and I do not have the intent to embark on recommended actions [**intentions to prepare**] ...” [OF-R2]*

“...I refuse to embark on certain recommendations such as strengthening the foundations of my house to reduce casualties during severe flood mainly because of the fear of being evicted from this community by AMA after investing the limited resources I have in mitigation and preparedness activities...” [OF-R6]

“...sometimes I am made to have the perception that flooding is nothing to be worried about based on how some NADMO experts explain flood management to us. This is the basis of why I fail to embark on the recommended actions...” [KO-R2]

5.11.3 Source Credibility

The study discovered that credibility of the initiator of the flood message has both positive and negative repercussions on flood preparedness. Respondents specified that the credibility of the source of flood messages encourages them to further seek information about flood risk, increases acceptance of flood risk messages and preparation towards flood hazards.

“...the public tend to seek for more information from a credible source when the needs arise...” [NI-R8]

The study revealed that when residents perceive the source of flood information as authentic and credible, they tend to act or be willing to embark on any recommended actions. The contrary is true when the source of flood information is considered suspicious, especially through social media platforms.

“...when I receive flood risk information from a trusted source, I do everything within my means to utilize the recommended actions towards preparedness ...” [KO-R5]

“...a trusted flood information source increases public acceptance and implementation of the preparedness recommendations...” [NI-R3]

“...flood messages which are simple and free of ambiguities and technicalities received from a source increases the trust and believe I have in the source of [the] flood message.” [NI-R4]

“...when people receive flood information from a trusted source, it increases the positive processing of information...” [OF-R3]

However, source credibility is a daily and complex phenomenon in flood preparedness. The study discovered that too much trust in experts makes the public relaxed and transfers the responsibility of preparedness to state institutions.

“...during flood awareness programs, utterances of NADMO officials increase people’s hope and belief that NADMO will come to their aid to rescue and provide them with relief items in times of emergency...” [NI-R3]

Also, some respondents stated that the trust they have for NADMO is based on the fact that it is government owned. However, the day to day operations of NADMO has led some respondents to lose trust for them with time.

“...I only see NADMO as credible because it is a lawfully established government institution, however, the way they go by their duties is questionable.” [NI-R8]

“...the constitution provides that NADMO will be equipped by the government to effectively deal with disasters. Though some respondents stated their trust in NADMO but have the perception that it is the responsibility of NADMO to protect them from the dangers of flood...” [KO-R3]

Similarly, some respondents point out that the message they receive from NADMO is credible, but they fail to implement it because they do not have the essential skills to embark upon it.

“...during radio programs NADMO recommends that each household should have a flood preparedness and evacuation plan. Several people including myself know that having a preparation and evacuation plan is necessary to reduce death and injuries, but because we do not have the skills and resources to undertake recommended action towards preparedness, I do not embark on some precautionary actions...” [KO-R5]

5.11.4 Availability of Resources

The study revealed that resources are needed to enhance the message to audiences to encourage them to embark on recommended actions from experts. Some residents in the case study area refused to embark on mitigation and preparedness strategies from NADMO officials, mainly because of the lack of the requisite resource to do so. For instance, some residents stated that they refuse to implement recommended actions such as strengthening the foundation of houses and attending swimming lessons because they lack the financial capacity to do it. Others indicated that their inability to take part in the National Sanitation Exercises because tools such as shovel and wheelbarrow are inadequate for the number of people available in the communities. Some respondents also made it evident that the available tools are also in poor conditions such that residents improvise during clean-up exercise.

“The recommended actions, which are expensive and less efficacious are ignored. Examples of such recommendations are embarking on swimming lesson. The truth is I refuse to do that because I find it difficult affording two square meals a day, let alone money to undertake swimming lesson.” [OF-R2]

5.11.5 Source Motivation and Self-Assurance

Self-assurance is the willingness, confidence and ability of audiences of flood messages to embark on recommended flood mitigation and preparedness strategies. Audiences of flood messages do not have the same confidence and willingness to perform recommended actions. The source of a communicated message plays an important role in motivating audiences with low will power. The involvement of the communication source in either direct or indirect activities towards the implementation of recommended actions encourages more people to partake in activities. For instance, in Old Fadama where most flood risk messages emanated from local authorities (OFDA, chiefs, assemblyperson), recommended actions such as desilting of drains are led by community leaders. According to some respondents, the involvement of a communication source serves as a motivation for them to embark on recommended actions. This accounts for why communal activities such as clean up exercises before the rainy season are less patronised in Kotobabi and Nima, where recommended actions are mostly disseminated by NADMO officials who reside outside the communities.

“...leaders lead by example by joining in actual community exercises and as such, I am persuaded.” [OF-R2]

“...I told myself not to attend any of [the] community meetings because it is time-consuming. However, an official from NADMO approached me and since then I have attended three community meetings...” [OF-R7]

“...the confidence I gain through discussions and experimentation of flood preparedness recommendations increases my skills in undertaking preparedness activities]...” [OF-R7]

“...we present community members with flood information necessary to help them prepare...one important thing that is core to effective risk communication is the willingness of message audience to embark on them.” [NM-NI]

5.12 Challenges to Effective Flood Risk Communication

Several factors militate against effective flood risk communication in flood-prone communities.

The study unravelled four main barriers to the smooth dissemination of flood risk information to the public. These challenges are summarized as electrical and telecommunication failure, inadequate and untimely provision of logistics, unreliability and inaccessibility of experts and language barrier.

5.12.1 Electrical and Telecommunication Failure

Interruptions in the supply of electricity in the study areas hamper the effective communication of flood risk. Electrical concerns relate to intermittent, albeit unexpected, cuts in the power supply to homes. Between 2015 and 2016, Ghana as a whole was in a state of severe powers shortage which unsurprisingly appeared to have affected flood risk communication. The study revealed cases of power cuts during weather forecast reports on TV and radio.

“...we usually suffer from regular electricity power cuts. In times of power outages during weather forecast or NADMO programs, I tend to lose relevant aspects of the flood information being disseminated...” [KO-R1]

“...Sometimes in the course of listening to the weather forecast, the power goes off and this greatly affects me who mostly rely on weather forecast information due to the busy nature of my work....” [OF-R7]

Also, in certain instances, respondents indicated instances where NADMO’s flood awareness presentation at community meetings was distorted through power cuts. The intermittent failure in the supply of electricity in the communities sometimes results in miscommunication of flood information.

“...I have received multiple flood information [messages] from the community that were conflicting with each other. The conflict came up as a result of electrical power cuts in the middle of NADMO’s radio program. A few hours later when the light came back, I called friends in other communities that had electricity and the information I had from them were conflicting each other...” [KO-R3]

“I have lost electrical power many times before a flood awareness program started or during the program. One of such moments I remember is one program that was organized by NADMO officials in the month of May last year...” [NI-R8]

Most respondents also indicated how poor telecommunication and radio reception affected their quest to monitor flooding and its associated impacts on neighbours, relatives and friends within and outside the community.

“...there are times the reception to radios became poor such that it becomes hard to hear a discussion by NADMO on the radio...” (NI-R1)

Also, the poor telecommunication network in times of rain affects the speed of the internet, thus making it very difficult to monitor flood information on social media and NADMO

websites. Correspondently, the loss of radio reception during bad weather conditions extremely affects the clarity of messages disseminated during NADMO radio programs.

“...During the June 2015 flood disaster, I stayed in my room to monitor flood updates on the radio. The news from the radio specified that communities such as Adabraka, Dansoman and Nima have flooded. The attempts to call my relatives in those communities proved futile and this made me more worried” [NI-R3]

“...here in Nima, there has been no time that the internet has run smoothly during the rainy season. This affects some of us who rely on the social media to access flooding updates during the rainy season...” [NI-R8]

“...our telephone lines are always active, but residents complain a lot about their inability to reach us during emergencies. The poor telecommunication reception is the cause of this....” [NM-KO]

5.12.2 Inadequate and Untimely Provision of Logistics

Inadequate and untimely provision of logistics is a major hindrance to the effective performance of the NADMO legal mandate of protecting citizens from flood and associated impacts. The study indicated that the decentralized NADMO offices do not receive adequate logistics to cover their areas of jurisdiction during flood education campaigns. Moreover, NADMO’s decentralized offices sometimes receive logistics such as flyers after the flood season has ended. This phenomenon affects the face-to-face channel of communicating risk, which is done simultaneously with the distribution of flyers.

“...it is sometimes difficult to execute laid down plans for the communication of flood risk in our respective catchment areas. This is because logistics such as flyers do not arrive on time...” [NM-KO]

“Kotobabi has approximately thirty thousand households, meanwhile the office here receives less than five thousand (5000) flyers to assist us in our house-to-house outreach program...” [NM-KO]

Also, some NADMO decentralized offices do not have vehicles to assist them in their community outreach programs. The NADMO decentralized offices rely on vehicles from other decentralized agencies such as the Ministry of Health when they are not in use.

“...we rely mostly on some decentralized agencies for vehicles for our outreach programs. In situations where we do not get access to the scheduled vehicles, we abandon and reschedule communication plans...” [NM-NI]

5.12.3 Unreliability and Inaccessibility of Experts

Residents' ability to contact relevant disaster management authorities such as NADMO was highlighted as one of the core barriers to flood risk communication. Respondents recount instances where NADMO offices were unable to respond to residents' calls. Correspondingly, they also mentioned unsuccessful attempts to call into NADMO radio programs during flood awareness campaigns.

"...NADMO is not reliable at all because they are not available on occasions where we needed them. For instance, during the June 2015 flood, we called their contacts on the flyers they distributed to us but didn't go through." [NI-R6]

"Whenever I receive information of flood conflicting each time, my first attempt to resolve it is to contact NADMO but I have never gotten in touch with them before..." [NI-R8]

The use of jargon and technical terms during weather forecasts appeared to have little relevance for respondents with little or no formal education. This impeded the successful delivery and reception of communication between experts and community members.

"...weather forecast makes use of terminologies, which makes it difficult for me with low educational level to understand. I wish GMA could get a reliable call centre where people with understanding difficulties can call in for clarification..." [KO-R4]

5.12.4 Language Barrier

English is the official language of Ghana and the main medium of instruction in the formal education system as well as all institutions. This is a legacy of the British Colonial Period. However, Ghana is culturally diverse, with about two hundred and fifty (250) languages and dialects. According to the Ghana Statistical Survey in 2000, there are about eight main ethnic groups and about eighty languages spoken. Although Akan is widely spoken due to the proportion of population belonging to this group. English language ability depends to a large extent on a person's level of formal education, as those who have never been to school fall on one of the local languages.

Although the English language is widely spoken and understood among the population, Accra represents a constellation of several languages often geographically defined by the ethnic compositions in specific neighbourhoods, typically low income and informal. Thus, communities such as Old Fadama, Kotobabi and Nima, which are highly informal with low

educational profiles, have several elderly populations not very fluent in English, especially writing.

“...some neighbours who migrated from northern Ghana to Accra months ago don’t understand any of the local languages of southern Ghana (Twi, Ga and Fante), always ask me and other neighbours around to explain to them flood information disseminated by NADMO.” [NI-R8]

For the purposes of this study, this is very critical as language is the foundation on which effective communication is built upon. According to the study, the use of English as a medium of communication on flyers and weather reports adversely affects understanding and interpretation of messages by residents with little or no formal education. The lack of understanding of the weather reports by some respondents also affects their preparation towards flood.

“...I am not literate in English and the main medium for the presentation of the weather reports in English. I sometimes rely on my experience and neighbours to prepare towards flood.” [KO-R5]

“...the only problem I have with the distribution of flyers to increase flood awareness is, illiterates can’t read, hence their inability to understand and implement recommended strategies towards flood risk reduction...” [NI-R2]

Furthermore, the inability of NADMO officials to speak some of the local languages is also one of the underpinning causes of information conflict.

“...some NADMO staff cannot speak Ga, which is the only language I understand and speak fluently. However, during house-to-house outreach education program, they mostly speak Twi...” [NI-R5]

5.13 Emergent Themes and Narratives on How Flood Risk Communication Impacts on Flood Preparedness

5.13.1 Regular Community-Agency Interactions is Key to Trust Building

Regular and continuous discussions between experts and community members on one side and among community members on the other side boost the interest of community members in tackling flood issues and impacts. The study found attempts by NADMO to initially get residents of Old Fadama to engage in flood management programs proved futile on a number of occasions. One underlying reason for this situation is the lack of trust. From the study,

residents of Old Fadama assumed public institutions such as AMA and NADMO have an agenda to evict them from their present location. However, NADMO's decision to engage local leaders regularly through meetings helped to explain their mandate as enshrined in the constitution of Ghana. In addition, NADMO indicated how resident's cooperation with them would help reduce flooding situations and impacts in the community.

5.13.2 Equal Platform for All Stakeholders Paves Way for Clarification of Flood Issues

Community meetings on flood management were chaired by both community leaders and officials of NADMO. NADMO officials provided technical guidance with flood management and preparedness during meetings. At such meetings, community members were given the opportunity to ask questions on flood issues. Even though each resident present at community meetings had a chance to express their opinions and seek clarification, the study found that it is common for those wielding social and political power to dominate and influence decision making. For instance, community members who were vocal and with high social status were mostly granted the opportunity to ask questions. For this reason, discussions are to be transparent and equally give an opportunity to all stakeholders to actively participate and contribute to the process. This will in effect increase audience understanding of flood issues discussed during community meetings,

5.13.3 Information as a Mechanism for Trust Building and Preparedness Intentions

The study found that the dissemination of flood information could help enhance source credibility and motivate residents to undertake precautionary measures. The study revealed that flood information (before, during and after floods) disseminated through a medium such as face-to-face, radio, television and mobile phones stimulated discussion relating to flood both at the household and community levels. Issues such as pre-flooding activities towards risk reduction, response and preparedness are talked about. These kinds of physical and digital aid interactions through questions and relevant responses helped build trust. Furthermore, the answering of questions helped to clarify the disseminated messages and increase adequacy of flood information available to the audience. The study found that the dissemination of flood information to residents helped residents to know what to do before, during and after flooding. This fostered residents' interest and commitment to action towards flood disaster events.

5.13.4 Social Capital as a Pathway to Increase Flood Message Content, Coverage And Understanding

Social capital in this sense is a network of stakeholders for flood management who share common values and understanding. There is a wide range of networks within the study communities that were mostly formed along ethnic and religious lines. These local networks helped to increase the coverage of information disseminated. The study showed that religious leaders and ethnic leaders assisted residents who had difficulty understanding issues discussed at community meetings. On a religious level, Friday is an important religious day (Jumah) for members of the Islamic religion to attend prayers and religious meetings at the mosque. Islamic leaders use this avenue to communicate important information such as flood management to those within the Islamic community. The same pattern was observed among those affiliated with the Christian religion, who do so during church meetings on Sundays. For those not affiliated with these religions, the regular community meetings and the strong social bonds meant information was accessible through local ties and networks. This certainly increases the coverage of information within the studied communities.

5.13.5 Provision of Rich Message Content Increases Message Understanding and a Motivation Towards Preparedness

The dissemination of flood information to motivate people to take up precautionary measures is highly dependent on the clarity of flood messages. According to the study, the provision of additional information improves recipients' understanding and empowers them to engage in activities geared toward flood risk reduction. In other words, residents were willing to act on or respond to flood disaster risks if the message communicated to them was simple, comprehensible and relevant to their circumstances at the time. Thus, clarity is a key determinant of residents' disaster preparedness. It is therefore important for communicators to also pay attention to clarity of adequate information disseminated during risk communication.

5.13.6 Trust in Message Source Facilitates Preparedness Intentions

The role of trust in the message source to preparedness cannot be overemphasized. Source of information is an important component of credibility, at least for the residents who are recipients. From the study, credibility in the source of a message emanated from three main instances, namely i) the ability of the source to explain flood information in simple and clear language; ii) the ability of the source to provide recommendations that reflected audience experiences and response efficaciousness; and iii) the communication source is from a well-

known institution recognized by government or constitution. Most participants in the study indicated that flood information received from a credible source encouraged them to accept and act on the message contents. This also explains that the provision of adequate information to empower the message's audience should also take into consideration the credibility of the information source.

5.13.7 Social Capital and Cohesion Provide Platform for Capacity Building and Stimulation of Preparedness Intentions

Regular and continuous interaction among all stakeholders provides a platform where community members and communicators can know each other better and build a good rapport. The strong ties, bonds and relationships provide an informal channel through which information can easily circulate. Strong ties and bonds among members of the communities also form a support network, as the study revealed, where mutual aid and reciprocal assistance is part of everyday life. As found in the study, participants who were absent from community meetings seek information from neighbours regarding the deliberations on flood management discussed. Besides, other community members also assist absentees from community meetings to implement recommended mitigation and preparedness strategies. The sense of togetherness and the zeal of community members to support each other helps to build capacity by transferring and sharing skills, knowledge and competencies among community members.

5.13.8 Simplicity Of Flood Messages As a Trap to Underrate Preparedness Benefits

The study found that information provision is an empowering tool to enhance preparedness intentions towards flood hazards. Unfortunately, the continuous dissemination of information in simple and clear language also weakens preparedness intentions in some circumstances. Findings of the study revealed that the constant provision of simple information enhances people's understanding, however, it could lead audiences to underestimate flood hazard impacts and the potential of the recommended actions to reduce hazard impacts. Also, the study showed that the message audience may transfer the responsibility of flood management to public institutions because they underestimate flood hazard impacts and the effectiveness of recommended actions from experts. Though the simplicity of flood messages stimulates preparedness intentions, still it is also a trap to prevent community and individual preparedness, thus a complex issue.

5.13.9 Information Clarity Empowers and Facilitates Skills Development

The provision of clear flood information is an important element of vulnerability and exposure reduction and skills development. Dissemination of information from experts provides an audience with knowledge about flood hazard and recommended actions to reduce its impacts. The receipt of clear messages from communicators by the message audience empowers them to take up the recommended actions geared towards preparedness. The study revealed that theory is an antecedent to practice. In other words, the provision of adequate information in clear language helps to guide the message audience to implement the recommended actions.

5.13.10 Skills Development Aids Preparedness Intentions

Development of the skills needed to undertake recommended actions to reduce flood impact is a major factor in predicting preparedness intentions. Findings of the study showed that most people refused to undertake precautionary measures towards risk reduction in the selected communities because they lack the necessary skills, abilities and resources to undertake recommended protective actions. The study found that it is important to equip “at risk” individuals and communities with the necessary knowledge on a risk they face as well as protective actions to reduce the impacts. However, communicators would have to ensure that message audiences have the skills, abilities and resources to embark on the recommended actions. Some participants indicated that they have adequate knowledge and information on preventive and protective actions to mitigate the impacts posed by flood hazard in their respective communities. Nevertheless, they have failed to undertake actions towards preparedness because they lack the requisite skills and resources to undertake the recommended actions. For instance, in Kotobabi and Old Fadama, some of the respondents indicated the inadequate and poor conditions of tools for clean-up exercises as a major factor that impedes participation in flood preparedness activities.

5.13.11 Local Institutions and Leaders are Mediators to Effective Flood Risk Communication

Local institutions such as in the studied areas (CBOs, NGOs, traditional authorities), such as Old Fadama Development Association (OFDA), People Dialogue on Human Settlement (PDHS), and ethnic chiefs, are critical to effective flood risk communication. Local leaders involve chiefs, opinion leaders and other people who are well known and respected based on the position (social, political, economic) they hold in the community. These local institutions, through several initiatives, build collaborative partnerships with local government institutions

like AMA and NADMO. Effective partnership and cordial relationships between communities and public institutions provide a strong foundation to disseminate messages for preparedness towards flood disaster. For instance, the Old Fadama community through OFDA and PDHS meets experts from NADMO, who debrief them on flood response and preparedness occasionally. This approach – of holding meetings between community members – increases the coverage of flood messages in the community. However, the communication strategy used by NADMO of distributing flyers to residents in Nima and Kotobabi is time-consuming and has limited coverage. Results show that the inability of NADMO to adopt mass face-to-face communication in Nima and Kotobabi is essential because of a lack of vibrant local institutions. This is suggestive of the pivotal role local institutions and leaders play in the communication of flood messages.

The partnership of local institutions and leaders and flood experts in the communication of flood messages facilitates and quickens the trust-building process between experts and community members. It is worth mentioning that, in several areas, local institutions are not only highly regarded but trusted more than the public institutions.

5.13.12 Public Institutions' Inefficiencies and Loss of Trust Inhibit Flood Preparedness

In Ghana, inadequate human resources and logistics are some of the fundamental issues that impede AMA, NADMO and GMA in the performance of their functions. As indicated by some respondents, AMA's inability to ensure that garbage and sediments from clean up exercises are transported to designated places makes them feel reluctant to engage in sanitation activities. According to these respondents, uncleared sediments from clean-up exercise are washed back into the drain during heavy rainfall and storms. The perennial failure of GMA to predict the weather accurately has made residents reluctant to treat information from them seriously. On the other hand, the perception of residents that officials of disaster management institutions hoard and use items designated for disaster victims has reduced the credibility NADMO. Loss of credibility and the inefficiency of NADMO, GMA and AMA has led some of the respondents to sometimes ignore flood messages or recommended actions toward preparedness. In Old Fadama, for instance, some residents disregarded advice to modify built structures given by public institutions during flood seasons because they fear being evicted after investing their financial resources.

5.14 Summary

This interview data has shown that flood vulnerability and exposure levels in informal settlements continues to rise due to population growth, lack of political will, institutional inefficiencies, temperature and rainfall changes and poor waste management. However, the extent of vulnerability is not uniform across and within the case study communities. The study revealed that residents close to the main Greater Accra Regional drain (Korle-Lagoon) are more susceptible to flood compared to their counterparts away from the drain. Risk communication is central to residents' and NADMO's efforts to reduce the impact of flooding. Communication of flood information is categorised as pre-flooding, response and post flooding.

Pre-flooding communication presents an avenue where residents get the opportunity to acquire more knowledge about flood, mitigation and preparedness strategies. Additionally, clarification of flood messages and trust building is a feature of communication before the rainy season commences. Whereas communication towards flood response is centred on the implementation of evacuation procedures to safer areas, communication after flooding helps to assess the effectiveness of strategies adopted during the response phase. Again, it helps to address shortfalls in strategies adopted during flood occurrences.

The study found four main channels for the communication of flood risk, namely: face-to-face, mass media, internet-mediated/social media and mobile phone. All of these channels have their strengths and weakness and respondents indicated that the ideal way of increasing coverage and clarity is through a combination of all the channels. The study also found that the three sources of flood information in the study area are through NADMO, GMA and community sources.

The study results showed that for risk communication to achieve its stated objectives, the content of flood information should be sufficient, clear and emanate from a trusted source. Apart from these, the availability of, and accessibility to, resources is critical for residents to translate information into real actions for flood risk mitigation and prevention. To enhance the effectiveness of flood risk communication, the study points to the need to pay attention to identified challenges such as power supply and telecommunication failures, inadequate and untimely provision of logistics, the unreliability of experts and language barriers. The common threads and the major findings, as well as the implications from this and the previous chapter,

are further elucidated in the next section. In the next chapter, results from the quantitative study (Chapter Four) and qualitative results (Chapter Five) will be synthesised and triangulated.

CHAPTER SIX

DISCUSSION OF THE STUDY FINDINGS

6.1 Introduction

The previous two chapters discussed the analysis of quantitative (Chapter Four) and qualitative (Chapter Five) data. In Chapter Four, an exploratory and confirmatory factor analysis was conducted to provide a basis for the theoretical model to be tested using SEM. Subsequently, the model enabled the theoretically formulated hypotheses for the study to be tested during the quantitative analysis. Chapter Five (5) presented results from the qualitative study to complement quantitative findings and present a comprehensive understanding of how risk communication influences public intentions to prepare towards flooding. The intent of Chapter Six (6) is to:

- Present the demographic characteristics of the study participants
- Discuss the tested hypothesis and synthesise it with the qualitative results
- Interpret and discuss the modified structural model
- Provide details on the theoretical and empirical implications of the study.

6.2 Overview of Demographic Characteristics of Respondents

6.2.1 *Demographics of Quantitative Survey Participants*

Demographic characteristics of the respondents in the quantitative study showed that 57.4 (n=611) percent and 42.6 (n=453) percent were males and females respectively. Similarly, the majority (52.2%) of the interviewees were males, with the remaining 47.8 percent being females. Findings from *Housing the Masses* (2010) confirms this study's finding that there are more males than females in informal settlements in Ghana. Similarly, analysis of migration patterns in urban areas in Ghana by Reed, Andrzejewski, and White (2010) indicates that females are less mobile than males, thus supporting the finding of more males than females in urban informal settlements. Also, in the Ghanaian context, the role that culture and religion assign to females is within the family. Mazzucato, Schans, Caarls, and Beauchemin (2015) argue that males take the opportunity to first migrate to the city and fully settle before their dependents follow them. Increased male migration, especially from the northern part of Ghana (Northern Region, Upper East Region and Upper West Region) into Accra and its environs, also explains the high male population in the study area (GSS, 2012). The survey showed that a majority of the respondents fell between the age cohorts 27-35 and 18-26, which were 35.4 percent and 24.9 percent respectively. Moreover, while 4.7 percent of the survey respondents

were between the ages 54-62, 3.8 percent were above 63 years. This study finding is also in accordance with the 2010 Population and Housing Census Report emphasizing the youthful nature of Ghana's population at the national, regional and metropolitan levels. With respect to education levels, 24.3 percent of the participants in the survey had no formal education, and 25.6 percent, 11.7 percent and 18 percent of the sampled population had senior high school, primary and middle/junior high school (JHS) education correspondingly.

6.2.2 Demographics of Qualitative Study Participants

Contrary to the quantitative results, the majority of the interview respondents (39.1% and 21.7%) were between the ages 54-62 and 45-53 respectively. Results from the interviews indicate that 82.6 percent of respondents had at least middle school education, and 17.4 percent had no formal education. Exploring the number of years respondents from the interview have been residents of the selected communities, 82.6 percent have stayed in the community for more than 10 years. In addition, 19.4 percent of the residents have been in the community for more than 3 years. Whereas 48.5 percent of the respondents were married, 43 percent were singles. Elsewhere, 53.2 percent of the sampled population were gainfully employed, 32.7 percent were unemployed, and 11.5 percent being students and 2.6 percent were retired. Additionally, majority (92 %) of the employed participants were engaged in service provision such as trading, head pottering, cleaning, tailoring, barbering, driving, carpentry and hair dressing. The study also showed 50.4 percent of the sampled population received a monthly income between GHC 1-300. While 29.9 percent received a monthly income between GHC 301-600, 14 percent earned a monthly income of GHC 601-900. The mean monthly income was between GHC 301-600. This finding reiterates the widely held view seen in the literature that most informal settlement dwellers engage in menial jobs with low-income returns (Fox, 2014; Gonmei, Siddhu, Toteja, Dwivedi, & Vikram, 2018; Li & Wu, 2013; Roy et al., 2018). The demographic data provides an understanding of the participant cohorts and the influence flood risk communications have on preparedness intentions.

6.3 Factors Contributing to Flood Vulnerability in Informal Settlements

Vulnerability to flood hazards in informal settlements was not seen as uniform across and within the communities. Flood vulnerability and impacts were found to be higher at places that were close to the main drain than those located further away. The study also revealed that there is an array of factors contributing to flood hazard vulnerability in informal settlements. One factor that contributes to increased flood vulnerability and impacts was increased rainfall and

temperature patterns. According to participants, by observation and monitoring, rainfall frequency and amount have risen over the past decades. This is because the duration and frequency of rainfall have significantly increased. Residents confirmed the increase in temperature, indicating the quick evaporation of stagnant waters in recent times after rainfall as the reason for increased temperature. In addition, participants also reported the increased scorching nature of the sun as another significant observation of temperature changes. This finding is in line with studies by Alfieri, Burek, Feyen, and Forzieri (2015) and Arnell and Gosling (2016) indicating climate change variability as a contributory factor to increased flood vulnerability and impacts respectively in Europe and globally.

The study also discovered rapid population growth in the three (3) selected communities as another factor leading to increased flood vulnerability and exposure. Participants who stayed in the communities for long periods (20 years and over) stated that flooding in the communities has been evident over the years but with no or little physical and economic damage. They state that about two (2) decades ago when the total population of the communities was much less than at present, no residents stayed close to the drain. Areas close to the drain were used for fishing and farming purposes. However, the migration of more people into the community due to the relatively cheap cost of rent and nearness of the community to market (Agbobloshie and Nima) have forced some residents to build and live close to the drain. Some residents also indicate that the increased demand for land for residential and small-scale industrial purposes has also increased impervious areas. According to participants, the increased impervious areas make it difficult for flood water to infiltrate through to the soil. This finding is also in accordance with Dewan (2015) study in Bangladesh and Nepal, which found increased population growth and density as a major cause of flood vulnerability and exposure. Similarly, findings from Du, Shi, Van Rompaey, and Wen (2015) of increased population growth and impervious surfaces as a major cause of flooding in urban areas also support this study.

Lack of political will together with institutional weakness and inefficiencies was also found to be another contributory factor to increased flood vulnerability and impacts. Metropolitan, municipal and district assemblies in Ghana are mandated constitutionally to control development within their respective jurisdictions. Similarly, NADMO which is established by an Act of Parliament, is also mandated to manage climate-related disaster hazards. However, the study found that AMA and NADMO's responsibilities are interspersed with several challenges in terms of inadequate logistics and political interference. Some NADMO staff

members who participated in the study indicated that the institution has not been able to perform its legally mandated responsibilities succinctly because influential individuals interfere with their duties. Interference by politicians has been shown in instances where a joint force from AMA and NADMO have been stopped from demolishing buildings along watercourses in 2016. This finding supports Howe and Bang (2017) study in Myanmar and the Philippines indicating political interference as a major barrier to effective disaster management. Also, Waugh (2015) finding of inadequate logistics as an impeding factor in disaster management in urban areas also corroborates this study's finding.

Inadequate infrastructure such as drains facilitates flood vulnerability of residents in informal settlements. The study found that there has been an increased amount of rainfall over the past decades, and inadequate drains have facilitated inundation in the study communities. Floodwaters have limited channels (drains) and the available drains are overwhelmed by increased floodwaters during torrential rainfall. Moreover, solid waste and eroded material that block the flow of floodwaters worsen the flooding situation in the area. This finding corroborates that of Owusu-Ansah (2016) in South Africa, in Kumasi, Ghana and Ziervogel et al. (2016), attributing inadequate drainage facilities and poor solid waste management to increased flood vulnerability in urban areas. The interaction of flood hazards with existing informal settlement characteristics increases vulnerability and exposure levels of residents. In summary, there are multiple factors found to increase vulnerability and these need to be considered within a disaster risk resilience strategy.

6.4 Discussion of Key Findings

This section presents the key findings of the study, obtained through the synthesis (triangulation) of quantitative and qualitative results.

6.4.1 Community Participation Positively Relates to Source Credibility

Table 6. 1: Synthesis of Community Participation and Source Credibility Relationship

Quantitative Results		Qualitative Results
Hypothesis	Theme	Selected Qualitative Quotes
H1 CP $\xrightarrow{+}$ SC $\beta=0.162$ C.R=4.525 P-Value=*** “Community participation positively relates to source credibility”	Local institutions and leaders are mediators of effective flood risk communication. Regular community-agency interactions is key to trust building	“...Getting in touch to provide Old Fadama residents with important flood information was very difficult initially. However, with regular interactions through numerous community meetings [community participation], the community leaders and members now believe and trust us [source credibility] and have taken the stance to partner us during our outreach programs” [NM-OF]

Community participation was hypothesised to enhance the credibility of the source of flood information. The tested hypothesis showed a statistical significance between stakeholder participation and source credibility. This indicates that the continuous and regular exchange of flood risk information among stakeholders helps to build a cordial relationship among them. A sustained cordial rapport between the public and experts obtained through flood risk discussions enhances trust building, which is a recipe for flood preparedness. Findings from the qualitative analysis further explained the statistical significance of community participation influence on source credibility.

Respondents in the qualitative interviews found that initial attempts by flood experts to engage the public in awareness programs received low patronage due to the low level of trust they had in experts. Further evidence indicates that current flood awareness programs have received higher patronage as a result of the public’s increased trust in flood experts. According to NADMO, this breakthrough in increased flood program patronage was built through consistent engagement with the communities through the active involvement of community leaders. In addition, participants from NADMO made it clear that without the involvement of community leaders in Old Fadama, flood programs would have received no or low patronage. This

confirms the widely held view in the literature of the importance of local leadership (traditional authorities and government representatives at the community level) in communication and trust building (Andrulis et al., 2007; Arlikatti et al., 2007; Habibi et al., 2014; Klaiman et al., 2010; Sloan & Oliver, 2013; Yoon et al., 2005).

6.4.2 Community Participation Positively Predicts Message Clarity

Table 6. 2: Synthesis of Community Participation and Message Clarity Relationship

Quantitative Results		Qualitative Results
Hypothesis	Theme	Selected Qualitative Quotes
H2 CP $\xrightarrow{+}$ MC $\beta=0.424$ C.R=10.551 P-Value=***	Equal platform for all stakeholders paves way for clarification of flood issues	“...community meetings involving NADMO officials [community participation] provide residents with the podium to ask questions on the technical aspects of the messages delivered. The answering of questions by NADMO officials deepens my understanding and clarifies technical issues on flood [message clarity]” [OF-R1]
“Community participation positively predicts message clarity”		

In the SEM model, it is shown that community participation presents a platform where questioning and answering among stakeholders through discussions enable the clarification of flood risk information. Furthermore, clarity of flood messages is achieved through continuous engagement and discussion between the community and flood experts, especially when all persons involved are given equal opportunities to air their views. In other words, the provision of answers to questions during discussions clarifies message ambiguities and makes technical areas of flood messages less technical. On the other hand, the qualitative results from the study showed that continuous engagement between flood experts and the public gives stakeholders the platform to ask questions on issues that are technical and lack clarity. This process of stakeholder engagements helps to break down technical aspects of risk message content in simple terms for the members of the communities to understand. Furthermore, the clarification of technical issues and terminology also deepens the public understanding of flood issues. This finding is in accordance with prior studies in risk communication and other disciplines such as

political science and education. In the field of political science, research by Zamora-Medina and Zurutuza-Muñoz (2014) suggest that participation that presents electorates the platform to ask questions enhances campaign message clarity. Teacher-student engagement has also been found to have a positive correlation with teacher clarity (Bolkan et al., 2016; Broeckelman-Post et al., 2016; Sidelinger & McCroskey, 1997). Also, other studies have found that risk communication that encourages the targeted audience to participate reduces message ambiguity (Tang et al., 2015; Terwel, 2015; Umansky & Fuhrberg, 2018).

6.4.3 Message Clarity has a Positive Relationship with Source Credibility

Table 6. 3: Synthesis of Message Clarity and Source Credibility Relationship

Quantitative Results		Qualitative Results	
Hypothesis	Theme	Selected Qualitative Quotes	
H3 MC $\xrightarrow{+}$ SC $\beta=0.469$ C.R=13.977 P-Value=***	Information as a mechanism in trust building and preparedness intentions	“...flood messages which are simple and free of ambiguities and technicalities [message clarity] received from a source increases the trust and believe I have in the source of the flood message [source credibility]” [NI-R4]	
“Message clarity has a positive relationship with source credibility”			

Study findings from the quantitative analysis indicate that the receipt of clear and simple messages to increase public understanding of flood issues helps to build trust in the source of flood messages. This means that trust held by the public about the message source is increased when the information received is articulated succinctly for the understanding and clarity of the lay public. In addition, the public increases the trust they have in the source of flood information when technical issues and terminologies inherent in a message are simplified and explained to message audiences. The qualitative results confirm the quantitative study, indicating that the public tends to believe and trust the source of flood messages when the content of flood information is explained according to the basic understanding of the public. Moreover, results from the interviews revealed that public trust in a message source could be initiated when new

flood information is provided to the audience. According to the interview results, the trust held by the public in the message source is higher when the new information provided is clear, relevant and practical, based on their perceptions. This finding is in accordance with other earlier studies indicating that clarity of a message is a major determinant of public trust in the message source (Curnin et al., 2015; Metzger et al., 2003; Schrodt et al., 2009).

6.4.4 Information Sufficiency has a Positive Relationship with Source Credibility

Table 6. 4: Synthesis of Information Sufficiency and Source Credibility Relationship

Quantitative Results		Qualitative Results	
Hypothesis	Theme	Selected Qualitative Quotes	
H4 IS $\xrightarrow{+}$ SC $\beta=0.408$ C.R.=11.408 P-Value=*** “Information sufficiency has a positive relationship with source credibility”	Information as a mechanism for trust building and preparedness intentions	“..whenever I receive flood information that is practical and rich in content [information sufficiency] I tend to trust and believe the information source [source credibility]” [KO-R4]	“...the public’s trust in the source [source credibility] rises when they receive additional flood information rich in content [information sufficiency] through information seeking...” [NI-R8]

Findings from the quantitative study revealed that the dissemination of adequate and up-to-date flood information paves a way for the public to increase their trust in an information source. Source credibility is enhanced especially when new flood risk and preparedness information received by the public is understood and seen as relevant from their perspectives. The qualitative study confirms this result, indicating that the public increases their trust in the source of flood information when the messages received are clear, relevant and practical. In other words, the public assessment and interpretation of the practicality and feasibility of flood preparedness information received is based on the public’s flood experiences and perceptions. This is mostly done by comparing their existing flood preparedness feasibility to that of experts’ recommendations. This suggests that for disseminated information to initiate trust

building between experts and the public, messages disseminated should be understood easily and meet the expectations of the public as envisaged in other similar previous studies such as Tomkins (2001) and Sako (2006).

6.4.5 Community Participation Positively Influences Information Sufficiency

Table 6.5: Synthesis of Community Participation and Information Sufficiency Relationship

Quantitative Results		Qualitative Results
Hypothesis	Theme	Selected Qualitative Quotes
H5 CP $\xrightarrow{+}$ IS $\beta=0.841$ C.R=29.396 P-Value=***	Social capital as a pathway to increase flood message content, coverage and understanding	"...my active involvement in radio programs organized by NADMO [community participation] has enhanced my understanding and knowledge of flood risk reduction [information sufficiency]..." [OF-R3] "...community meetings [community participation] involving NADMO provide a platform for residents to gain more insights on flood preparedness [information sufficiency] ..." [OF-R6]
"Community Participation positively influences information sufficiency"		

The quantitative results showed that community participation provides a podium where the public gains more insight and acquires additional information on flood risk and preparedness. Similarly, findings in the qualitative studies suggest, as part of NADMO's responsibilities for reducing flood risk in Ghana, it liaises with GMA to obtain updates on the weather conditions during the rainy season. NADMO disseminates updated weather information received from GMA to the public through community meetings and NADMO radio programs to increase flood awareness and preparedness. Also, respondents who are new to issues of flood and its associated impacts lacked information on preparedness and mitigation approaches. They use community meetings and NADMO radio programs to gain more information on flood risk and preparedness. In addition, the interactions amongst stakeholders open up an opportunity for experts to clarify issues and disseminate updated information during questioning and answering times. The public acquires additional flood information on flood risk and preparedness through discussions among stakeholders. This finding supports several other

preceding studies indicating that community participation as a communication tool provides the podium for the discovery of new ideas and information (Trombetta & Rogers, 1988; Veach et al., 2007; Vuong & Nguyen, 2015; Zaman et al., 2008).

6.4.6 Information Sufficiency has a Positive Relationship Message Clarity

Table 6. 6: Synthesis of Information Sufficiency and Message Clarity Relationship

Quantitative Results		Qualitative Results
Hypothesis	Theme	Selected Qualitative Quotes
<p>H6</p> <p>IS \rightarrow MC</p> <p>$\beta=0.488$</p> <p>C.R=12.810</p> <p>P-Value=***</p> <p>“Information sufficiency has a positive relationship message clarity”</p>	<p>Provision of rich message content increases message understanding and a motivation towards preparedness</p>	<p>“...the more flood information [information sufficiency] I receive, increases my understanding and awareness [message clarity]...” [KO-R2]</p> <p>“...my understanding and clarity of flood information [message clarity] is increased when I combine information received from community meetings and radio programs [information sufficiency]...” [OF-R4]</p> <p>“...rich information content [information sufficiency] received through numerous sources eases understanding and clarity [message clarity]...” [NI-R8]</p>

The study results from the quantitative analysis showed that the dissemination of more information on flooding to the public deepens their understanding of flood issues and preparedness. Correspondingly, the qualitative results indicated that the public’s understanding of technical and ambiguous issues about flood increases when they are provided with adequate information about a flood. This commonly happens in scenarios where an explanation of technical aspects within the content of flood messages is done using local language. As some respondents indicated, their understanding of flood issues is increased when the information they receive is delivered in local languages. This finding coincides with several previous

studies indicating that the more information an individual receives about a product or an issue under discussion, the higher the understanding and clarity (Hsu, 2017; Johnson, 2005; Liu et al., 2018; Mai, 2016; Mishra et al., 2015).

6.4.7 Source Credibility has a Positive Relationship with Preparedness Intentions

Table 6. 7: Synthesis of Information Sufficiency and Message Clarity Relationship

Quantitative Results		Qualitative Results
Hypothesis	Theme	Selected Qualitative Quotes
<p>H7</p> <p>SC $\xrightarrow{+}$ IP</p> <p>$\beta = 0.263$</p> <p>C.R=4.857</p> <p>P-Value=***</p> <p>“Source credibility has a positive relationship with preparedness intentions”</p>	<p>Trust in message source facilitates preparedness intentions</p>	<p>“...when I receive flood risk information from a trusted source [source credibility], I do everything within my means to utilize the recommended actions towards preparedness [intentions to prepare]...” [KO-R5]</p> <p>“...a trusted flood information source [source credibility] increases public acceptance and implementation of the preparedness recommendations [intentions to prepare]...” [NI-R3]</p>

The quantitative results proved that the trust and believe the public has in the source of flood information positively influences their decisions to prepare towards flood. The public usually attaches a lot of importance to recommended flood actions emanating from a credible source, hence higher intentions towards flood preparation. The qualitative result also supports the fact that the credibility of the source of flood information is a major determinant of the public decision to accept and implement recommended actions. In one scenario, some respondents observed that they gather every resource and seek more information to prepare towards flood hazard when flood messages received are from a credible source. Similarly, the results made it evident that the decision to accept and implement recommended actions toward flood preparedness is judged on several factors, including the credibility of the flood information source. This finding is in line with previous studies stating the credibility of a message source positively influences audiences to accept recommendations and make informed decision

(Apatu, Gregg, Lindell, Hillhouse, & Wang, 2015; De Meulenaer et al., 2018; Han, Lu, Hörhager, & Yan, 2017; Nunes et al., 2018; Yoon et al., 2005).

6.4.8 Community Participation has a Positive Relationship with Preparedness Intentions

Table 6. 8: Synthesis of Community Participation and Preparedness Intention Relationship

Quantitative Results		Qualitative Results
Hypothesis	Theme	Selected Qualitative Quotes
<p>H8</p> <p>CP $\xrightarrow{+}$ IP</p> <p>$\beta = 0.603$</p> <p>C.R=10.045</p> <p>P-Value=***</p> <p>“Community participation has a positive relationship with preparedness intentions”</p>	<p>Social capital and cohesion provide a platform for capacity building and stimulation of preparedness intentions</p>	<p>“...community meetings involving NADMO [community participation] provide an opportunity for residents to gain more insights on flood preparedness and remind us of activities to mitigate flood impacts [intentions to prepare]” [OF-R6]</p> <p>“...weeks before the rainy seasons and during the rainy seasons when flood education campaign is intensified, the topic of flood is discussed at all corners of the community [community participation] and this whets residents’ appetites to take up preparedness actions [intentions to prepare]” [NI-R1]</p>

The quantitative results showed that continuous engagement between flood managers and experts provides a platform from which to clarify all doubt surrounding flood impacts. This practice is especially true when the community participation platform encourages the public to openly ask questions and talk about their views on flood issues. Findings from the qualitative analysis also showed that the appetite of the public to actively make preparation towards flood hazard is increased through expert-community engagement. In other words, community participation serves as a forum where residents lacking information about flood preparedness and understanding of flood message content are resolved. Also, other respondents also mentioned the critical role community meetings played in their decision towards flood

preparedness. For instance, interview respondents stated that expert-community engagement reminded them of their responsibilities towards flood preparedness. According to them, engagement in flood discussions helped them to understand and make positive decisions towards flood risk preparedness. In conformity with this finding are prior studies such as (Cretney, 2016; Kim & Zakour, 2017; van Manen, Avard, & Martinez-Cruz, 2015) specifying how interaction among stakeholders helps others to make informed decisions.

6.4.9 Community Participation has a Positive Relationship with Self-Efficacy

Table 6. 9: Synthesis of Community Participation and Self-Efficacy Relationship

Quantitative Results		Qualitative Results	
Hypothesis		Theme	Selected Qualitative Quotes
H9		Social capital and cohesion provides a platform for capacity building and stimulation of preparedness intentions	“...Community meetings involving NADMO officials [community participation] are accompanied by practical demonstrations of some recommended actions on preparedness [self-efficacy]...” [OF-R2]
CP → SE			
$\beta = 0.621$	C.R=9.623		
P-Value=***			
“Community participation has a positive relationship with self-efficacy”			

Results from the quantitative study revealed that continuous and regular interactions between experts and the public enhances their skills and abilities to put into action the recommended actions towards flood management. This is because aspects of community participation present a forum where recommended actions towards flood risk reduction are experimented with. The continuous practice of putting into actions flood preparedness information helps the public to correct mistakes done in the process. Corrections of wrongdoings in the process of putting into actions recommended flood preparedness activities improves public skills and abilities. Moreover, some participants in the qualitative study indicated that evacuation exercises to respond to flood are conducted with guidance from flood experts. Some respondents revealed how the platform of community participation has enhanced their skills in flood preparedness. This study finding is in line with prior studies specifying that engagement among stakeholders is a recipe to improve skills and abilities of participants (Fan & Williams, 2010; Ohmer, 2007; Sakakibara et al., 2014).

However, the qualitative results suggest that some residents are reluctant to engage with the community to enhance their skills and abilities in flood preparedness recommendations, even though they are aware of the benefits and this includes:

- Regular eviction threat
- Low-income levels
- Inadequate resources/logistics

6.4.10 Message Clarity has a Relationship with Intentions to Prepare

Table 6. 10: Synthesis of Message Clarity and Intentions to Prepare Relationship

Quantitative Results		Qualitative Results	
Hypothesis	Theme	Selected Qualitative Quotes	
H11 MC $\xrightarrow{-}$ IP $\beta = -0.148$ C.R = -2.899 P-Value = ***	Simplicity of flood messages as a trap to underrate preparedness benefits Public institutions' inefficiencies and loss of trust inhibit flood preparedness	<p>"...for the past years, I have come to understand that clean-up exercise reduces flood occurrence [message clarity], however, I don't have the zeal to participate in sanitation exercises [intentions to prepare] because ..." [OF-R1]</p> <p>"... I clearly understand flood preparedness recommendations from experts [message clarity] but my family and I do not have the intent to embark on recommended actions [intentions to prepare] because..." [OF-R2]</p>	
"Message clarity has a relationship with intentions to prepare"			

In the quantitative study, the result revealed that clarity of flood messages discourages the public from preparing towards risk reduction. Correspondingly, the qualitative results confirmed this finding, specifying that the clear message is not the underlying cause of public decisions not to prepare towards flood. Some respondents stated that they receive a clear message but fail to embark on the messages because they do not have the will to prepare. Further analysis showed that the respondents' unwillingness to implement flood preparedness recommended actions is due to the fear of being evicted by the local government authority (AMA). Respondents revealed that they have received more than three eviction threats since 2002 and as a result fear being evicted by the AMA after investing their scarce resources into

risk reduction activities. Also, another reason for respondents' failure to implement the clear recommended action is attributed to their inability to afford or acquire resources to enable them to embark on the recommended actions. For instance, some respondents stated that they have not been able to embark on recommended flood preparedness actions because they do not have the financial capability to afford the cost of swimming lessons or strengthening the foundations of their homes. It was also evident that respondents also fail to engage in clean-up exercises because they do not have enough tools, such as shovels, rakes and wheelbarrows. Furthermore, the on-going issue of government authorities allowing the collected rubbish from clean-up exercises to be washed back into drains made some respondents reluctant to embark on sanitation exercises. The finding of message clarity impeding flood preparedness contradicts prior studies indicating the persuasive influence of message clarity towards the public intentions to prepare (Bolkan et al., 2016; Furner & Zinko, 2017; Lindell et al., 2016).

6.4.11 Message Clarity has a Positive Relationship with Self-Efficacy

Table 6. 11: Synthesis of Message Clarity and Self-efficacy Relationship

Quantitative Results		Qualitative Results	
Hypothesis	Theme	Selected Qualitative Quotes	
H12 MC → + SE $\beta = 0.207$ C.R=3.981 P-Value=*** “Message clarity has a positive relationship with self-efficacy”	Information clarity empowers and facilitates skills development	“...content of flood preparedness messages disseminated in simple and clear language [message clarity] serves as a guide to enhance my skills and abilities [self-efficacy] in flood preparedness...” [OF-R6]	

Study findings from the quantitative results proved that a simple and clear message disseminated by flood experts helps to improve the skills and abilities of the public in adhering to flood preparedness recommended actions. Similarly, respondents from the qualitative study revealed that the simplicity of flood information received by the public enhances their abilities to put into action received messages. This is because flood information free from ambiguities is a recipe for the public to put into practice the recommended actions. The continuous process

recommended actions from experts. Similarly, findings from the qualitative study are in conformity with the quantitative results in that some respondents indicated that their receipt of adequate information on flood provides them with several options to deal with flood impacts. The public chooses to put into action any of the available options within their abilities to prepare towards flood. It was evident from the interview that the several options available to prepare towards flood hazards put residents on alert to embark on the recommended actions. Moreover, other respondents stated that the provision of adequate information from flood experts increased their skills in undertaking precautionary flood interventions to deal with flooding. In addition, the qualitative study revealed that the provision of sufficient flood information increases the public’s confidence and abilities to reduce flood impacts. This invariably encourages the recipients of flood messages to explain flood recommendations from experts to others lacking understanding. This finding underscores the influential role that adequate information provision plays in decision making (Camerini & Schulz, 2016; Thevissen et al., 2017).

6.4.13 Message Clarity has a Positive Relationship with Empowerment

Table 6. 13: Synthesis of Information Sufficiency and Message Clarity Relationship

Quantitative Results		Qualitative Results	
Hypothesis	Theme	Selected Qualitative Quotes	
H14 MC $\xrightarrow{+}$ EM $\beta=0.593$ C.R=14.669 P-Value=***	Provision of rich message content increases understanding and a motivation towards preparedness	“...flood information free of jargon and technicalities [message clarity] gives me the courage and eagerness [empowerment] to explain to other people who seek for clarification on flood issues...” [NI-R8]	
“Message clarity has a positive relationship with empowerment”	Information clarity empowers and facilitates skills development		

On one hand, the quantitative study found that the dissemination of simple and clear information encourages recipients of flood messages to take up preparedness intentions. This is because flood information free from ambiguities makes it easy for the public to comprehend, hence motivating them to take up actions geared towards flood risk reduction. On the other

hand, the qualitative results illustrated that a simple and clear message makes it easy for flood message recipients to act on recommendations. For instance, some respondents indicated that due to the simplicity and clarity of the messages they receive, they are encouraged to put into practice risk reduction recommended actions. Also, other respondents revealed that the clarity of the information received presents them the courage to explain it to neighbours, friends and community members who seek more information on flood preparedness. Respondents receiving flood preparedness information from significant others embarking on the recommended actions themselves are motivated to take precautionary actions as well. This finding coincides with prior studies indicating the influence that message clarity has on the motivation to take up advice (Bolkan et al., 2016; Titsworth, Mazer, Goodboy, Bolkan, & Myers, 2015).

6.4.14 Empowerment has a Positive Relationship with Self-Efficacy

Table 6. 14: Synthesis of Message Clarity and Self-efficacy Relationship

Quantitative Results		Qualitative Results	
Hypothesis		Theme	Selected Qualitative Quotes
H15		Information clarity empowers and facilitates skills development	“...the confidence I gain through discussions and experimentation with flood preparedness recommendations [empowerment] increases my skills in undertaking preparedness activities [self-efficacy]...” [OF-R7]
EM $\xrightarrow{+}$ SE			
$\beta=0.119$			
C.R=3.051			
P-Value=***			
“Empowerment has a positive relationship with self-efficacy”			

The quantitative results predicted that empowerment through the provision of clear, adequate and up to date flood information enhances the skills and abilities of the public to embark on recommended actions towards flood preparedness. Correspondingly, the qualitative studies suggested that the skills and abilities of message recipients are improved when they receive sufficient advice of recommended activities towards flood preparedness. In addition, further analysis of the qualitative results revealed that sufficient flood information does not solely enhance the improvement in the skills and abilities of the public. Rather, sufficient flood

information enhances the skills of the public when the adequate flood information received is put into action through experimentation. For instance, flood preparedness information such as clean-up exercise does not explain in detail the processes to follow. It became evident in the interview results that experimentation in such an exercise enhances the skills and abilities of the public to take up precautionary actions. This infers the critical role information provision plays towards the improvement of public skills in prior studies (Kim & Beehr, 2017; Moein et al., 2017).

6.4.15 Self-Efficacy has a Positive Relationship with Preparedness Intentions

Table 6. 15: Synthesis of Message Clarity and Self-Efficacy Relationship

Quantitative Results		Qualitative Results
Hypothesis	Theme	Selected Qualitative Quotes
H16 $SE \xrightarrow{+} IP$ $\beta=0.119$ $C.R=3.051$ $P\text{-Value}=***$ “Self-efficacy has a positive relationship with preparedness intentions”	Skills development aids preparedness intentions	“...during radio programs NADMO recommends that each household should have a flood preparedness and evacuation plan. Several people including myself know that having a preparation and evacuation plan is necessary to reduce death and injuries, but because we do not have the skills and resources [self-efficacy] to undertake recommended actions towards preparedness, I do not embark on some precautionary actions [intentions to prepare]...” [KO-R5]

The quantitative study revealed that when the skills and abilities to embark on flood recommended actions are enhanced, the public’s intentions to prepare towards flood hazard is high. This finding is supported by the qualitative results suggesting that the lack of skills and inabilities to implement recommended actions hinders the public decision towards preparedness. For instance, a public that has adequate and clear flood information from a credible source may not be able to take precautionary actions if they do not have the resources and capacity to act on it. This finding is in line with other similar studies iterating the relative importance of empowering the public with the skills and abilities to ensure increased disaster preparedness (Newnham et al., 2017; Ronan et al., 2015; Wirtz & Rohrbeck, 2018).

6.5 Model Interpretations

It is evident in the tested structural model that community participation (the continuous and regular exchange of flood risk information between flood experts and community members and community members themselves) plays a critical role in flood information exchange. This is intrinsic because community participation influences all the theoretical constructs used in the study apart from empowerment. Community participation openly provides a platform where flood risk information exchange and discussions take place. Community participation forums allow all stakeholders to ask questions on ambiguous areas of flood information exchanges and discussions. The answering of questions together with the explanation of answers where necessary clears all doubt and ambiguities and deepens stakeholders' understanding (message clarity) of issues under discussions. Deliberations on flood issues during continuous stakeholder engagement results in the discovery of new flood information to add up to an already existing flood risk knowledge (information sufficiency) through information sharing among stakeholders. Moreover, the initial stages of community participation gradually establish good rapport among stakeholders which eventually helps to build trust (source credibility) with time.

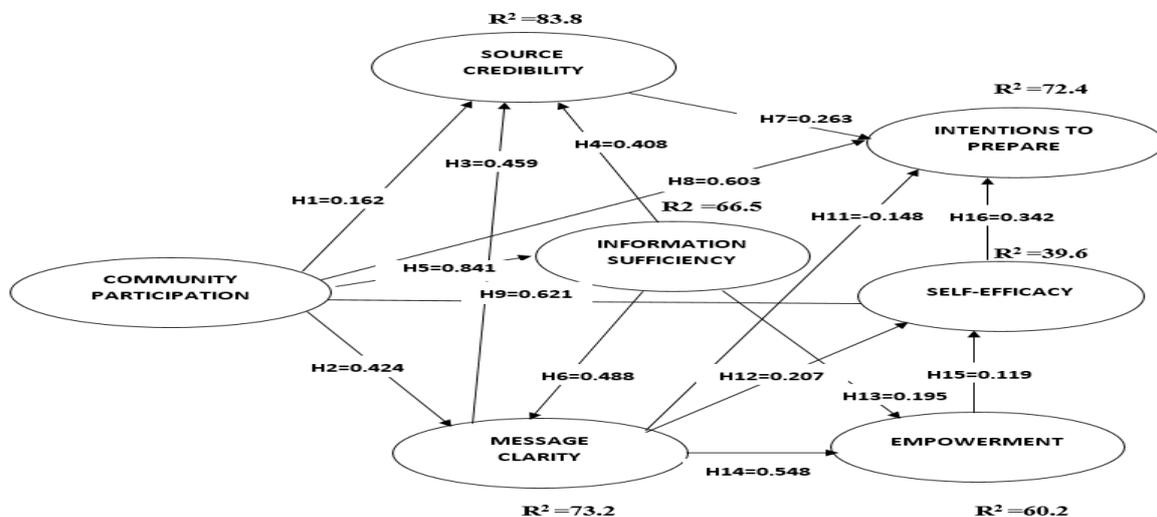


Figure 6. 1: Critical Constructs: Risk Communication and Intentions to Prepare

Information sufficiency impacts on message clarity and source credibility are also apparent in the tested structural model. Stakeholders in their quest to clarify technical and ambiguous aspects of flood issues under consideration provide additional information to add up to existing flood knowledge. The provision of adequate and clear flood information among stakeholders

strengthens the trust the audience of the message has in the source (source credibility). Furthermore, flood message recipients equipped with sufficient flood information free of technicalities motivates (empowers) positive decisions to take up precautionary actions towards preparedness. The empowerment of message recipients through the provision of sufficient and clear flood information helps to improve their skills and abilities (self-efficacy) especially when recommended actions are put into practice with guidance from flood experts.

The model further suggests that source credibility, information sufficiency, community participation, message clarity and self-efficacy are major determinants of intentions to prepare. With the exception of message clarity, all the remaining themes have a positive influence on intentions to prepare. The amount of trust (source credibility) the audience of a message has in the source influences their decision to prepare towards flood. Moreover, the public intention towards flood preparation is highly dependent on the quantity and quality of information (information sufficiency) available to them. Furthermore, the extent to which message audiences are engaged in flood risk discussions (community participation) influences their decisions to prepare towards flooding. Also, the skills to embark on recommended actions possessed by the audience of a message is a primary determinant of their preparedness intentions. Due to low levels of skills possessed by the study respondents, the audience received clear flood information but refused to prepare. This explains the negative relationship between clarity of flood messages and intentions to prepare towards flood hazard. In other words, the public receives clear messages but fails to prepare due to their low self-efficacy and lack of skills and tools to embark on recommended actions and fear of eviction.

6.5.1 Key Paths Towards Intentions to Prepare

- The Most Powerful Paths

The tested structural model indicates that community participation forms the basis of all paths leading to intentions to prepare. This portrays the critical role of community participation towards the effective dissemination of flood risk information to motivate preparedness intentions. Using the total correlation estimates between 2.5 and 1.5 ($2.5 < X > 1.5$) as a major criterion, the study found five most powerful paths, which are showed in Figure 6.2:

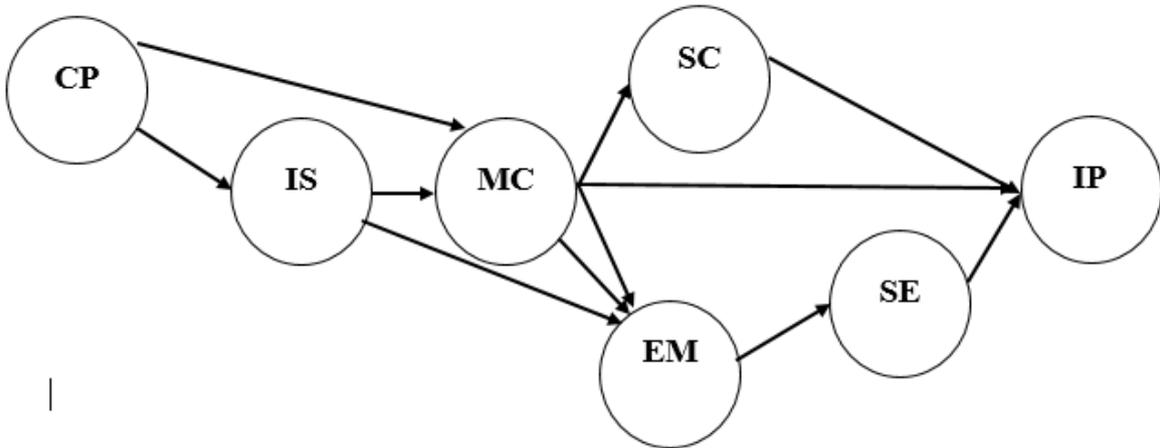


Figure 6. 2: Most Powerful Paths Towards Intentions to Prepare

- Moderate Powerful Paths

The study used total correlation estimates between one (1) and zero point five ($1 > x > 0.5$) as a criterion for moderate powerful paths. In relation to this, four (4) moderate powerful paths were identified as displayed in Figure 6.3.

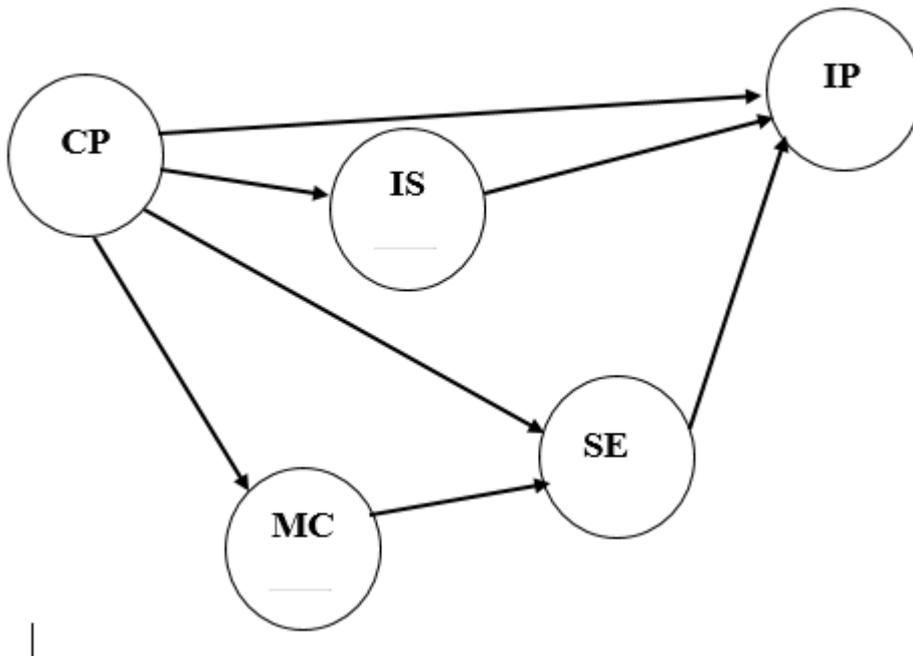


Figure 6. 3: Moderate Powerful Paths Towards Intentions To Prepare

- Least Powerful Path

The study identified one (1) least powerful path towards intentions to prepare using the criterion of total correlation estimates of less point 5 ($X < 0.5$) as a major criterion. Figure 6.4 summarises the least powerful paths towards intentions to prepare.

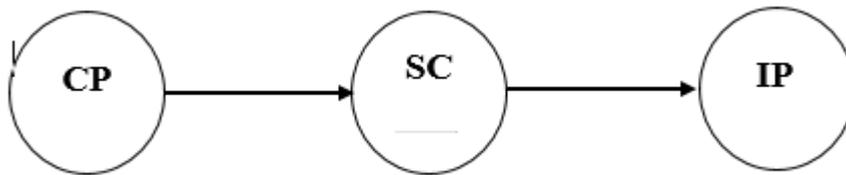


Figure 6. 4: Least Powerful Path

6.6 Implications of the Structural Model

6.6.1 Practical Implications

The study has provided useful information and valuable insight for disaster managers and risk communication professionals. The predictive ability of community participation to influence information sufficiency, message clarity, source credibility, self-efficacy and intentions to prepare to underscore the critical role community participation plays in the acceptance and adherence to communicated risk messages. The study finds that active involvement of the public in the design and implementation of risk communication plans is central to increased public intentions to prepare towards floods. It is suggested that policymakers strengthen policy and funding support for participatory approaches towards disaster risk communication and management.

Moreover, the study emphasises that the trust bestowed on the source of a message by the message audience is reliant on the source's ability to actively engage the public regularly, and provide sufficient disaster information in simple and clear terms for the lay public to understand. The receipt of adequate and clear risk messages from a credible source motivates a message audience to take precautionary actions. It is therefore proposed that risk communicators should make assessments of the clarity and sufficiency of the message content in the process of communication before dissemination.

Furthermore, the study reveals that the skills and abilities of the public to embark on recommended actions from experts is crucial. This is because the public may have valuable information with clear contents but may fail to prepare towards flood if they lack the skills and abilities to adhere to the received messages. Findings from this research advocates that risk communicators should pay additional attention to the development of the skills and abilities needed by the message audience to embark on recommended actions from experts.

6.6.2 Theoretical Implications

The study provides a significant contribution to theory because it is underpinned by two distinct theoretical perspectives that have yet to be applied in the context of this research. The protection motivation theory proposes that the public's decision to protect themselves from any harm or injury (disaster hazards) is first based on the assessment of their vulnerability and severity to the harm. Threat assessment is followed by a public assessment of their coping abilities (self-efficacy and response efficacy) to deal with the impending harm. Previous studies guided by PMT have mostly made use of existing constructs to either confirm or modify Rogers' theory. However, this study introduces additional assessments that the public makes when making decisions to protect themselves from flood disaster. The study indicates that the decision of the public to take precautionary actions towards an impending hazard or injury is not only dependent on threat and coping appraisals but also on the assessment of the amount of hazard information available to them (information sufficiency), clarity of information in their possession as well as the credibility of the information source. In addition, the study postulates that community participation is an antecedent to information sufficiency, clarity and source credibility. This finding expands existing knowledge of factors influencing preparedness intentions.

Moreover, the study modifies the information deficit theory mooted by Brian Wynne in the 1980s. The theory is anchored on two basic theoretical assumptions. Firstly, the model assumes that public scepticism about the communication of scientific findings is principally due to the lack of public knowledge about the topic and issues being communicated. Secondly, the proponent of the theory believes that the provision of sufficient information about the topic to fill the knowledge gap is the ideal approach to alleviate public scepticism (Brown, 2009; Miller, 1983; Miller, 2001). In recent times, the information deficit theory has lost popularity both in theory and practice due to enormous criticisms that have been levelled against it. This study contributes by making modifications to existing information deficit theory through the

introduction of additional variables. This study confirms Boykoff (2011) criticism that the provision of adequate information to fill up knowledge gaps is important but insufficient to create active behavioural engagement. Similarly, in the field of disaster management, critics have raised concerns about low levels of disaster preparedness globally amidst increasing expenditure on awareness creation through disaster education (Paton et al, 2000; Ballyntyne et al, 2000). The findings of the study propose that the provision of adequate information could instigate the intentions of the public to prepare towards disaster when the:

1. Audience of the message is willing to accept and embark on the recommended action.
2. Sufficient information received is simple, clear and concise.
3. Source of the information is credible and persuasive.
4. Message audience has the skills and abilities to adhere to recommended actions
5. Message source is accessible by the audience.
6. Relationship between community and message source is cordial.

6.7 Summary

In Chapter Six (6) findings from quantitative and qualitative studies were discussed and synthesised. In other words, results from the quantitative study (tested hypothesis) were discussed and explained using narratives from the qualitative study. Specifically, the triangulated results revealed that apart from the threats and coping appraisal the public makes as indicated by the protection motivation theory (PMT), the public also assesses the amount of hazard information available to them (information sufficiency), clarity of information in their possession as well as the credibility of the information source. Synthesised results also showed that community participation is an important platform that cannot be overlooked, especially if risk communication is to motivate the audience to take up precautionary measures.

The study also highlighted the underlying assumption that providing adequate flood information is necessary but insufficient to persuade and motivate the public to take precautionary measures. The research revealed that the provision of adequate flood information instigates public discussion and will motivate the public to take protective action if i) the audience of the message is willing to accept and embark on recommended action; ii) sufficient information received is simple, clear and concise; iii) the source of the information is credible and persuasive; iv) the message audience has the skills and abilities to adhere to recommended actions; v) the message source is accessible by the audience, and vi) the relationship between community and message source is cordial.

CHAPTER SEVEN

CONCLUSION

7.1 Introduction

Chapter Seven presents a summary of the overall research and conclusion of the study. The goal of this chapter is to:

- Present a background summary of the study
- Present a summary of the research aim and objectives
- Present directions for future research
- Present a concluding remark for the study

7.2 Background Summary to the Study

Disaster frequency and severity have been in ascendency for the past two decades, especially in developing countries of the world. Literature indicates that proportionally it is the poor that suffer most from the impacts of flood. Those residing in the urban areas of developing countries often find themselves in informal settlements – sections of the urban area that lie outside the scope of planning regulations and laws and are generally located in unsafe locations such as floodplains and marshes. The traditional structural approaches to disaster risk reduction have not seen expected attention and investment due to low-income levels of residents and neglect on the part of urban authorities towards the wellbeing of informal settlement dwellers. As a result, Brass (2012) and Subbiah et al. (2008) have recommended non-structural approaches as the most effective technique for disaster risk reduction.

Risk communication has been identified as one of the non-structural approaches to disaster risk reduction through the motivation and persuasion of “at risk” individuals to prepare before disaster strikes. Literature exploring and explaining the linkage between risk communication and preparedness is limited. Therefore, the aim of this study is *to investigate the relationship between flood risk communication and intentions to prepare towards flood hazard in informal settlements*. Through an understanding of this relationships, city authorities are better able to assist residents of informal settlements to better prepare towards flood hazards.

7.3 Addressing the Research Objectives

The study was guided by the research aim, question and objectives. Six (6) research objectives were developed to serve as a map for the study. The objectives of the study encompassed a

review of relevant literature on the key concepts, development of a theoretical model, research methodology, quantitative and qualitative analysis and the synthesis of results. The following sections identify each of the objectives and provide a commentary on how each of the research objectives was addressed.

- ***Objective One***

Review literature associated with the key concepts of informal settlements, risk communication and flood hazard preparation

Chapter One provided a snapshot of the background to the study and projected the underlying fact in the literature that risk communication's potential for disaster risk reduction is vast. One of the identified yet unexplored areas was coupling the concept of risk communication and disaster preparedness to investigate their relationships and linkages. Objective one was in Chapter Two of the study, where literature on the extent of disaster vulnerability and exposure in informal settlements was reviewed. The review of the literature on disaster vulnerability was followed by an investigation into how risk communication can be used as a tool to enhance disaster risk reduction through the motivation of "at risk" individuals to undertake precautionary measures towards preparedness.

The review of the literature found that the formation of informal settlement is a global phenomenon predominantly found in Asia, Africa and South American continents. Informal settlements harbours a quarter of the world's population and almost two-thirds of Africa's population with inhabitants lacking basic necessities of life such as quality housing and environmental sanitation located disaster hubs. Also, the review revealed that residents of informal settlements are aware of the disaster risk they are exposed to and consciously are ignored by government authorities in decisions of risk reduction and management. Due to the conscious efforts of such settlements being ignored, residents rely mostly on self-help initiatives and experience to cope and adopts to disaster hazards. Several studies including risk communication influence on people's perception and risk perception influence on disaster preparedness have received a lot of attention in the literature. However, in terms of risk communication influence on disaster preparedness, little has been done within the context of informal settlements.

- ***Objective Two***

Create a theoretical model of the influence of risk communication on preparation intentions towards flood hazard

Chapter Two again presented the theoretical basis of the proposed model of risk communication influence on disaster preparedness. The model encompasses risk communication variables (information sufficiency, message clarity and source credibility) and “societal governance” constructs (community participation, empowerment and self-efficacy). The theoretical model proposed sixteen (16) hypotheses, supported by the protection motivation theory and information deficit theory, predicting the intentions to prepare towards floods in informal settlements.

The theoretical model showed that community participation helps to strengthen the credibility of a communication source, increase the adequacy of hazard information available to the targeted audience and improves the clarity of risk message. More so, clarity of risk message and adequacy of risk information empowered message recipients to take up actions towards disaster preparedness. The empowerment of message audience and clarity of risk message increase the ability of message audience to embark on communicated information. The review found that community participation, message clarity, source credibility, information sufficiency and self-efficacy predict intentions of people to prepare towards disaster hazards.

- ***Objective Three***

Develop a convergent mixed research methodology to investigate how risk communication influences the intentions to prepare towards flood hazard

Chapter Three emphasizes the methodology used to answer the research question and accomplish the aim of the study. The study employed the convergent triangulation mixed research methodology involving a case study approach. Three informal settlements, namely Old Fadama, Kotobabi, and Nima in Accra, Ghana, were selected for the study because they are the largest, most populous settlements in the region and are acknowledged as the most culturally diverse (Ghana Statistical Service, 2010). In addition, these settlements are among the few informal settlements in the region that have suffered most from the devastating impact of flood over the period (Housing the Masses, 2010). Whereas the quantitative component of the study was underpinned by a positivist paradigm, the qualitative aspect was guided by the principles of constructivism. The quantitative and qualitative elements of the study,

respectively, tested the theoretical model using questionnaire survey data and explained the hypothesized relationships using qualitative narratives.

The review found that the choice of philosophical stance, research design and strategy is highly dependent on the research question. The purpose of this study was to test the hypothetical relationships between risk communication variables and preparedness and explain in details why the relationship exists between risk communication variable and disaster preparedness using qualitative narratives. The review found that pragmatism philosophy and mixed research design were appropriate for the study because they present an opportunity to adopt and combine the ideals of positivism and constructivism in a single study.

- ***Objective Four***

Perform SEM (Structural Equation Modelling) analyses to confirm the influence of risk communication on preparation intentions towards flood hazard using quantitative data from a questionnaire survey

Quantitative data consisting of 1064 responses were analysed using SPSS AMOS 24. Before the commencement of the quantitative analysis, data were screened (variable and case-by-case screening). The process of data screening helped to identify outliers and missing variables, which are agents of bias in quantitative studies. An exploratory factor analysis (EFA) employing the Maximum Likelihood Extraction and Promax Oblique Rotation Methods to reduce the set of variables measured each construct. This was followed by confirmatory factor analysis (CFA) to test how well the measured variables represented the latent constructs (community participation, information sufficiency, message clarity, source credibility empowerment, self-efficacy and intentions to prepare). Results of the CFA were used to run an overall structural equation modelling to test the hypothesised relationships between the constructs.

The tested model showed that community participation has a positive relationship with source credibility, information sufficiency, message clarity, self-efficacy and intentions to prepare. Information sufficiency also has a positive relationship between message clarity, source credibility and empowerment. Similarly, self-efficacy and source credibility have a positive relationship with intentions to prepare. However, message clarity has a negative relationship with intentions to prepare and the qualitative analysis showed that some residents in informal

settlement fail to invest in preparedness initiatives due to the fear of being evicted by government authorities and their inability to afford the resource needed to ensure their preparedness, even though they receive clear risk message from a credible source. The study also found that source credibility, information sufficiency, message clarity and self-efficacy explained 72.4 percent of variance in intentions to prepare. Also, community participation, message clarity and information sufficiency explained 83.8 percent of variance in source credibility. In addition, community participation and information sufficiency explained 73.2 percent of the variance in message clarity. More so, information sufficiency and message clarity, and message clarity and empowerment contributed 60.2 and 39.6 percent respectively of variance in empowerment and self-efficacy. The study also found that the most powerful path to intentions to prepare is CP → IS → MC → EM → SE → IP; the least powerful of all the paths is CP → SC → IP using total correlation estimates as the major criterion.

- **Objective Five**

Conduct case studies to explore the context-specific narratives on how risk communication influences preparation intentions towards flood hazard using qualitative data collected through an in-depth interview

Qualitative data involving twenty (20) household and three (3) institutional (NADMO) interviews. A six (6) step thematic analysis was undertaken to identify patterns and develop emerging themes from coded responses. Data collected from the field, which was audio recorded, was first transcribed verbatim and initial codes developed. The initial codes were categorized, and emerging themes developed. This was followed by a review and definition of the themes for the study. The outcome of the analysis indicated that the requirement for this objective was attained.

The study found that flood risk and its communication is context specific, however, issues such as causes of flood vulnerability and impacts were cross-cutting in all the selected communities. For instance, the most widely used medium of communication employed in all the three informal settlements was face-to-face communication. However, in terms of the approaches of flood risk communication, while in Old Fadama, NADMO predominantly relied on the use of social structures such as traditional authorities and OFDA to disseminate risk information, in Nima and Kotobabi, NADMO mostly reached community members through the distribution

of flyers in a house to house visit. In other instances too, NADMO in Nima and Kotobabi make use of community vans with megaphones to disseminate information.

- **Objective Six**

Explain how risk communication influences preparation intentions towards flood hazard by synthesising quantitative and qualitative results through integrative analysis.

The convergent triangulation was adopted to further explain the quantitative model using qualitative narratives. Results from quantitative (Chapter Four) and qualitative analysis (Chapter Five) were synthesized to compare how risk communication influences the public intentions to prepare toward flood. Requirements for the achievement of objective six were achieved.

The study found that community participation is an antecedent of source credibility, information sufficiency, message clarity and self-efficacy. Information sufficiency positively influences the message clarity, source credibility and empowerment. Similarly, self-efficacy and source credibility have a positive relationship with intentions to prepare. However, message clarity has a negative relationship with intentions to prepare.

7.4 Concluding Remarks

The study sought to investigate the relationship between flood risk communication and intentions to prepare towards flood hazards in informal settlements in three selected communities of the Greater Accra Metropolitan Area (GAMA) of Ghana. In view of the findings from the study, it can be asserted that the aim of the study has been achieved. The research aim was achieved by first reviewing in-depth literature on risk communication, disaster preparedness and informal settlements. The outcome of the literature review helped to develop a theoretical model with sixteen (16) hypotheses, supported by the protection motivation theory and information deficit theory. The proposed model predicted intentions to prepare towards flood hazards in informal settlements through ‘communication’ constructs (message clarity, information sufficiency and source credibility) and ‘societal governance’ constructs (community participation, empowerment and self-efficacy).

The literature review was followed by a methodology to confirm the theoretical model and explain the hypotheses using qualitative narratives. The study made use of the convergent triangulation mixed research methodology with a case study approach. The quantitative

component collected a total of 1064 survey questionnaires from three (3) informal settlements in the Greater Accra Area of Ghana (Old Fadama, Nima and Kotobabi) to test the proposed theoretical model. The theoretical model was tested using structural equation modelling (SEM) with Analysis of Moment Structure based on a quantitative dataset. Results of the SEM showed that the quantitative data supports fifteen (15) out of sixteen (16) hypothesized relationships. The study found that source credibility, community participation, message clarity, information sufficiency and self-efficacy explain 72.4 percent of variance in intentions to prepare towards flood hazards. Community participation, message clarity and information sufficiency account for 83.8 percent of variance in source credibility, and community participation and information sufficiency explain 73.2 percent of variance in message clarity.

The qualitative component sought to explain the tested hypothesis by using qualitative narratives collected from twenty-three (23) in-depth interviews consisting of twenty (20) households and three (3) institutional interviews. Following the six (6) step thematic analysis by Braun and Clarke (2006), findings from the qualitative analysis showed that regular exchanges of flood information between community members and experts strengthen message credibility, clarifies intent and increases sufficiency of flood information to the relevant audience. In addition, the research found that community participation improves skills and imparts positive attitudes to residents towards flood hazards preparedness. Overall, findings from the thematic analysis of the qualitative data both enhanced and provided context-specific explanations for the tested hypothesized paths. In other words, the synthesized results demonstrated strong support of both the quantitative and qualitative results

The study contributes to knowledge in the areas of communication, governance and psychological factors that motivate intentions to prepare towards flood hazards. The contributions of this study have been summarized under three broad headings, namely: contribution to theory, empirical contribution and contribution to methodology.

7.4.1 Contribution to Theory

One significant theoretical contribution of this study is in its expansion of the Protection Motivation Theory (PMT) and the information deficit model. PMT proposes that the public's decision to protect themselves from any harm or injury (disaster hazards in this case) is first based on the assessment of their vulnerability to and severity of the harm. That is, threat assessment is followed by public assessment of their coping abilities (self-efficacy and

response efficacy) to deal with the impending harm. Previous studies guided by PMT have mostly made use of existing constructs to either confirm or modify Roger's theory. This study, however, expands this by introducing additional assessments the public makes when taking decisions to protect themselves from flood disaster. This study showed that the decision of the public to take precautionary actions towards an impending hazard or injury is not only dependent on threat and coping appraisals but also on the assessment of the amount of hazard information available to them (information sufficiency), clarity of information in their possession as well as the credibility of the information source. Moreover, the study postulates that community participation is an antecedent to information sufficiency, clarity and source credibility. Moreover, the study indicated that effective community participation is a major determinant of information sufficiency, clarity and source credibility. Stated differently, the success of information sufficiency, clarity and source credibility towards intent for flood preparedness depends on community participation. This finding expands existing knowledge from information gaps to the characteristics of the specific information and its source as important for influencing preparedness intentions.

Similarly, the study modifies Brian Wynne's information deficit theory – which was formulated in 1980. The Information Deficit Theory is anchored on two basic theoretical assumptions. Firstly, the model assumes that public scepticism about the communication of scientific findings is principally due to the lack of public knowledge about the topic and issues being communicated. Secondly, the underlying belief that the provision of sufficient information about the topic to fill the knowledge gap – an important aim for Wynne – is the ideal approach to alleviate public scepticism. In recent times, however, the information deficit theory has lost popularity both in theory and practice due to enormous criticisms that have been levelled against it. In view of these criticisms, this study improves the relevance of the Information Deficit Theory in contemporary theoretical discourse through the introduction of additional variables for its modification. The study confirms the criticism by Boykoff (2011) that the provision of adequate information to fill up knowledge gaps is important but insufficient to create active behavioural engagement. In the field of disaster management, especially, critics have raised similar concerns on low levels of disaster preparedness globally despite increased expenditure on awareness creation through disaster education. The findings of the study both demonstrate and support the fact that the provision of adequate information could positively influence the intentions of the public to prepare towards disaster when: i) the audience of the message are willing to accept and embark on recommended action; ii) sufficient

information received is simple, clear and concise; iii) the source of the information is credible and persuasive; iv) the message's audience has the skills and abilities to adhere to recommended actions; v) the message source is easily accessible by the audience, and vi) the relationship between community and message source is cordial.

7.4.2 Empirical Contribution

The study has provided practical and context-specific evidence that is relevant to disaster managers, risk communication professionals and associated stakeholders. The predictive ability of community participation to influence information sufficiency, message clarity, source credibility, self-efficacy and intentions to prepare to underscore the critical role community participation plays in the acceptance and adherence to communicated risk messages. The study finds that active involvement of the public in the design and implementation of risk communication plans is central to increased public intention to prepare towards floods. It is suggested that policymakers strengthen policy and funding support for participatory approaches towards disaster risk communication and management at the local level. In addition, the study emphasises that the trust bestowed on the source of a message by the audience of a message is reliant on the source's ability to actively engage the public regularly and provide sufficient disaster information in simple and clear terms for the lay public to understand. Those who receive adequate and clear risk messages from a credible source motivate others (be it those within the general message audience or outside of it) to take precautionary actions. It is therefore proposed that risk communicators should pay careful attention to and scrutinise (message assessment) the clarity and sufficiency of the message content in the process of communication before dissemination.

Furthermore, the study categorises the paths for effective risk communication into powerful, moderately powerful and least powerful. While the most powerful path for effective flood risk communication is CP → IS → MC → EM → SE → IP, the least powerful path is CP → SC → IP. This categorisation can serve as a tool for disaster management professionals to identify the factors and indicators to use to examine how their risk communication strategies can potentially affect intentions for flood preparedness. In other words, this categorisation can provide a potent base for decision-making and selection of optimal strategies for risk communication towards flood disaster management.

7.4.3 Methodological Contribution

The study also contributes to an existing research methodology by employing a mixed method approach involving a case study strategy to explore a purely quantitative model. This is quite a unique methodological approach in the sense that it is the first of its kind coupling risk communication and disaster preparedness in a single study. Hence, it provides an avenue for researchers in the field to explore how such coupling techniques can advance new knowledge and innovations in disaster management and other related fields. Most importantly, it illustrates the merits and demerits of such techniques for both epistemological and ontological strands in disaster management and risk communication.

7.5 Directions for Future Research

Based on the findings from this research the following recommendations are suggested for further research in the future:

7.5.1 Extension of Research Geographical Coverage

This study was conducted in three informal settlements within the Greater Accra Region of Ghana. To enhance the generalisation of research findings, further research would need to be replicated in other informal settlements in Ghana and other developing countries.

7.5.2 Extension of Model to include Actual Preparedness

As confirmed in this research, risk communication which actively involves all stakeholders helps to align at-risk individuals' intentions to prepare towards flood. The intention-behaviour relationship has received attention in previous research, with findings being mixed. However, there has been little research in the field of disaster management testing intention-actual preparedness relationships. In addition, researchers should endeavour to investigate how risk communication influences actual preparedness. This research lays a foundation and draws other researchers' attention to the need to investigate intentions-actual preparedness, and risk communication-actual preparedness relationships.

7.5.3 Extent to Which the Use of Local Leaders Enhances Risk Communication in Informal Settlements

Programs and strategies for disaster hazards education, vulnerability reduction and risk communication have failed to achieve their predicted outcomes mainly due to several factors. One of the repetitive factors has been the inability of target audiences to understand and decode

messages. Instances from communication in African-American communities on Hurricane Katrina and the 2011 flooding in Queensland, Australia have been cited (Mayhorn and McLaughlin, 2014; Multicultural Development Association (MDA), 2011). Studies have found that communities with diverse populations, including informal settlements, see public authorities as threats to their lives and so they rely and believe more on interpersonal sources (Lindell & Perry, 2004; Spence et al., 2007). It is against this backdrop that this study suggests that further research should be embarked on to ascertain how, and the extent to which, local leaders (chiefs, queens, government representatives at the community level (assemblyperson)) influence residents to undertake precautionary activities through risk communication.

7.5.4 Explore Ideal Medium and Mode of Communication for Disaster Preparedness in Informal Settlements

Disaster preparedness makes a significant contribution towards the reduction of hazard consequences. Risk communication has been identified as one of the most effective tools for ensuring preparedness towards a hazard (Terpstra & Gutteling, 2008). Public education and awareness about hazard are not sufficient to ensure preparedness (Paton, 2003; Paton et al., 2005). Sound risk communication not only creates awareness and educates the public about risk, but also motivates actions through persuasion to enable preparatory measures to reduce the impacts posited by hazard risk. Vulnerabilities to disaster hazards in informal settlements are high but the best mode of communicating this has remained a daunting and confusing task. Channels of communication include face-to-face contact, telephone, radio, newspaper, television and Internet-mediated channels. Each medium of communication has its underlying strengths and weaknesses (Lindell, Tretyakov, Nikoskinen, & Ilvonen, 2001). For instance, due to the intermittent and erratic supply of electricity in informal settlements (Gilbert, 2014; Kamau & Njiru, 2018), television, radio, telephone and Internets channels of communication are not effective in communicating hazard risk. Similarly, the high level of unemployment and lower level of literacy and income levels in informal settlements (Hagan et al., 2016; Soyinka & Siu, 2017) impair communication through the written media. The study recommends future researchers explore the ideal medium and mode of communication in informal settlements.

7.5.5 Explore How and Extent to Which Community Participation Influences Preparedness in Informal Settlements.

Communication takes place within all the stages of the disaster management cycle. The widely accepted view that prevention is better than cure makes it evident that communication during

the pre-disaster phase is the most important among the phases. Communication during the pre-disaster phase of the disaster management cycle provides a platform where experts and community members interact to know each other better, create risk awareness and make a clear understanding of real and perceived risk as well as build trust and credibility. However, limited knowledge of how and the extent to which community participation influences disaster preparedness is rare. This study recommends future researchers explore this phenomenon.

7.5.6 Explore How Communication Sources Can Persuade Message Audience Towards Disaster Preparedness

Many strategies of risk communication have failed to inspire people to undertake precautionary measures towards disaster preparedness due to their lack of persuasiveness (Campbell & Babrow, 2004). Persuasions could emanate from the content of risk message or the source of risk communication. Persuasion is needed, together with awareness creation and risk education, to motivate people to take preparedness measures for disaster risks. Hazard risk is uncertain and has no clear-cut way of evolving. Authorities require additional skills of persuasion to drive home the perceptions and attitudes to community members in accordance with scientific outcomes (Clark, 1984; Cole & Fellows, 2008). The strategy involved in the process of persuasion should encourage and accommodate views of audiences from all angles. The effectiveness of risk communication towards preparedness does not only depend on the best strategies available but also exhaustively depends on the ability of communication sources and risk messages to persuade at-risk people to adhere to risk communication instructions. However, knowledge is limited about avenues and strategies that can help in the persuasion of at-risk individuals and communities to heed risk communication instructions.

7.5.7 Theories of Persuasive Risk Communication and Strategies Should Consider the Socio-Cultural Context in Which Risk Perception is Shaped and Communicated

The most common form of persuasion in disaster risk communication has been the use of informational and fear appeal (Reynolds & Seeger, 2005; Ruiters, Kessels, Peters, & Kok, 2014). This measure makes use of people's assessment of threat and coping factors. Even though the employment of fears to motivate and persuade people to take up protective and proactive actions towards disaster preparedness has contributed immensely towards disaster preparedness, yet more persuasion theories and studies are needed to augment the existing ones (Lindell & Perry, 2012). Furthermore, the heterogeneous nature of communities and risk

perceptions require that risk communication strategies must not be the same for all audiences. In other words, persuasive strategies mounted to motivate the message's audience must differ from each other.

Future theories should focus on appropriate approaches to divide at-risk community members into different segments in terms of their perceptions, beliefs, attitudes, gender etc. Moreover, experts should analyse these characteristics and provide persuasive strategies for each segment of the segregated population. It is therefore recommended that further research is needed to ascertain the best communication and persuasive strategies for each segment of the population.

References

- Abraham, E. M., Drechsel, P., & Cofie, O. (2006). *The Challenge of urban flood control: The case of Accra's Korle Lagoon*. Paper presented at the 5th Worldwide Workshop for Young Environmental Scientist in France, 8th-14th May.
- Abubakar, A., Romice, O., & Salama, A. M. (2017). Defining slums using multidimensional and relational properties: a dynamic framework for intervention. *ArchNet-IJAR: International Journal of Architectural Research*, 11(2), 34-54.
- Adams, K. A., & Lawrence, E. K. (2018). *Research methods, statistics, and applications*: Sage Publications.
- Adams, R. M., Prelip, M. L., Glik, D. C., Donatello, I., & Eisenman, D. P. (2018). Facilitating partnerships with community-and faith-based organizations for disaster preparedness and response: results of a national survey of public health departments. *Disaster medicine and public health preparedness*, 12(1), 57-66.
- Adhikari, M., Paton, D., Johnston, D., Prasanna, R., & McColl, S. T. (2018). Modelling predictors of earthquake hazard preparedness in Nepal. *Procedia engineering*, 212, 910-917.
- Aerts, J., Botzen, W., Clarke, K., Cutter, S., Hall, J. W., Merz, B., . . . Kunreuther, H. (2018). Integrating human behaviour dynamics into flood disaster risk assessment. *Nature Climate Change*, 1.
- Afeku, K. (2005). *Urbanization and flooding in Accra, Ghana*. Miami University,
- Agarwal, S., Satyavada, A., Kaushik, S., & Kumar, R. (2018). Urbanization, urban poverty and health of the urban poor: status, challenges and the way forward.
- Ahn, H. S., Bong, M., & Kim, S.-i. (2017). Social models in the cognitive appraisal of self-efficacy information. *Contemporary Educational Psychology*, 48, 149-166.
- Aid, A. (2006). Climate change, urban flooding and the rights of the urban poor in Africa. *Key findings from six African cities. A report by Action Aid International*.
- Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior 1. *Journal of applied social psychology*, 32(4), 665-683.
- Aldoory, L., & Van Dyke, M. A. (2006). The roles of perceived "shared" involvement and information overload in understanding how audiences make meaning of news about bioterrorism. *Journalism & Mass Communication Quarterly*, 83(2), 346-361.
- Aldrich, B. C., & Sandhu, R. S. (1995). *Housing the urban poor: policy and practice in developing countries*: Zed Books London.
- Alexander, M., Doorn, N., & Priest, S. (2018). Bridging the legitimacy gap—translating theory into practical signposts for legitimate flood risk governance. *Regional environmental change*, 18(2), 397-408.
- Alfieri, L., Burek, P., Feyen, L., & Forzieri, G. (2015). Global warming increases the frequency of river floods in Europe. *Hydrology and Earth System Sciences*, 19(5), 2247-2260.
- Allison, P. D. (2003). Missing data techniques for structural equation modeling. *Journal of abnormal psychology*, 112(4), 545.
- Alluhaidan, A., Chatterjee, S., Drew, D., & Stibe, A. (2018). *Sustaining Health Behaviors Through Empowerment: A Deductive Theoretical Model of Behavior Change Based on Information and Communication Technology (ICT)*. Paper presented at the International Conference on Persuasive Technology.
- Amis, P., & Lloyd, P. (2018). *Housing Africa's urban poor*: Routledge.
- Amoako, C. (2016). Brutal presence or convenient absence: The role of the state in the politics of flooding in informal Accra, Ghana. *Geoforum*, 77, 5-16.
- Amoako, C., & Boamah, E. F. (2017). Build as you earn and learn: informal urbanism and incremental housing financing in Kumasi, Ghana. *Journal of Housing and the Built Environment*, 32(3), 429-448.

- Amoako, C., & Frimpong Boamah, E. (2015). The three-dimensional causes of flooding in Accra, Ghana. *International Journal of Urban Sustainable Development*, 7(1), 109-129.
- Amri, A., Haynes, K., Bird, D. K., & Ronan, K. (2018). Bridging the divide between studies on disaster risk reduction education and child-centred disaster risk reduction: a critical review. *Children's Geographies*, 16(3), 239-251.
- Amuzu, D. (2018). Environmental injustice of informal e-waste recycling in Agbogbloshie-Accra: urban political ecology perspective. *Local Environment*, 23(6), 603-618.
- Andresen, B. B. (2018). The missing link between student capabilities and motivation: Perceived self-efficacy. *GSTF Journal on Education (JEd)*, 4(2).
- Andrulis, D. P., Siddiqui, N. J., & Gantner, J. L. (2007). Preparing racially and ethnically diverse communities for public health emergencies. *Health Affairs*, 26(5), 1269-1279.
- Anson, S., Watson, H., Wadhwa, K., & Metz, K. (2017). Analysing social media data for disaster preparedness: Understanding the opportunities and barriers faced by humanitarian actors. *International journal of disaster risk reduction*, 21, 131-139.
- Apatu, E., Gregg, C., Lindell, M. K., Hillhouse, J., & Wang, L. (2015). Survivors perceptions of stakeholders and the 2009 South Pacific tsunami. *Disaster Prevention and Management*, 24(5), 596-609.
- Appeaning Addo, K., Larbi, L., Amisigo, B., & Ofori-Danson, P. K. (2011). Impacts of coastal inundation due to climate change in a cluster of urban coastal communities in Ghana, West Africa. *Remote Sensing*, 3(9), 2029-2050.
- Araos, M., Ford, J., Berrang-Ford, L., Biesbroek, R., & Moser, S. (2017). Climate change adaptation planning for Global South megacities: the case of Dhaka. *Journal of Environmental Policy & Planning*, 19(6), 682-696.
- Arbuckle, J. L. (2010). IBM SPSS Amos 19 user's guide. *Crawfordville, FL: Amos Development Corporation*, 635.
- Arlikatti, S., Lindell, M. K., & Prater, C. S. (2007). Perceived stakeholder role relationships and adoption of seismic hazard adjustments. *International Journal of Mass Emergencies and Disasters*, 25(3), 218.
- Arnell, N. W., & Gosling, S. N. (2016). The impacts of climate change on river flood risk at the global scale. *Climatic Change*, 134(3), 387-401.
- Arnold Jr, C. L., & Gibbons, C. J. (1996). Impervious surface coverage: the emergence of a key environmental indicator. *Journal of the American planning Association*, 62(2), 243-258.
- Aryeetey-Attoh, S. (1998). Urban planning and management under Structural Adjustment. *The Political Economy of Housing and Urban Development in Africa: Ghana's Experience from Colonial Times to*, 333-356.
- Aven, T. (2011). *Quantitative risk assessment: the scientific platform*: Cambridge University Press.
- Aven, T., & Renn, O. (2009). On risk defined as an event where the outcome is uncertain. *Journal of Risk Research*, 12(1), 1-11.
- Babcicky, P., & Seebauer, S. (2017). The two faces of social capital in private flood mitigation: Opposing effects on risk perception, self-efficacy and coping capacity. *Journal of Risk Research*, 20(8), 1017-1037.
- Baker, J. L. (2012). *Climate change, disaster risk, and the urban poor: cities building resilience for a changing world*: The World Bank.
- Bakker, M. H., Kerstholt, J. H., & Giebels, E. (2018). Deciding to help: effects of risk and crisis communication. *Journal of contingencies and crisis management*, 26(1), 113-126.

- Ballantyne, M. (2000). *Information on volcanic and earthquake hazards: the impact on awareness and preparation*: Institute of Geological & Nuclear Sciences.
- Bandura, A. (1977). Self-efficacy: Toward a Unifying Theory of Behavioral Change. *Psychological Review*, 84(2), 191-215.
- Bandura, A. (2007). Much ado over a faulty conception of perceived self-efficacy grounded in faulty experimentation. *Journal of Social and Clinical Psychology*, 26(6), 641-658.
- Barclay, D., Higgins, C., & Thompson, R. (1995). *The Partial Least Squares (pls) Approach to Casual Modeling: Personal Computer Adoption Ans Use as an Illustration*.
- Barclay, J., Haynes, K., Mitchell, T., Solana, C., Teeuw, R., Darnell, A., . . . Lowe, C. (2008). Framing volcanic risk communication within disaster risk reduction: finding ways for the social and physical sciences to work together. *Geological Society, London, Special Publications*, 305(1), 163-177.
- Barnett, J., & Breakwell, G. M. (2001). Risk perception and experience: Hazard personality profiles and individual differences. *Risk analysis*, 21(1), 171-178.
- Barreiro, P. L., & Albandoz, J. P. (2001). Population and sample. Sampling techniques. *Management mathematics for European schools*, 6.
- Basher, R. (2006). Global early warning systems for natural hazards: systematic and people-centred. *Philosophical Transactions of the Royal Society of London A: Mathematical, Physical and Engineering Sciences*, 364(1845), 2167-2182.
- Basolo, V., Steinberg, L. J., Burby, R. J., Levine, J., Cruz, A. M., & Huang, C. (2009). The effects of confidence in government and information on perceived and actual preparedness for disasters. *Environment and behavior*, 41(3), 338-364.
- Beck, U. (2013). Risk Society Revisited: eory, Politics and Research Programmes. In *The sociology of risk and gambling reader* (pp. 68-90): Routledge.
- Becker, J. S., Paton, D., Johnston, D. M., & Ronan, K. R. (2012). A model of household preparedness for earthquakes: How individuals make meaning of earthquake information and how this influences preparedness. *Natural hazards*, 64(1), 107-137. doi:10.1007/s11069-012-0238-x
- Beggs, J. C. (2018). Applications: Disaster Communication and Community Engagement. In *Disaster Epidemiology* (pp. 163-169): Elsevier.
- Belsley, D. A., Kuh, E., & Welsch, R. E. (2005). *Regression diagnostics: Identifying influential data and sources of collinearity* (Vol. 571): John Wiley & Sons.
- Bennett, G., Kean, J., Rengers, F., Ryan, S., & Rathburn, S. (2017). *Landslide-channel feedbacks amplify flood response and channel erosion*. Paper presented at the EGU General Assembly Conference Abstracts.
- Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological bulletin*, 107(2), 238.
- Bentler, P. M., & Chou, C.-P. (1987). Practical issues in structural modeling. *Sociological Methods & Research*, 16(1), 78-117.
- Beretta, S., & Bozzolan, S. (2004). A framework for the analysis of firm risk communication. *The International Journal of Accounting*, 39(3), 265-288.
- Bernard, H. R. (2017). *Research methods in anthropology: Qualitative and quantitative approaches*: Rowman & Littlefield.
- Bernard, H. R., & Bernard, H. R. (2012). *Social research methods: Qualitative and quantitative approaches*: Sage.
- Biesta, G., & Burbules, N. (2003). *Pragmatism and educational research. Philosophy, theory, and educational research*: Lanham, MD: Rowman & Littlefield.
- Bin Wan Abdul Majid, W., Brown, E., Bin Osman, S., Bin Asan, G., Bin Osman, A., Bin Samsudin, R., . . . Ahmad, F. (2017). Flood forecasting and warning for Muar River: non-structural measures for flood mitigation.

- Biney, C. (1982). Preliminary survey of the state of pollution of the coastal environment of Ghana. *Oceanologica Acta, Special issue*.
- Black, S. A., & Porter, L. J. (1996). Identification of the critical factors of TQM. *Decision sciences*, 27(1), 1-21.
- Blanchard-Boehm, R. D., & Cook, M. J. (2004). Risk communication and public education in Edmonton, Alberta, Canada on the 10th anniversary of the 'Black Friday' tornado. *International Research in Geographical & Environmental Education*, 13(1), 38-54.
- Blumberg, B., Cooper, D., & Schindler, P. (2005). Survey research. *Business research methods*, 243-276.
- Boase, N., White, M., Gaze, W., & Redshaw, C. (2017). Evaluating the mental models approach to developing a risk communication: A scoping review of the evidence. *Risk analysis*, 37(11), 2132-2149.
- Bolkan, S., Goodboy, A. K., & Kelsey, D. M. (2016). Instructor Clarity and Student Motivation: Academic Performance as A Product of Students' Ability and Motivation to Process Instructional Material. *Communication Education*, 65(2), 129-148. doi:10.1080/03634523.2015.1079329
- Bortz, J., & Döring, N. (2007). *Forschungsmethoden und Evaluation für Human-und Sozialwissenschaftler: Limitierte Sonderausgabe*: Springer-Verlag.
- Botzen, W., Aerts, J., & Van Den Bergh, J. (2009). Dependence of flood risk perceptions on socioeconomic and objective risk factors. *Water Resources Research*, 45(10).
- Bourke, S. (2018). Survey of non-invasive ventilation use in ALS in Britain: authors' response.
- Bourque, L., & Fielder, E. P. (2003). *How to conduct self-administered and mail surveys* (Vol. 3): Sage.
- Bourque, L. B., Regan, R., Kelley, M. M., Wood, M. M., Kano, M., & Mileti, D. S. (2013). An examination of the effect of perceived risk on preparedness behavior. *Environment and behavior*, 45(5), 615-649.
- Boykoff, M. (2012). Who speaks for the climate? Making sense of media reporting on climate change. *Environment and Planning A*, 44, 2785-2786.
- Boykoff, M. T. (2011). *Who speaks for the climate?: Making sense of media reporting on climate change*: Cambridge University Press.
- Brace, I. (2018). *Questionnaire design: How to plan, structure and write survey material for effective market research*: Kogan Page Publishers.
- Bradford, R., O'Sullivan, J., Van der Craats, I., Krywkow, J., Rotko, P., Aaltonen, J., . . . Schelfaut, K. (2012). Risk perception—issues for flood management in Europe. *Natural Hazards and Earth System Sciences*, 12(7), 2299-2309.
- Brass, J. N. (2012). Blurring boundaries: The integration of NGOs into governance in Kenya. *Governance*, 25(2), 209-235.
- Braun, B., & Abheuer, T. (2011). Floods in megacity environments: vulnerability and coping strategies of slum dwellers in Dhaka/Bangladesh. *Natural Hazards*, 58(2), 771-787.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. doi:10.1191/1478088706qp063oa
- Braun, V., Clarke, V., & Terry, G. (2014). Thematic analysis. *Qual Res Clin Health Psychol*, 24, 95-114.
- Breakwell, G. M. (2000). Risk communication: factors affecting impact. *British medical bulletin*, 56(1), 110-120.
- Broeckelman-Post, M. A., Tacconelli, A., Guzmán, J., Rios, M., Calero, B., & Latif, F. (2016). Teacher misbehavior and its effects on student interest and engagement. *Communication Education*, 65(2), 204-212.

- Brouwers, M. C., & Sorrentino, R. M. (1993). Uncertainty orientation and protection motivation theory: The role of individual differences in health compliance. *Journal of Personality and Social Psychology*, 65(1), 102.
- Brown, A., Msoka, C., & Dankoco, I. (2015). A refugee in my own country: Evictions or property rights in the urban informal economy? *Urban Studies*, 52(12), 2234-2249.
- Brown, S. (2009). The new deficit model. *Nature nanotechnology*, 4(10), 609.
- Bryman, A., & Cramer, D. (2005). Quantitative data analysis with SPSS 12 and 13. London, New York.
- Bubeck, P., Kreibich, H., Penning-Rowsell, E. C., Botzen, W., De Moel, H., & Klijn, F. (2017). Explaining differences in flood management approaches in Europe and in the USA—a comparative analysis. *Journal of Flood Risk Management*, 10(4), 436-445.
- Bubeck, P., Wouter Botzen, W., Laudan, J., Aerts, J. C., & Thieken, A. H. (2018). Insights into Flood-Coping Appraisals of Protection Motivation Theory: Empirical Evidence from Germany and France. *Risk analysis*, 38(6), 1239-1257.
- Bui, L. (2018). Island Cities and Disaster Risk: A Study of San Juan's Hurricane Early Warning System.
- Bulte, E., Xu, L., & Zhang, X. (2018). Post-disaster aid and development of the manufacturing sector: Lessons from a natural experiment in China. *European Economic Review*, 101, 441-458.
- Burger, J. M., & Palmer, M. L. (1992). Changes in and generalization of unrealistic optimism following experiences with stressful events: Reactions to the 1989 California earthquake. *Personality and Social Psychology Bulletin*, 18(1), 39-43.
- Byrne, B. M. (2016). *Structural equation modeling with AMOS: Basic concepts, applications, and programming*: Routledge.
- Camerini, A. L., & Schulz, P. J. (2016). Patients' need for information provision and perceived participation in decision making in doctor-patient consultation: Micro-cultural differences between French- and Italian-speaking Switzerland. *Patient Education and Counseling*, 99(3), 462-469. doi:10.1016/j.pec.2015.10.018
- Campbell, R. G., & Babrow, A. S. (2004). The role of empathy in responses to persuasive risk communication: Overcoming resistance to HIV prevention messages. *Health Communication*, 16(2), 159-182.
- Case, K. R., Lazard, A. J., Mackert, M. S., & Perry, C. L. (2018). Source credibility and e-cigarette attitudes: implications for tobacco communication. *Health communication*, 33(9), 1059-1067.
- Castree, N. (2008). Neoliberalising nature: the logics of deregulation and reregulation. *Environment and Planning A*, 40(1), 131-152.
- Cattell, R. B., & Vogelmann, S. (1977). A comprehensive trial of the scree and KG criteria for determining the number of factors. *Multivariate behavioral research*, 12(3), 289-325.
- Chan, E. Y., & Ho, J. Y. (2018). Urban community disaster and emergency health risk perceptions and preparedness. In *Science and Technology in Disaster Risk Reduction in Asia* (pp. 95-110): Elsevier.
- Chand, S., & Yala, C. (2008). Informal land systems within urban settlements in Honiara and Port Moresby. *Making land work*, 2, 85-106.
- Chatterjee, M. (2010). Slum dwellers response to flooding events in the megacities of India. *Mitigation and Adaptation Strategies for Global Change*, 15(4), 337-353.
- Chen, Z.-S. (2017). Metal contamination of flooded soils, rice plants, and surface waters. In *Biogeochemistry of trace metals* (pp. 97-120): CRC Press.
- Cheng, S. S. (2013). Crisis communication failure: A case study of typhoon Morakot. *Asian Social Science*, 9(3), 18.

- Chesebro, J. L., & McCroskey, J. C. (1998). The development of the teacher clarity short inventory (TCSI) to measure clear teaching in the classroom. *Communication Research Reports, 15*(3), 262-266.
- Chess, C. (2001). Organizational theory and the stages of risk communication. *Risk analysis, 21*(1), 179-188.
- Chiloane-Tsoka, E., & Mmako, N. (2018). Effects of migration and immigration on SMMEs: The case study of Diepsloot informal settlement, South Africa. *Management, 12*, 4.
- Chin, W. W., Marcolin, B. L., & Newsted, P. R. (2003). A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study. *Information systems research, 14*(2), 189-217.
- Choguill, C. L. (1996). Toward sustainability of human settlements. *Habitat International, 20*(3), v-viii.
- Clark, R. A. (1984). *Persuasive messages*: HarperCollins Publishers.
- Clark, R. A., Bryant, A. L., Pua, Y., McCrory, P., Bennell, K., & Hunt, M. (2010). Validity and reliability of the Nintendo Wii Balance Board for assessment of standing balance. *Gait & posture, 31*(3), 307-310.
- Cohen, L., Manion, L., & Morrison, K. (2013). Validity and reliability. In *Research methods in education* (pp. 203-240): Routledge.
- Cole, T. W., & Fellows, K. L. (2008). Risk communication failure: A case study of New Orleans and Hurricane Katrina. *Southern Communication Journal, 73*(3), 211-228.
- Coombs, W. T. (2010). Parameters for crisis communication. *The handbook of crisis communication, 17-53*.
- Coombs, W. T. (2014). *Ongoing crisis communication: Planning, managing, and responding*: Sage Publications.
- Coppola, D. P. (2006). *Introduction to international disaster management*: Elsevier.
- Covello, V. T. (2003). Best practices in public health risk and crisis communication. *Journal of health communication, 8*(S1), 5-8.
- Covello, V. T., McCallum, D. B., & Pavlova, M. T. (2012). *Effective risk communication: the role and responsibility of government and nongovernment organizations* (Vol. 4): Springer Science & Business Media.
- Creswell, J. W. (2002). *Educational research: Planning, conducting, and evaluating quantitative*: Prentice Hall Upper Saddle River, NJ.
- Creswell, J. W. (2014). *A concise introduction to mixed methods research*: Sage Publications.
- Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*: Sage publications.
- Creswell, J. W., Plano Clark, V. L., Gutmann, M. L., & Hanson, W. E. (2003). Advanced mixed methods research designs. *Handbook of mixed methods in social and behavioral research, 209, 240*.
- Cretney, R. M. (2016). Local responses to disaster: The value of community led post disaster response action in a resilience framework. *Disaster Prevention and Management, 25*(1), 27-40.
- Crocker, L., & Algina, J. (1986). *Introduction to classical and modern test theory*: ERIC.
- Cronbach, L. J., & Shavelson, R. J. (2004). My current thoughts on coefficient alpha and successor procedures. *Educational and Psychological Measurement, 64*(3), 391-418.
- Crouch, M., & McKenzie, H. (2006). The logic of small samples in interview-based qualitative research. *Social science information, 45*(4), 483-499.
- Csikszentmihalyi, M., & Larson, R. (2014). Validity and reliability of the experience-sampling method. In *Flow and the foundations of positive psychology* (pp. 35-54): Springer.

- Curnin, S., Owen, C., Paton, D., Trist, C., & Parsons, D. (2015). Role clarity, swift trust and multi-agency coordination. *Journal of contingencies and crisis management*, 23(1), 29-35. doi:10.1111/1468-5973.12072
- Cutter, S. L., Emrich, C. T., Gall, M., & Reeves, R. (2017). Flash flood risk and the paradox of urban development. *Natural Hazards Review*, 19(1), 05017005.
- Da Silva, J., Lubkowski, Z., & Batchelor, V. (2010). *Lessons from Aceh: key considerations in post-disaster reconstruction*: Practical Action Rugby.
- Dalu, M. T., Shackleton, C. M., & Dalu, T. (2018). Influence of land cover, proximity to streams and household topographical location on flooding impact in informal settlements in the Eastern Cape, South Africa. *International journal of disaster risk reduction*, 28, 481-490.
- Davis, S., Frankenberry, N., Godlove, T. F., Kahn, J. S., Kitcher, P., Proudfoot, W., . . . Wetzel, J. (2018). *Pragmatism and Naturalism: Scientific and Social Inquiry After Representationalism*: Columbia University Press.
- de Brito, M. M., Evers, M., Almoradie, S., & Delos, A. (2018). Participatory flood vulnerability assessment: a multi-criteria approach. *Hydrology & Earth System Sciences*, 22(1).
- De Meulenaer, S., De Pelsmacker, P., & Dens, N. (2018). Power Distance, Uncertainty Avoidance, and the Effects of Source Credibility on Health Risk Message Compliance. *Health Communication*, 33(3), 291-298. doi:10.1080/10410236.2016.1266573
- De Risi, R., Jalayer, F., De Paola, F., Iervolino, I., Giugni, M., Topa, M., . . . Gasparini, P. (2013). Flood risk assessment for informal settlements. *Natural Hazards*, 69(1), 1003-1032.
- DE SWAEF, T. (2016). *Use of New Media for Emergency Communication by Nuclear Emergency Management Authorities*. University of Antwerp,
- de Winter*, J. d., Dodou*, D., & Wieringa, P. (2009). Exploratory factor analysis with small sample sizes. *Multivariate behavioral research*, 44(2), 147-181.
- Del Mistro, R., & A. Hensher, D. (2009). Upgrading informal settlements in South Africa: Policy, rhetoric and what residents really value. *Housing Studies*, 24(3), 333-354.
- Denzin, N. K. (2017). *The research act: A theoretical introduction to sociological methods*: Routledge.
- Denzin, N. K., & Lincoln, Y. S. (2000). Strategies of inquiry. *Handbook of qualitative research*, 2, 367-378.
- Desai, B., Maskrey, A., Peduzzi, P., De Bono, A., & Herold, C. (2015). Making Development Sustainable: The Future of Disaster Risk Management, Global Assessment Report on Disaster Risk Reduction.
- Desai, R. (2012). Governing the urban poor: Riverfront development, slum resettlement and the politics of inclusion in Ahmedabad. *Economic and Political Weekly*, 49-56.
- DeSimone, J. A., Harms, P. D., & DeSimone, A. J. (2015). Best practice recommendations for data screening. *Journal of Organizational Behavior*, 36(2), 171-181.
- DeVellis, R. F. (2006). Classical test theory. *Medical care*, S50-S59.
- Dewan, T. H. (2015). Societal impacts and vulnerability to floods in Bangladesh and Nepal. *Weather and Climate Extremes*, 7, 36-42.
- Diagne, K. (2007). Governance and natural disasters: addressing flooding in Saint Louis, Senegal. *Environment and Urbanization*, 19(2), 552-562.
- Diakakis, M., Deligiannakis, G., Pallikarakis, A., & Skordoulis, M. (2017). Identifying elements that affect the probability of buildings to suffer flooding in urban areas using Google Street View. A case study from Athens metropolitan area in Greece. *International journal of disaster risk reduction*, 22, 1-9.
- Dick, B. (2002). Convergent interviewing. Session 8 of Areol-action research and evaluation. *Southern Cross University*.

- Dickson, D. (2005). The case for a 'deficit model' of science communication. *SciDev. net*, 27.
- Doberstein, B., & Stager, H. (2013). Towards guidelines for post-disaster vulnerability reduction in informal settlements. *Disasters*, 37(1), 28-47.
- DONG, W. (2018). Combining Earth Observation and Social Media Data for Informal Settlements Identification in Dar es Salaam, Tanzania.
- Donner, W., & Rodríguez, H. (2008). Population composition, migration and inequality: The influence of demographic changes on disaster risk and vulnerability. *Social forces*, 87(2), 1089-1114.
- Dörnyei, Z. (2007). *Research methods in applied linguistics: Quantitative, qualitative, and mixed methodologies*: Oxford University Press.
- Doss, D. A., Mcelreath, D., Goza, R., Tesiero, R., Gokaraju, B., & Henley, R. (2018). Assessing the recovery aftermaths of selected disasters in the Gulf of Mexico. *Logistics & Sustainable Transport*, 9(1), 1-10.
- Douglas, M. (2013). *Risk and blame*: Routledge.
- Drabek, T. E. (2012). *Human system responses to disaster: An inventory of sociological findings*: Springer Science & Business Media.
- Du, S., Shi, P., Van Rompaey, A., & Wen, J. (2015). Quantifying the impact of impervious surface location on flood peak discharge in urban areas. *Natural hazards*, 76(3), 1457-1471.
- Durand-Lasserve, A. (2006). Informal settlements and the Millennium Development Goals: global policy debates on property ownership and security of tenure. *Global Urban Development*, 2(1), 1-15.
- Durand-Lasserve, A., & Royston, L. (2002). *Holding their ground: Secure land tenure for the urban poor in developing countries*: Earthscan.
- Duval, T. S., & Mulilis, J. P. (1999). A Person-Relative-to-Event (PrE) Approach to Negative Threat Appeals and Earthquake Preparedness: A Field Study 1. *Journal of applied social psychology*, 29(3), 495-516.
- Dworkin, S. L. (2012). Sample size policy for qualitative studies using in-depth interviews. In: Springer.
- Dziuban, C. D., & Shirkey, E. C. (1974). When is a correlation matrix appropriate for factor analysis? Some decision rules. *Psychological Bulletin*, 81(6), 358.
- Earle, T. C. (2004). Thinking aloud about trust: A protocol analysis of trust in risk management. *Risk Analysis: An International Journal*, 24(1), 169-183.
- Eisenman, D. P., Wold, C., Fielding, J., Long, A., Setodji, C., Hickey, S., & Gelberg, L. (2006). Differences in individual-level terrorism preparedness in Los Angeles County. *American journal of preventive medicine*, 30(1), 1-6.
- Enders, C. K., & Bandalos, D. L. (2001). The relative performance of full information maximum likelihood estimation for missing data in structural equation models. *Structural equation modeling*, 8(3), 430-457.
- Eng, E., & Parker, E. (1994). Measuring community competence in the Mississippi Delta: The interface between program evaluation and empowerment. *Health Education Quarterly*, 21(2), 199-220.
- Eriksen, C., & Prior, T. (2013). Defining the importance of mental preparedness for risk communication and residents well-prepared for wildfire. *International journal of disaster risk reduction*, 6, 87-97.
- Erman, A., Motte, E., Goyal, R., Asare, A., Takamatsu, S., Chen, X., . . . Hallegatte, S. (2018). The road to recovery: the role of poverty in the exposure, vulnerability and resilience to floods in Accra. In: The World Bank.
- Esteban, M., Takagi, H., Mikami, T., Aprilia, A., Fujii, D., Kurobe, S., & Utama, N. A. (2017). Awareness of coastal floods in impoverished subsiding coastal communities in Jakarta:

- tsunamis, typhoon storm surges and dyke-induced tsunamis. *International journal of disaster risk reduction*, 23, 70-79.
- Fan, W., & Williams, C. M. (2010). The effects of parental involvement on students' academic self-efficacy, engagement and intrinsic motivation. *Educational psychology*, 30(1), 53-74.
- Faria, R., Gomes, M., Epstein, D., & White, I. R. (2014). A guide to handling missing data in cost-effectiveness analysis conducted within randomised controlled trials. *Pharmacoeconomics*, 32(12), 1157-1170.
- Farmer, S. M., & Tierney, P. (2017). Considering creative self-efficacy: Its current state and ideas for future inquiry. In *The creative self* (pp. 23-47): Elsevier.
- Fearnley, C., Winson, A. E. G., Pallister, J., & Tilling, R. (2017). Volcano crisis communication: challenges and solutions in the 21st century.
- Fekade, W. (2000). Deficits of formal urban land management and informal responses under rapid urban growth, an international perspective. *Habitat International*, 24(2), 127-150.
- Fields, D. J., & Hodkinson, S. N. (2018). Housing Policy in Crisis: An International Perspective. In: Taylor & Francis.
- Finch, K. C., Snook, K. R., Duke, C. H., Fu, K.-W., Tse, Z. T. H., Adhikari, A., & Fung, I. C.-H. (2016). Public health implications of social media use during natural disasters, environmental disasters, and other environmental concerns. *Natural Hazards*, 83(1), 729-760.
- Fischhoff, B. (2012). *Communicating risks and benefits: An evidence based user's guide*: Government Printing Office.
- Fischhoff, B., Watson, S. R., & Hope, C. (1984). Defining risk. *Policy sciences*, 17(2), 123-139.
- Floyd, D. L., Prentice-Dunn, S., & Rogers, R. W. (2000). A meta-analysis of research on protection motivation theory. *Journal of applied social psychology*, 30(2), 407-429.
- Fornell, C., & Larcker, D. (1981). Structural equation modeling and regression: guidelines for research practice. *Journal of Marketing Research*, 18(1), 39-50.
- Fox, S. (2014). The political economy of slums: Theory and evidence from Sub-Saharan Africa. *World Development*, 54, 191-203.
- Frewer, L. (2004). The public and effective risk communication. *Toxicology Letters*, 149(1-3), 391-397.
- Frick-Trzebitzky, F., Baghel, R., & Bruns, A. (2017). Institutional bricolage and the production of vulnerability to floods in an urbanising delta in Accra. *International journal of disaster risk reduction*, 26, 57-68.
- Friestad, M., & Thorson, E. (1985). The Role of Emotion in Memory for Television Commercials.
- Frimpong, A. (2013). Perennial Floods in the Accra Metropolis: Dissecting the Causes and Possible Solutions. *African Social Science Review*, 6(1).
- Furner, C. P., & Zinko, R. A. (2017). The influence of information overload on the development of trust and purchase intention based on online product reviews in a mobile vs. web environment: an empirical investigation. *Electronic Markets*, 27(3), 211-224. doi:10.1007/s12525-016-0233-2
- Fusch, P. I., & Ness, L. R. (2015). Are we there yet? Data saturation in qualitative research. *The qualitative report*, 20(9), 1408-1416.
- Galperin, B. L., Michaud, J., Senaji, T. A., & Taleb, A. (2018). Perceptions of Leadership Effectiveness among the African Diaspora in Canada and USA. *Journal of African Business*, 1-21.

- Garcia-Marques, T., & Loureiro, F. (2016). Dispositional beliefs regarding affect as information determine the perception of persuasive self-efficacy. *Análise Psicológica*, 34(1), 73-86.
- Garson, G. D. (2012). Testing statistical assumptions. *Asheboro, NC: Statistical Associates Publishing*.
- Gaskin, J., & Lim, J. (2016). Model Fit Measures. *Gaskination's StatWiki*.
- Geaves, L. H., & Penning-Rowsell, E. C. (2016). Flood risk management as a public or a private good, and the implications for stakeholder engagement. *Environmental Science & Policy*, 55, 281-291.
- Gencer, E. A. (2013). Natural disasters, urban vulnerability, and risk management: a theoretical overview. In *The interplay between urban development, vulnerability, and risk management* (pp. 7-43): Springer.
- Gilbert, A. (2014). Housing the urban poor. *The companion to development studies*, 21, 257-262.
- Gillespie, T. (2018). Collective Self-Help, Financial Inclusion, and the Commons: Searching for Solutions to Accra's Housing Crisis. *Housing Policy Debate*, 28(1), 64-78.
- Gillham, B. (2000). *Case study research methods*: Bloomsbury Publishing.
- Girons Lopez, M., Di Baldassarre, G., & Seibert, J. (2017). Impact of social preparedness on flood early warning systems. *Water Resources Research*, 53(1), 522-534.
- Glasser, M. (1964). Linear regression analysis with missing observations among the independent variables. *Journal of the American Statistical Association*, 59(307), 834-844.
- Glik, D. C. (2007). Risk communication for public health emergencies. *Annu. Rev. Public Health*, 28, 33-54.
- Gonmei, Z., Siddhu, A., Toteja, G. S., Dwivedi, S., & Vikram, N. K. (2018). SOCIO DEMOGRAPHIC PROFILE OF ELDERLY HOUSEHOLDS IN SLUMS OF WEST DELHI. *INDIAN JOURNAL OF APPLIED RESEARCH*, 7(2).
- Goodhue, D., Lewis, W., & Thompson, R. (2006). *PLS, small sample size, and statistical power in MIS research*. Paper presented at the System Sciences, 2006. HICSS'06. Proceedings of the 39th Annual Hawaii International Conference on.
- Goodman, R., Meltzer, H., & Bailey, V. (1998). The Strengths and Difficulties Questionnaire: A pilot study on the validity of the self-report version. *European child & adolescent psychiatry*, 7(3), 125-130.
- Green, J., & Thorogood, N. (2018). *Qualitative methods for health research*: Sage.
- Greene, J. C. (2007). *Mixed methods in social inquiry* (Vol. 9): John Wiley & Sons.
- Griffin, R. J., Neuwirth, K., Dunwoody, S., & Giese, J. (2004). Information sufficiency and risk communication. *Media Psychology*, 6(1), 23-61.
- Gross, A. G. (1994). The roles of rhetoric in the public understanding of science. *Public understanding of science*, 3(1), 3-24.
- Grothmann, T., & Reusswig, F. (2006). People at risk of flooding: why some residents take precautionary action while others do not. *Natural hazards*, 38(1-2), 101-120.
- Gryc, W. (2005). The importance of secure tenure in slum communities. *Five Minutes to Midnight*, 3(5).
- GSS. (2012). 2010 population and housing census: summary report of final results. In: Ghana Statistical Service Accra.
- Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field methods*, 18(1), 59-82.
- Guha-Sapir, D., Below, R., & Hoyois, P. (2016). EM-DAT: The CRED. *OFDA International Disaster Database—www. emdat. be—Université Catholique de Louvain—Brussels—Belgium*.

- Guha-Sapir, D., Vos, F., Below, R., & Ponserre, S. (2012). *Annual disaster statistical review 2011: the numbers and trends*. Retrieved from
- Gutteling, J. M., & Wiegman, O. (2013). *Exploring risk communication* (Vol. 8): Springer Science & Business Media.
- Gyekye, A. (2013). Environmental change and flooding in Accra, Ghana. *Sacha Journal of Environmental Studies*, 3(1), 65-80.
- Ha, T. M., & Duong, V. H. (2018). Using System Dynamics Modelling and Communication Strategies for a Resilient and Smart City in Vietnam.
- Habibi, M. R., Laroche, M., & Richard, M.-O. (2014). The roles of brand community and community engagement in building brand trust on social media. *Computers in Human Behavior*, 37, 152-161.
- Habitat, U. (2013). *State of the world's cities 2012/2013: Prosperity of cities*: Routledge.
- Habitat, U. (2016). Slums Almanac 2015-16. Tracking Improvement in the Lives of Slum Dwellers. In: Nairobi.
- Haer, T., Botzen, W. W., de Moel, H., & Aerts, J. C. (2017). Integrating household risk mitigation behavior in flood risk analysis: an agent-based model approach. *Risk analysis*, 37(10), 1977-1992.
- Hagan, J. E., Moraga, P., Costa, F., Capián, N., Ribeiro, G. S., Wunder Jr, E. A., . . . Santana, F. S. (2016). Spatiotemporal determinants of urban leptospirosis transmission: four-year prospective cohort study of slum residents in Brazil. *PLoS neglected tropical diseases*, 10(1), e0004275.
- Haigh, R., Amartunga, D., & Hemachandra, K. (2018). A capacity analysis framework for multi-hazard early warning in coastal communities. *Procedia engineering*, 212, 1139-1146.
- Haimes, Y. Y. (2015). *Risk modeling, assessment, and management*: John Wiley & Sons.
- Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). Multivariate data analysis (Vol. 6). In: Upper Saddle River, NJ: Pearson Prentice Hall.
- Hallegatte, S., Rentschler, J., & Walsh, B. (2018). Building Back Better: Achieving Resilience through Stronger, Faster, and More Inclusive Post-Disaster Reconstruction. In: World Bank.
- Hambati, H., & Yengoh, G. T. (2018). Community resilience to natural disasters in the informal settlements in Mwanza City, Tanzania. *Journal of Environmental Planning and Management*, 61(10), 1758-1788.
- Han, Z., Lu, X., Hörhager, E. I., & Yan, J. (2017). The effects of trust in government on earthquake survivors' risk perception and preparedness in China. *Natural hazards*, 86(1), 437-452.
- Hancock, G. R., & Freeman, M. J. (2001). Power and sample size for the root mean square error of approximation test of not close fit in structural equation modeling. *Educational and psychological measurement*, 61(5), 741-758.
- Hanlon, B., & Larget, B. (2011). Samples and populations. *Article: Department of Statistics*, 1-21.
- Hasselman, L. (2017). Adaptive management; adaptive co-management; adaptive governance: what's the difference? *Australasian Journal of Environmental Management*, 24(1), 31-46.
- Hayton, J. C., Allen, D. G., & Scarpello, V. (2004). Factor retention decisions in exploratory factor analysis: A tutorial on parallel analysis. *Organizational research methods*, 7(2), 191-205.
- Heath, R. L. (1995). Corporate environmental risk communication: Cases and practices along the Texas Gulf Coast. *Annals of the International Communication Association*, 18(1), 255-277.

- Heath, R. L., Bradshaw, J., & Lee, J. (2002). Community relationship building: Local leadership in the risk communication infrastructure. *Journal of Public Relations Research, 14*(4), 317-353.
- Heath, R. L., Lee, J., & Ni, L. (2009). Crisis and risk approaches to emergency management planning and communication: The role of similarity and sensitivity. *Journal of Public Relations Research, 21*(2), 123-141.
- Heath, R. L., Lee, J., Palenchar, M. J., & Lemon, L. L. (2018). Risk communication emergency response preparedness: contextual assessment of the protective action decision model. *Risk analysis, 38*(2), 333-344.
- Heath, R. L., & Palenchar, M. (2000). Community relations and risk communication: A longitudinal study of the impact of emergency response messages. *Journal of Public Relations Research, 12*(2), 131-161.
- Helmerhorst, H. H. J., Brage, S., Warren, J., Besson, H., & Ekelund, U. (2012). A systematic review of reliability and objective criterion-related validity of physical activity questionnaires. *International Journal of Behavioral Nutrition and Physical Activity, 9*(1), 103.
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the academy of marketing science, 43*(1), 115-135.
- Hicks, A., Armijos, M. T., Barclay, J., Stone, J., Robertson, R., & Cortés, G. P. (2017). Risk communication films: Process, product and potential for improving preparedness and behaviour change. *International journal of disaster risk reduction, 23*, 138-151.
- Hinyard, L. J., & Kreuter, M. W. (2007). Using narrative communication as a tool for health behavior change: a conceptual, theoretical, and empirical overview. *Health Education & Behavior, 34*(5), 777-792.
- Hirata, N., Kimura, R., & Ohtomo, S. (2017). Special Issue on Communicating Hazard and Risk: From Scientific Information to Community Involvement. In: FUJI TECHNOLOGY PRESS LTD 4F TORANOMON SANGYO BLDG, 2-29, TORANOMON 1-CHOME, MINATO-KU, TOKYO, 105-0001, JAPAN.
- Ho, R. (1998). The intention to give up smoking: Disease versus social dimensions. *The Journal of social psychology, 138*(3), 368-380.
- Hoffmann, R., & Muttarak, R. (2017). Learn from the past, prepare for the future: Impacts of education and experience on disaster preparedness in the Philippines and Thailand. *World Development, 96*, 32-51.
- Homer-Dixon, T., & Percival, V. (2018). The Case of South Africa. In *Environmental Conflict* (pp. 13-35): Routledge.
- Horlick-Jones, T., Sime, J., & Pidgeon, N. (2003). The social dynamics of environmental risk perception: implications for risk communication research and practice. *The social amplification of risk, 262-285*.
- Howe, B., & Bang, G. (2017). Nargis and Haiyan: The Politics of Natural Disaster Management in Myanmar and the Philippines. *Asian Studies Review, 41*(1), 58-78.
- Hsu, C.-w. (2017). "What should we do?" The after-action review of village heads' information seeking and decision making during the unprecedented Kaohsiung blast. *Disaster Prevention and Management, 26*(5), 582-596.
- Hu, L. t., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary journal, 6*(1), 1-55.
- Humphreys, L. G. (1964). Number of cases and number of factors: An example where N is very large. *Educational and Psychological Measurement, 24*(3), 457-466.

- Hunter, M., & Posel, D. (2012). Here to work: the socioeconomic characteristics of informal dwellers in post-apartheid South Africa. *Environment and Urbanization*, 24(1), 285-304.
- Hutcheson, G. D., & Sofroniou, N. (1999). *The multivariate social scientist: Introductory statistics using generalized linear models*: Sage.
- Hwang, Y., Choi, I., Yum, J.-Y., & Jeong, S.-H. (2017). Parental mediation regarding children's smartphone use: role of protection motivation and parenting style. *Cyberpsychology, Behavior, and Social Networking*, 20(6), 362-368.
- Ikeda, S., & Nagasaka, T. (2011). An emergent framework of disaster risk governance towards innovating coping capability for reducing disaster risks in local communities. *International journal of disaster risk science*, 2(2), 1-9.
- Isunju, J. B., Orach, C. G., & Kemp, J. (2016). Hazards and vulnerabilities among informal wetland communities in Kampala, Uganda. *Environment and Urbanization*, 28(1), 275-293.
- Jamir, S., & Khan, N. (2018). Community Awareness on Landslide Disaster: 'Experience of Nagaland'. In *Development and Disaster Management* (pp. 361-371): Springer.
- Jennings, M. K., & Stoker, L. (2004). Social trust and civic engagement across time and generations. *Acta politica*, 39(4), 342-379.
- Jiang, L., & O'Neill, B. C. (2017). Global urbanization projections for the Shared Socioeconomic Pathways. *Global Environmental Change*, 42, 193-199.
- Jin, S. A. A., & Phua, J. (2014). Following celebrities' tweets about brands: The impact of Twitter-based electronic word-of-mouth on consumers source credibility perception, buying intention, and social identification with celebrities. *Journal of Advertising*, 43(2), 181-195. doi:10.1080/00913367.2013.827606
- Johnson, B. B. (2005). Testing and expanding a model of cognitive processing of risk information. *Risk Analysis: An International Journal*, 25(3), 631-650.
- Johnston, D. M., Bebbington Chin-Diew Lai, M. S., Houghton, B. F., & Paton, D. (1999). Volcanic hazard perceptions: comparative shifts in knowledge and risk. *Disaster Prevention and Management: An International Journal*, 8(2), 118-126.
- Kahan, D. M., Jenkins-Smith, H., & Braman, D. (2011). Cultural cognition of scientific consensus. *Journal of Risk Research*, 14(2), 147-174.
- Kahlor, L., Dunwoody, S., Griffin, R. J., Neuwirth, K., & Giese, J. (2003). Studying heuristic-systematic processing of risk communication. *Risk Analysis: An International Journal*, 23(2), 355-368.
- Kaiser, M. (1974). Kaiser-Meyer-Olkin measure for identity correlation matrix. *Journal of the Royal Statistical Society*, 52, 296-298.
- Kamau, N., & Njiru, H. (2018). Water, Sanitation and Hygiene Situation in Kenya's Urban Slums. *Journal of health care for the poor and underserved*, 29(1), 321-336.
- Kane, M. T. (2013). Validating the interpretations and uses of test scores. *Journal of Educational Measurement*, 50(1), 1-73.
- Kapucu, N. (2006). Interagency communication networks during emergencies: Boundary spanners in multiagency coordination. *The American Review of Public Administration*, 36(2), 207-225.
- Karley, N. K. (2009). Flooding and physical planning in urban areas in West Africa: situational analysis of Accra, Ghana. *Theoretical and Empirical Researches in Urban Management*, 4(4 (13), 25-41.
- Kearnes, M., Macnaghten, P., & Wilsdon, J. (2006). Governing at the Nanoscale. *Demos*.
- Kellens, W., Terpstra, T., & De Maeyer, P. (2013). Perception and communication of flood risks: a systematic review of empirical research. *Risk Analysis: An International Journal*, 33(1), 24-49.

- Keller, C., Siegrist, M., & Gutscher, H. (2006). The role of the affect and availability heuristics in risk communication. *Risk analysis*, 26(3), 631-639.
- Kim, H., & Zakour, M. (2017). Disaster preparedness among older adults: Social support, community participation, and demographic characteristics. *Journal of Social Service Research*, 43(4), 498-509.
- Kim, M., & Beehr, T. A. (2017). Self-Efficacy and Psychological Ownership Mediate the Effects of Empowering Leadership on Both Good and Bad Employee Behaviors. *Journal of Leadership and Organizational Studies*, 24(4), 466-478. doi:10.1177/1548051817702078
- Kimura, A. H. (2018). Fukushima ETHOS: Post-disaster risk communication, affect, and shifting risks. *Science as Culture*, 27(1), 98-117.
- King, R., & Amponsah, O. (2012). The role of city authorities in contributing to the development of urban slums in Ghana. *Journal of Construction Project Management and Innovation*, 2(1), 285-313.
- Klaiman, T., Knorr, D., Fitzgerald, S., DeMara, P., Thomas, C., Heake, G., & Hausman, A. (2010). Locating and communicating with at-risk populations about emergency preparedness: the vulnerable populations outreach model. *Disaster medicine and public health preparedness*, 4(3), 246-251.
- Kline, R. (2005). Methodology in the social sciences. In: Principles and practice of structural equation modeling (2nd ed.). New York, NY, US: Guilford Press.
- Kline, R. (2013). Exploratory and Confirmatory Factor Analysis. In *Applied quantitative analysis in education and the social sciences* (pp. 183-217): Routledge.
- Kline, R. B. (2015). *Principles and practice of structural equation modeling*: Guilford publications.
- Korah, P. I., & Cobbinah, P. B. (2017). Juggling through Ghanaian urbanisation: flood hazard mapping of Kumasi. *GeoJournal*, 82(6), 1195-1212.
- KORDIE, G., CODJOE, S., & DE GRAFT, A. (2018). PERCEIVED VULNERABILITY TO FLOODING AMONG URBAN POOR DWELLERS IN ACCRA. *Ethiopian Journal of Environmental Studies & Management*, 11(3), 317-331.
- Kreuter, M. W., & McClure, S. M. (2004). The role of culture in health communication. *Annu. Rev. Public Health*, 25, 439-455.
- Kuffer, M., Pfeffer, K., Sliuzas, R., Baud, I., & Maarseveen, M. v. (2017). Capturing the diversity of deprived areas with image-based features: The case of Mumbai. *Remote sensing*, 9(4), 384.
- Kuhn, K. M. (2000). Message format and audience values: Interactive effects of uncertainty information and environmental attitudes on perceived risk. *Journal of Environmental Psychology*, 20(1), 41-51.
- Kyessi, A. G. (2018). Enhancing Security of Land Tenure in Informal Settlements: The Case of Wat-Human Settlements Trust in Hanna Nassif Settlement, Dar es Salaam Tanzania. *Utafiti Journal*, 8(1).
- La Ferrara, E. (2002). Self-help groups and income generation in the informal settlements of Nairobi. *Journal of African Economies*, 11(1), 61-89.
- Lam, S.-P. (2015). Predicting support of climate policies by using a protection motivation model. *Climate Policy*, 15(3), 321-338.
- Lawler, M., Prue, G., Banks, I., Law, K., Selby, P., McVie, G., & Sullivan, R. (2018). Mapping the cancer patient information landscape: A comparative analysis of patient groups across Europe and North America. *European Journal of Cancer*, 92, 88-95. doi:10.1016/j.ejca.2018.01.074
- Leaning, J., & Guha-Sapir, D. (2013). Natural disasters, armed conflict, and public health. *New England journal of medicine*, 369(19), 1836-1842.

- Lee, S. Y., Hwang, H., Hawkins, R., & Pingree, S. (2008). Interplay of negative emotion and health self-efficacy on the use of health information and its outcomes. *Communication Research*, 35(3), 358-381.
- Leech, N. L., & Onwuegbuzie, A. J. (2009). A typology of mixed methods research designs. *Quality & Quantity*, 43(2), 265-275.
- Leech, N. L., Onwuegbuzie, A. J., & Combs, J. P. (2011). Writing publishable mixed research articles: Guidelines for emerging scholars in the health sciences and beyond. *International Journal of Multiple Research Approaches*, 5(1), 7-24.
- Leiss, W. (2004). Effective risk communication practice. *Toxicology Letters*, 149(1-3), 399-404.
- Lemyre, L., Gibson, S., Zlepnig, J., Meyer-Macleod, R., & Boutette, P. (2009). Emergency preparedness for higher risk populations: Psychosocial considerations. *Radiation Protection Dosimetry*, 134(3-4), 207-214.
- Li, Z., & Wu, F. (2013). Residential satisfaction in China's informal settlements: A case study of Beijing, Shanghai, and Guangzhou. *Urban Geography*, 34(7), 923-949.
- Liang, Y., Lau, P. W., Huang, W. Y., Maddison, R., & Baranowski, T. (2014). Validity and reliability of questionnaires measuring physical activity self-efficacy, enjoyment, social support among Hong Kong Chinese children. *Preventive medicine reports*, 1, 48-52.
- Lin, L., McCloud, R. F., Bigman, C. A., & Viswanath, K. (2016). Tuning in and catching on? Examining the relationship between pandemic communication and awareness and knowledge of MERS in the USA. *Journal of Public Health*, 39(2), 282-289.
- Lindell, I. V., Tretyakov, S., Nikoskinen, K., & Ilvonen, S. (2001). BW media—Media with negative parameters, capable of supporting backward waves. *Microwave and Optical Technology Letters*, 31(2), 129-133.
- Lindell, M. K. (2018). Communicating imminent risk. In *Handbook of Disaster Research* (pp. 449-477): Springer.
- Lindell, M. K., Huang, S. K., Wei, H. L., & Samuelson, C. D. (2016). Perceptions and expected immediate reactions to tornado warning polygons. *Natural hazards*, 80(1), 683-707. doi:10.1007/s11069-015-1990-5
- Lindell, M. K., & Perry, R. W. (2004). *Communicating Environmental Risk in Multiethnic Communities (Communicating Effectively in Multicultural Contexts)*: Sage Publications Thousand Oaks, CA.
- Lindell, M. K., & Perry, R. W. (2012). The protective action decision model: theoretical modifications and additional evidence. *Risk Analysis: An International Journal*, 32(4), 616-632.
- Lindell, M. K., & Whitney, D. J. (2000). Correlates of household seismic hazard adjustment adoption. *Risk analysis*, 20(1), 13-26.
- Lion, R., Meertens, R. M., & Bot, I. (2002). Priorities in information desire about unknown risks. *Risk Analysis: An International Journal*, 22(4), 765-776.
- Little, R. J., & Rubin, D. B. (2014). *Statistical analysis with missing data* (Vol. 333): John Wiley & Sons.
- Liu, B. F., Fowler, B. M., Roberts, H. A., & Herovic, E. (2018). Keeping hospitals operating during disasters through crisis communication preparedness. *Public Relations Review*.
- Lovejoy, J. (2018). Conceptualizing Risk. *Natural Disasters and Risk Communication: Implications of the Cascadia Subduction Zone Megaquake*, 1.
- Löwe, R., Urich, C., Domingo, N. S., Mark, O., Deletic, A., & Arnbjerg-Nielsen, K. (2017). Assessment of urban pluvial flood risk and efficiency of adaptation options through simulations—A new generation of urban planning tools. *Journal of Hydrology*, 550, 355-367.

- Lundgren, R., & McMakin, A. (2013). Principles of risk communication. *Risk communication: A handbook for communicating environmental, safety, and health risks*. Wiley-IEEE Press, 71-82.
- Lundgren, R. E., & McMakin, A. H. (2018). *Risk communication: A handbook for communicating environmental, safety, and health risks*: John Wiley & Sons.
- Maddux, J. E., & Rogers, R. W. (1983). Protection motivation and self-efficacy: A revised theory of fear appeals and attitude change. *Journal of experimental social psychology*, 19(5), 469-479.
- Madon, S., & Sahay, S. (2017). 14 Urbanisation and Megacities in Developing Countries: The Management Challenge. *Information Technology in Context: Studies from the Perspective of Developing Countries: Studies from the Perspective of Developing Countries*.
- Maguire, B., & Hagan, P. (2007). Disasters and communities: understanding social resilience. *Australian Journal of Emergency Management, The*, 22(2), 16.
- Mai, J.-E. (2016). *Looking for information: A survey of research on information seeking, needs, and behavior*: Emerald Group Publishing.
- Maidl, E., & Buchecker, M. (2015). Raising risk preparedness by flood risk communication. *Natural Hazards and Earth System Sciences*, 15(7), 1577-1595.
- Majid, S., & Ahmed, K. (2008). *Post-disaster communications: A cognitive agent approach*. Paper presented at the Networking, 2008. ICN 2008. Seventh International Conference on.
- Mal, S., Singh, R., Huggel, C., & Grover, A. (2018). Introducing linkages between climate change, extreme events, and disaster risk reduction. In *Climate Change, Extreme Events and Disaster Risk Reduction* (pp. 1-14): Springer.
- Manandhar, M. D., Varughese, G., Howitt, A. M., & Kelly, E. (2017). Disaster preparedness and Response during political Transition in Nepal: Assessing civil and military roles in the aftermath of the 2015 earthquakes.
- Markus, K. A. (2012). Principles and practice of structural equation modeling by Rex B. Kline. In: Taylor & Francis.
- Marsh, H. W., & Hau, K.-T. (1996). Assessing goodness of fit: Is parsimony always desirable? *The Journal of Experimental Education*, 64(4), 364-390.
- Marsh, H. W., Hau, K.-T., & Wen, Z. (2004). In search of golden rules: Comment on hypothesis-testing approaches to setting cutoff values for fit indexes and dangers in overgeneralizing Hu and Bentler's (1999) findings. *Structural equation modeling*, 11(3), 320-341.
- Mason, J. (2002). Linking qualitative and quantitative data analysis. In *Analyzing qualitative data* (pp. 103-124): Routledge.
- Masses, H. t. (2010). Final Report to People's Dialogue on Human Settlements on Community-Led Enumeration of Old Fadama Community, Accra-Ghana. In: Housing the Masses and People's Dialogue on Human Settlements Accra, Ghana.
- Mayaka, M., Croy, W. G., & Cox, J. W. (2018). Participation as motif in community-based tourism: a practice perspective. *Journal of Sustainable Tourism*, 26(3), 416-432.
- Mayhorn, C. B., & McLaughlin, A. C. (2014). Warning the world of extreme events: A global perspective on risk communication for natural and technological disaster. *Safety science*, 61, 43-50.
- Mazzocchi, M. (2008). *Statistics for marketing and consumer research*: Sage.
- Mazzucato, V., Schans, D., Caarls, K., & Beauchemin, C. (2015). Transnational Families Between Africa and Europe. *International Migration Review*, 49(1), 142-172.

- McCallum, E., & Heming, J. (2006). Hurricane Katrina: an environmental perspective. *Philosophical Transactions of the Royal Society of London A: Mathematical, Physical and Engineering Sciences*, 364(1845), 2099-2115.
- McComas, K. A. (2003). Citizen satisfaction with public meetings used for risk communication. *Journal of Applied Communication Research*, 31(2), 164-184.
- McCroskey, J. C. (1966). Scales for the measurement of ethos.
- McDaniel, C. (1998). JR and Roger Gates. *Contemporary Marketing Research, 6th edition*, South-Western College Publishing.
- McDivitt, P. (2016). The Information Deficit Model is Dead. Now What? Evaluating New Strategies for Communicating Anthropogenic Climate Change in the Context of Contemporary American Politics, Economy, and Culture.
- McNamara, C. (1999). General guidelines for conducting interviews, Minnesota. *Missouri Institute of science*.
- Mercer, J., Gaillard, J.-C., Crowley, K., Shannon, R., Alexander, B., Day, S., & Becker, J. (2012). Culture and disaster risk reduction: lessons and opportunities. *Environmental Hazards*, 11(2), 74-95.
- Meredith, L. S., Shugarman, L. R., Chandra, A., Taylor, S. L., Howard, S., Beckjord, E. B., . . . Tanielian, T. (2009). Analysis of Risk Communication Strategies and Approaches with At-Risk Populations to Enhance Emergency Preparedness, Response, and Recovery.
- Merriam, S. (1988). The case study approach to research problems. *Case study research in education: A qualitative approach*, 5-21.
- Merton, R. K. (1987). The focussed interview and focus groups: Continuities and discontinuities. *The Public opinion quarterly*, 51(4), 550-566.
- Metzger, M. J., Flanagin, A. J., Eyal, K., Lemus, D. R., & McCann, R. M. (2003). Credibility for the 21st century: Integrating perspectives on source, message, and media credibility in the contemporary media environment. *Communication Yearbook*, 27, 293-335.
- Meyer, V. (2018). Decision Support on Flood Management in Complex Urban Settings. Is Risk Assessment the Right Approach or Do We Need Decision Heuristics? In *Urban Transformations* (pp. 363-373): Springer.
- Miceli, R., Sotgiu, I., & Settanni, M. (2008). Disaster preparedness and perception of flood risk: A study in an alpine valley in Italy. *Journal of environmental psychology*, 28(2), 164-173.
- Miles, M. B., Huberman, A. M., & Saldana, J. (2013). *Qualitative data analysis*: Sage.
- Mileti, D. S., & Darlington, J. D. (1997). The role of searching in shaping reactions to earthquake risk information. *Social Problems*, 44(1), 89-103.
- Mileti, D. S., & Fitzpatrick, C. (1992). The causal sequence of risk communication in the Parkfield earthquake prediction experiment. *Risk analysis*, 12(3), 393-400.
- Miller, G. A. (1983). Information theory in psychology.
- Miller, S. (2001). Public understanding of science at the crossroads. *Public understanding of science*, 10(1), 115-120.
- Milne, S., Orbell, S., & Sheeran, P. (2002). Combining motivational and volitional interventions to promote exercise participation: Protection motivation theory and implementation intentions. *British journal of health psychology*, 7(2), 163-184.
- Mishra, J., Allen, D., & Pearman, A. (2015). Information seeking, use, and decision making. *Journal of the Association for Information Science and Technology*, 66(4), 662-673.
- Moein, M., Aghajani, M., Ajorpaz, N. M., & Khorasanifar, L. (2017). Effect of an empowerment program on self-efficacy of patients with type 2 diabetes. *Iranian Red Crescent Medical Journal*, 19(1). doi:10.5812/ircmj.29252

- Monney, I., Buamah, R., Odai, S., Awuah, E., & Nyenje, P. (2013). Evaluating access to potable water and basic sanitation in Ghana's largest urban slum community: Old Fadama, Accra. *Journal of Environment and Earth Science*, 3(11), 72-79.
- Morgan, D. L. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of mixed methods research*, 1(1), 48-76.
- Morgan, M. G., Fischhoff, B., Bostrom, A., & Atman, C. J. (2002). *Risk communication: A mental models approach*: Cambridge University Press.
- Morse, J. M. (1994). Designing funded qualitative research.
- Morse, J. M. (2016). *Mixed method design: Principles and procedures*: Routledge.
- Moser, C. A., & Kalton, G. (2017). *Survey methods in social investigation*: Routledge.
- Mulilis, J. P., & Lippa, R. (1990). Behavioral change in earthquake preparedness due to negative threat appeals: A test of protection motivation theory. *Journal of applied social psychology*, 20(8), 619-638.
- Murakami, M., & Tsubokura, M. (2017). Evaluating risk communication after the Fukushima disaster based on nudge theory. *Asia Pacific Journal of Public Health*, 29(2_suppl), 193S-200S.
- Murphy, M. (2016). Population definitions for comparative surveys in education.
- Musacchio, G., Falsaperla, S., Solarino, S., Piangiamore, G. L., Crescimbene, M., Pino, N. A., . . . Fabbri, M. (2017). *KnowRISK on Seismic Risk Communication: The Set-Up of a Participatory Strategy-Italy Case Study*. Paper presented at the International Conference on Earthquake Engineering and Structural Dynamics.
- Muthén, L. K., & Muthén, B. O. (2002). How to use a Monte Carlo study to decide on sample size and determine power. *Structural equation modeling*, 9(4), 599-620.
- Myers, M. D. (2013). *Qualitative research in business and management*: Sage.
- Myers, M. D., & Avison, D. (2002). *Qualitative research in information systems: a reader*: Sage.
- Napier, M. (2007). Informal settlement integration, the environment and sustainable livelihoods in sub-Saharan Africa. *Council for Scientific & Industrial Research in South Africa*.
- Nardi, P. M. (2018). *Doing survey research: A guide to quantitative methods*: Routledge.
- Nations, U. (2006). World Urbanization Prospects: The 2005 Revision Population Database. In: Department of Economic and Social Affairs, Population Division, United Nations New York, NY.
- Neale, P., Thapa, S., & Boyce, C. (2006). *Preparing a case study: A guide for designing and conducting a case study for evaluation input*: Pathfinder international Massachusetts.
- Neuman, W. L., & Kreuger, L. (2003). *Social work research methods: Qualitative and quantitative approaches*: Allyn and Bacon.
- Newnham, E. A., Balsari, S., Lam, R. P. K., Kashyap, S., Pham, P., Chan, E. Y. Y., . . . Leaning, J. (2017). Self-efficacy and barriers to disaster evacuation in Hong Kong. *International Journal of Public Health*, 62(9), 1051-1058. doi:10.1007/s00038-017-1036-8
- Ntema, J., Massey, R., Marais, L., Cloete, J., & Lenka, M. (2018). Informal settlement upgrading in South Africa: beneficiaries' perceptions over nearly twenty-five years. *Journal of Urbanism: International Research on Placemaking and Urban Sustainability*, 1-20.
- Nunes, R. H., Ferreira, J. B., de Freitas, A. S., & Ramos, F. L. (2018). The effects of social media opinion leaders' recommendations on followers' intention to buy. *Revista Brasileira de Gestao de Negocios*, 20(1), 57-73. doi:10.7819/rbgn.v20i1.3678
- Nunnally, J. (1978). Psychometric methods. In: New York: McGraw-Hill.

- Nyarko, B. K. (2002). Application of a rational model in GIS for flood risk assessment in Accra, Ghana. *Journal of Spatial Hydrology*, 2(1).
- Nyhan, B., & Reifler, J. (2018). The roles of information deficits and identity threat in the prevalence of misperceptions. *Journal of Elections, Public Opinion and Parties*, 1-23.
- O'Keefe, D. (1990). Current communication: An advanced text series, Vol. 2. Persuasion: Theory and research. Thousand Oaks, CA, US. In: Sage Publications, Inc.
- O'Sullivan, J., Bradford, R., Bonaiuto, M., Dominicus, S. D., Rotko, P., Aaltonen, J., . . . Langan, S. (2012). Enhancing flood resilience through improved risk communications. *Natural Hazards and Earth System Sciences*, 12(7), 2271-2282.
- O'Hare, P., & White, I. (2018). Beyond 'just' flood risk management: the potential for—and limits to—alleviating flood disadvantage. *Regional environmental change*, 18(2), 385-396.
- Öhlén, J. (2011). *Mixed Method Design: Principles and Procedures*. Paper presented at the Forum qualitative Sozialforschung.
- Ohmer, M. L. (2007). Citizen participation in neighborhood organizations and its relationship to volunteers' self-and collective efficacy and sense of community. *Social Work Research*, 31(2), 109-120.
- Okada, N., & Matsuda, Y. (2005). *Risk communication strategy for disaster preparedness viewed as multilateral knowledge development*. Paper presented at the Systems, Man and Cybernetics, 2005 IEEE International Conference on.
- Oktari, R. S., Shiwaku, K., Munadi, K., & Shaw, R. (2018). Enhancing community resilience towards disaster: The contributing factors of school-community collaborative network in the tsunami affected area in Aceh. *International journal of disaster risk reduction*, 29, 3-12.
- Okyere, C. Y., Yacouba, Y., & Gilgenbach, D. (2013). The problem of annual occurrences of floods in Accra: an integration of hydrological, economic and political perspectives. *Theoretical and Empirical Researches in Urban Management*, 8(2), 45-79.
- Oldham, K., & Astbury, K. (2018). Evolution of disaster risk governance in Greater Manchester: a case study from the UK. *Procedia engineering*, 212, 7-14.
- Onuma, H., Shin, K. J., & Managi, S. (2017). Household preparedness for natural disasters: Impact of disaster experience and implications for future disaster risks in Japan. *International journal of disaster risk reduction*, 21, 148-158.
- Onwuegbuzie, A. J., & Collins, K. M. (2007). A typology of mixed methods sampling designs in social science research. *The qualitative report*, 12(2), 281-316.
- Onwuegbuzie, A. J., & Collins, K. M. (2017). The Role of Sampling in Mixed Methods-Research Die Rolle von Stichproben in der Mixed Methods-Forschung. *KZfSS Kölner Zeitschrift für Soziologie und Sozialpsychologie*, 69(2), 133-156.
- Osofsky, H., Osofsky, J., Hansel, T., Lawrason, B., & Speier, A. (2018). Building resilience after disasters through the youth leadership program: the importance of community and academic partnerships on youth outcomes. *Progress in community health partnerships: research, education, and action*, 12(1), 11-21.
- Ouikotan, R., van der Kwast, J., Mynett, A., & Afouda, A. (2017). *Gaps and challenges of flood risk management in West African coastal cities*. Paper presented at the World Water Congress XVI, International Water Recourses Association (IWRA), Cancun, Quintana Roo, Mexico.
- Owusu-Ansah, J. K. (2016). The influences of land use and sanitation infrastructure on flooding in Kumasi, Ghana. *GeoJournal*, 81(4), 555-570.
- Oxford, R. L., & Burry-Stock, J. A. (1995). Assessing the use of language learning strategies worldwide with the ESL/EFL version of the Strategy Inventory for Language Learning (SILL). *System*, 23(1), 1-23.

- Pal, I., & Shaw, R. (2018). *Disaster Risk Governance in India and Cross Cutting Issues*: Springer.
- Palen, L., & Hughes, A. L. (2018). Social Media in Disaster Communication. In *Handbook of Disaster Research* (pp. 497-518): Springer.
- Palenchar, M. J., & Heath, R. L. (2002). Another part of the risk communication model: Analysis of communication processes and message content. *Journal of Public Relations Research, 14*(2), 127-158.
- Palenchar, M. J., Heath, R. L., & Orberton, E. M. (2005). Terrorism and industrial chemical production: A new era of risk communication. *Communication Research Reports, 22*(1), 59-67.
- Pallant, J. (2011). *SPSS Survival manual: a step by step guide to data analysis using SPSS*. Crows Nest. *New South Wales: Allen & Unwin*.
- Patel, S., d'Cruz, C., & Burra, S. (2002). Beyond evictions in a global city: people-managed resettlement in Mumbai. *Environment and Urbanization, 14*(1), 159-172.
- Paton, D. (2003). Disaster preparedness: a social-cognitive perspective. *Disaster Prevention and Management: An International Journal, 12*(3), 210-216.
- Paton, D. (2006). Disaster resilience: integrating individual, community, institutional and environmental perspectives. *Disaster resilience: An integrated approach, 320*.
- Paton, D., & Johnston, D. (2017). *Disaster resilience: an integrated approach*: Charles C Thomas Publisher.
- Paton, D., Millar, M., & Johnston, D. (2001). Community resilience to volcanic hazard consequences. *Natural Hazards, 24*(2), 157-169.
- Paton, D., Smith, L., Daly, M., & Johnston, D. (2008). Risk perception and volcanic hazard mitigation: Individual and social perspectives. *Journal of Volcanology and Geothermal Research, 172*(3-4), 179-188.
- Paton, D., Smith, L., & Johnston, D. (2005). When good intentions turn bad: promoting natural hazard preparedness. *Australian Journal of Emergency Management, The, 20*(1), 25.
- Paton, D., Smith, L., & Violanti, J. (2000). Disaster response: risk, vulnerability and resilience. *Disaster Prevention and Management: An International Journal, 9*(3), 173-180.
- Patton, M. Q. (1987). *How to use qualitative methods in evaluation*: Sage.
- Paul, B. K. (2005). Evidence against disaster-induced migration: the 2004 tornado in north-central Bangladesh. *Disasters, 29*(4), 370-385.
- Paul, B. K., & Bhuiyan, R. H. (2010). Urban earthquake hazard: perceived seismic risk and preparedness in Dhaka City, Bangladesh. *Disasters, 34*(2), 337-359.
- Pelling, M. (2007). *Urbanization and disaster risk*. Paper presented at the Cyber-seminar on Population and Natural Hazards.
- Pelling, M., & Wisner, B. (2012). *Disaster risk reduction: Cases from urban Africa*: Routledge.
- Peterson, R. A., & Kim, Y. (2013). On the relationship between coefficient alpha and composite reliability. *Journal of Applied Psychology, 98*(1), 194.
- Pinto, A., Saeed, M., Sakka, H. E., Rashford, A., Colombo, A., Valenciano, M., & Sabatinelli, G. (2005). Setting up an early warning system for epidemic-prone diseases in Darfur: a participative approach. *Disasters, 29*(4), 310-322.
- Plapp, T., & Werner, U. (2006). Understanding risk perception from natural hazards: examples from Germany. In *RISK21-coping with risks due to natural hazards in the 21st century* (pp. 111-118): CRC Press.
- Plough, A., & Krinsky, S. (1987). The emergence of risk communication studies: social and political context. *Science, Technology, & Human Values, 12*(3/4), 4-10.
- Populations, C. o. C. f. B. C. i. t. s. C. I. t. H. o. D. (2002). *Speaking of health: assessing health communication strategies for diverse populations*.

- Pornpitakpan, C. (2004). The persuasiveness of source credibility: A critical review of five decades' evidence. *Journal of applied social psychology*, 34(2), 243-281.
- Powell, D. A., Blaine, K., Gomes, L., Grant, S. E., LaCroix, B., Morris, S., & Powell, D. (2001). BEST COMMUNICATION PRACTICES IN COMMUNICATING A DRINKING-WATER-RELATED PUBLIC HEALTH EMERGENCY. *A Paper Prepared For The Walkerton Inquiry*. Accessed, 10, 12.
- Power, N. (2018). Extreme teams: Toward a greater understanding of multiagency teamwork during major emergencies and disasters. *American Psychologist*, 73(4), 478.
- Prashar, S., & Shaw, R. (2018). A Participatory Approach to Enhance Disaster Risk Governance: The Case of Delhi, India. In *Disaster Risk Governance in India and Cross Cutting Issues* (pp. 261-293): Springer.
- Preacher, K. J., & MacCallum, R. C. (2003). Repairing Tom Swift's electric factor analysis machine. *Understanding statistics: Statistical issues in psychology, education, and the social sciences*, 2(1), 13-43.
- Purchase, T. (2018). *A Correlational Study of Self-Efficacy and Mindset as Mediators of High School Teacher Fear Appeals Made Prior to End of Course Tests*. Northcentral University,
- Putnam, H. (2017). 4. Pragmatism and Nonscientific Knowledge.
- Quinlan, C., Babin, B. J., Carr, J., Griffin, M., & Zikmund, W. G. (2011). *Business research methods*: South-Western Cengage Learning Andover, Hampshire.
- Rain, D., Engstrom, R., Ludlow, C., & Antos, S. (2011). Accra Ghana: A city vulnerable to flooding and drought-induced migration. *UN-Habitat (Ed.), Background paper for*.
- Rausand, M. (2013). *Risk assessment: theory, methods, and applications* (Vol. 115): John Wiley & Sons.
- razvoja poljoprivrede Srbije, S. (2005). Službeni glasnik Republike Srbije, br. 78. In: Beograd.
- Reed, H. E., Andrzejewski, C. S., & White, M. J. (2010). Men's and women's migration in coastal Ghana: An event history analysis. *Demographic research*, 22.
- Renn, O. (2017). *Risk governance: coping with uncertainty in a complex world*: Routledge.
- Renn, O., Levine, D., Kaspersen, R. E., & Stallen, P. J. M. (1991). Communicating risks to the public. *Credibility and trust in risk communication*. Dordrecht, The Netherlands: Kluwer Academic Publishers.
- Reynolds, B., & Seeger, M. (2005). Crisis and emergency risk communication as an integrative model. *Journal of health communication*, 10(1), 43-55.
- Ritchie, J. (2003). The applications of qualitative methods to social research. *Qualitative research practice: A guide for social science students and researchers*, 24, e46.
- Ritchie, J., Lewis, J., Nicholls, C. M., & Ormston, R. (2013). *Qualitative research practice: A guide for social science students and researchers*: sage.
- Rød, S. K., Botan, C., & Holen, A. (2012). Risk communication and the willingness to follow evacuation instructions in a natural disaster. *Health, Risk & Society*, 14(1), 87-99.
- Rodríguez-Priego, N., & Montoro-Ríos, F. J. (2018). How Cultural Beliefs and the Response to Fear Appeals Shape Consumer's Purchasing Behavior Toward Sustainable Products. In *Sustainability in Innovation and Entrepreneurship* (pp. 47-62): Springer.
- Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change¹. *The journal of psychology*, 91(1), 93-114.
- Rohli, R. V., Collins, J. M., Ersing, R. L., Lunsford, G. D., & Ludwig, A. M. (2018). Hurricane Preparedness among University Residential Housing Assistants and Staff. *Weather, Climate, and Society*, 10(2), 341-359.
- Rohr, C. (2018). Avoiding conflicts by revisiting historical experience? Flood marks and their use for disaster memory past and present.

- Rohrmann, B. (2008). *Risk perception, risk attitude, risk communication, risk management: A conceptual appraisal*. Paper presented at the Conferencia presentada en la Sociedad Internacional de Gerenciamiento de Emergencias.
- Ronan, K. R., Alisic, E., Towers, B., Johnson, V. A., & Johnston, D. M. (2015). Disaster Preparedness for Children and Families: a Critical Review. *Current Psychiatry Reports*, 17(7), 1-9. doi:10.1007/s11920-015-0589-6
- Ronan, K. R., Crellin, K., & Johnston, D. (2010). Correlates of hazards education for youth: a replication study. *Natural hazards*, 53(3), 503-526.
- Rosa, E. A. (2003). The logical structure of the social amplification of risk framework (SARF): Metatheoretical foundations and policy implications. *The social amplification of risk*, 47.
- Roy, D., Palavalli, B., Menon, N., King, R., Pfeffer, K., Lees, M., & Sloot, P. M. (2018). Survey-based socio-economic data from slums in Bangalore, India. *Scientific data*, 5, 170200.
- Ruiter, R. A., Kessels, L. T., Peters, G. J. Y., & Kok, G. (2014). Sixty years of fear appeal research: Current state of the evidence. *International journal of psychology*, 49(2), 63-70.
- Rumbach, A., & Shirgaokar, M. (2017). Predictors of household exposure to monsoon rain hazards in informal settlements. *Natural Hazards*, 85(2), 709-728.
- Ryan, G. W., & Bernard, H. R. (2000). Data management and analysis methods.
- Saha, S., Nandi, S., Paul, P. S., Shah, V. K., Roy, A., & Das, S. K. (2015). Designing delay constrained hybrid ad hoc network infrastructure for post-disaster communication. *Ad Hoc Networks*, 25, 406-429.
- Sakakibara, B. M., Miller, W. C., Routhier, F., Backman, C. L., & Eng, J. J. (2014). Association between self-efficacy and participation in community-dwelling manual wheelchair users aged 50 years or older. *Physical therapy*, 94(5), 664-674.
- Sakijege, T., Sartohadi, J., Marfai, M. A., Kassenga, G. R., & Kasala, S. E. (2014). Assessment of adaptation strategies to flooding: A comparative study between informal settlements of Keko Machungwa in Dar es Salaam, Tanzania and Sangkrah in Surakarta, Indonesia. *Jambá: Journal of Disaster Risk Studies*, 6(1), 1-10.
- Sako, M. (2006). Does trust improve business performance. *Organisafional trust: A reader*, 267-294.
- Sarantakos, S. (2012). *Social research*: Macmillan International Higher Education.
- Satterthwaite, D., Sverdlík, A., & Brown, D. (2018). Revealing and Responding to Multiple Health Risks in Informal Settlements in Sub-Saharan African Cities. *Journal of Urban Health*, 1-11.
- Saunders, B., Sim, J., Kingstone, T., Baker, S., Waterfield, J., Bartlam, B., . . . Jinks, C. (2018). Saturation in qualitative research: exploring its conceptualization and operationalization. *Quality & Quantity*, 52(4), 1893-1907.
- Schafer, J. L., & Graham, J. W. (2002). Missing data: our view of the state of the art. *Psychological methods*, 7(2), 147.
- Scheer, D., Benighaus, C., Benighaus, L., Renn, O., Gold, S., Röder, B., & Böl, G. F. (2014). The distinction between risk and hazard: understanding and use in stakeholder communication. *Risk analysis*, 34(7), 1270-1285.
- Schensul, S. L., Schensul, J. J., & LeCompte, M. D. (1999). *Essential ethnographic methods: Observations, interviews, and questionnaires* (Vol. 2): Rowman Altamira.
- Scheufele, D. A., Corley, E. A., Shih, T.-j., Dalrymple, K. E., & Ho, S. S. (2009). Religious beliefs and public attitudes toward nanotechnology in Europe and the United States. *Nature nanotechnology*, 4(2), 91.

- Schoenbachler, D. D., & Whittler, T. E. (1996). Adolescent processing of social and physical threat communications. *Journal of Advertising*, 25(4), 37-54.
- Schrodt, P., Witt, P. L., Turman, P. D., Myers, S. A., Barton, M. H., & Jernberg, K. A. (2009). Instructor credibility as a mediator of instructors' prosocial communication behaviors and students' learning outcomes. *Communication Education*, 58(3), 350-371. doi:10.1080/03634520902926851
- Schwartz, R. (2018). Pragmatism, Inquiry, and Knowledge.
- Schwarzer, R. (2014). *Self-efficacy: Thought control of action*: Taylor & Francis.
- Scolobig, A., De Marchi, B., & Borga, M. (2012). The missing link between flood risk awareness and preparedness: findings from case studies in an Alpine Region. *Natural Hazards*, 63(2), 499-520.
- Scolobig, A., Prior, T., Schröter, D., Jörin, J., & Patt, A. (2015). Towards people-centred approaches for effective disaster risk management: Balancing rhetoric with reality. *International journal of disaster risk reduction*, 12, 202-212.
- Seeger, M. W. (2006). Best practices in crisis communication: An expert panel process. *Journal of Applied Communication Research*, 34(3), 232-244.
- Seeger, M. W. (2018). Answering the Call for Scholarship: The Journal of International Crisis and Risk Communication Research. *Journal of International Crisis and Risk Communication Research*, 1(1), 1.
- Seeger, M. W., & Griffin Padgett, D. R. (2010). From image restoration to renewal: Approaches to understanding postcrisis communication. *The Review of Communication*, 10(2), 127-141.
- Seeger, M. W., Pechta, L. E., Price, S. M., Lubell, K. M., Rose, D. A., Sapru, S., . . . Smith, B. J. (2018). A Conceptual Model for Evaluating Emergency Risk Communication in Public Health. *Health security*, 16(3), 193-203.
- Seeger, M. W., Sellnow, T. L., & Ulmer, R. R. (2003). *Communication and organizational crisis*: Greenwood Publishing Group.
- Segal, D. L., Coolidge, F. L., O'Riley, A., & Heinz, B. A. (2006). Structured and semi-structured interviews. *Clinician's handbook of adult behavioral assessment*, 121-144.
- Sellnow, T. L., Sellnow, D. D., Helsel, E. M., Martin, J. M., & Parker, J. S. (2018). Risk and crisis communication narratives in response to rapidly emerging diseases. *Journal of Risk Research*, 1-12.
- Sellnow, T. L., Ulmer, R. R., Seeger, M. W., & Littlefield, R. (2008). *Effective risk communication: A message-centered approach*: Springer Science & Business Media.
- Selltiz, C., Wrightsman, L. S., & Cook, S. W. (1976). *Research methods in social relations*: Holt, Rinehart and Winston.
- Shah, M. A. R., Rahman, A., & Chowdhury, S. H. (2018). Challenges for achieving sustainable flood risk management. *Journal of Flood Risk Management*, 11, S352-S358.
- Shaheen, F. (2018). Comparing Informal Sector Engagement Across Pakistan's Largest Urban Centers: Lessons in State and Non-state Engagement from Karachi and Lahore. In *Metropolitan Governance in Asia and the Pacific Rim* (pp. 95-122): Springer.
- Shaw, R., Shiwaku Hirohide Kobayashi, K., & Kobayashi, M. (2004). Linking experience, education, perception and earthquake preparedness. *Disaster Prevention and Management: An International Journal*, 13(1), 39-49.
- Sheppard, B., Janoske, M., & Liu, B. (2012). Understanding risk communication theory: a guide for emergency managers and communicators.
- Shi, J., Kapucu, N., Zhu, Z., Guo, X., & Haupt, B. (2017). Assessing risk communication in social media for crisis prevention: a social network analysis of microblog. *Journal of homeland security and emergency management*, 14(1).

- Sidelinger, R. J., & McCroskey, J. C. (1997). Communication correlates of teacher clarity in the college classroom. *Communication Research Reports, 14*(1), 1-10.
- Siegrist, M., Cvetkovich, G., & Roth, C. (2000). Salient value similarity, social trust, and risk/benefit perception. *Risk analysis, 20*(3), 353-362.
- Siegrist, M., & Gutscher, H. (2006). Flooding risks: A comparison of lay people's perceptions and expert's assessments in Switzerland. *Risk analysis, 26*(4), 971-979.
- Silvia, E. S. M., & MacCallum, R. C. (1988). Some factors affecting the success of specification searches in covariance structure modeling. *Multivariate Behavioral Research, 23*(3), 297-326.
- Singla, A., Ahuja, I. S., & Sethi, A. S. (2018). Validation of demand pull strategies for accomplishing sustainable development in manufacturing organizations through structural equation modeling. *Management Decision, 56*(5), 1135-1156.
- Sjöberg, L. (2000). Factors in risk perception. *Risk analysis, 20*(1), 1-12.
- Sloan, P., & Oliver, D. (2013). Building trust in multi-stakeholder partnerships: Critical emotional incidents and practices of engagement. *Organization Studies, 34*(12), 1835-1868.
- Slovic, P. (2000). The perception of risk: Risk, society and policy. London (UK): Earthscan, 473.
- Slovic, P. (2016). *The perception of risk*: Routledge.
- Slovic, P., Monahan, J., & MacGregor, D. G. (2000). Violence risk assessment and risk communication: The effects of using actual cases, providing instruction, and employing probability versus frequency formats. *Law and human behavior, 24*(3), 271-296.
- Sophian, A., Tian, G. Y., Taylor, D., & Rudlin, J. (2003). A feature extraction technique based on principal component analysis for pulsed eddy current NDT. *NDT & e International, 36*(1), 37-41.
- Sorensen, J. H. (2000). Hazard warning systems: Review of 20 years of progress. *Natural Hazards Review, 1*(2), 119-125.
- Šotić, A., & Rajić, R. (2015). The review of the definition of risk. *Online Journal of Applied Knowledge Management, 3*(3), 17-26.
- Soy, S. (2015). The case study as a research method.
- Soyinka, O., & Siu, K. W. M. (2017). Investigating informal settlement and infrastructure adequacy for future resilient urban center in Hong Kong, SAR. *Procedia Engineering, 198*, 84-98.
- Speer, P. W., & Peterson, N. A. (2000). Psychometric properties of an empowerment scale: Testing cognitive, emotional, and behavioral domains. *Social Work Research, 24*(2), 109-118.
- Spence, P. R., Lachlan, K. A., & Griffin, D. R. (2007). Crisis communication, race, and natural disasters. *Journal of Black Studies, 37*(4), 539-554.
- Stockwell, D. R., & Peterson, A. T. (2002). Effects of sample size on accuracy of species distribution models. *Ecological modelling, 148*(1), 1-13.
- Strauss, A., & Corbin, J. (1998). Basics of qualitative research. Thousands Oaks, CA: Sage.
- Straus, EE (2009). *Unequal pieces of a shrinking pie: The struggle between African Americans and Latinos over education, employment, and empowerment in Compton, California. History of Education Quarterly, 49*(4), 507-529.
- Subbiah, A., Bildan, L., & Narasimhan, R. (2008). Background Paper on Assessment of the Economics of Early Warning Systems for Disaster Risk Reduction. *World Bank Group for Disaster Reduction and Recovery*.
- Tabachnick, B. G., & Fidell, L. S. (2001). Using multivariate analysis.

- Tacoli, C., McGranahan, G., & Satterthwaite, D. (2015). *Urbanisation, rural-urban migration and urban poverty*: Human Settlements Group, International Institute for Environment and Development.
- Tadgell, A., Doberstein, B., & Mortsch, L. (2018). Principles for climate-related resettlement of informal settlements in less developed nations: a review of resettlement literature and institutional guidelines. *Climate and Development, 10*(2), 102-115.
- Taibah, H., Arlikatti, S., & Andrew, S. (2018). Risk communication for religious crowds: preferences of Hajj pilgrims. *Disaster Prevention and Management, 27*(1), 102-114.
- Tang, J.-S., & Feng, J.-Y. (2018). Residents' Disaster Preparedness after the Meinong Taiwan Earthquake: A Test of Protection Motivation Theory. *International Journal of Environmental Research and Public Health, 15*(7).
- Tang, Z., Zhang, L., Xu, F., & Vo, H. (2015). Examining the role of social media in California's drought risk management in 2014. *Natural Hazards, 79*(1), 171-193.
- Tanner Jr, J. F., Hunt, J. B., & Eppright, D. R. (1991). The protection motivation model: A normative model of fear appeals. *The journal of marketing, 36*-45.
- Tansey, J., & Rayner, S. (2009). Cultural theory and risk. *Handbook of risk and crisis communication, 53*-79.
- Tapsell, S., Burton, R., Parker, D., & Oakes, S. (2004). The social performance of flood warning communications technologies. *Environment Agency, Technical Report W5C-016, ISBN, 1*(84432), 434.
- Taş, M., Taş, N., Durak, S., & Atanur, G. (2013). Flood disaster vulnerability in informal settlements in Bursa, Turkey. *Environment and Urbanization, 25*(2), 443-463.
- Tashakkori, A., & Creswell, J. W. (2007). The new era of mixed methods. In: Sage Publications.
- Tashakkori, A., & Teddie, C. (2003). Mixed Methods research, Alternative approaches and Unresolved Issues in Conceptualization and Design of Mixed Methods. In: Thousand Oaks, Sage Canada.
- Tashakkori, A., Teddlie, C., & Teddlie, C. B. (1998). *Mixed methodology: Combining qualitative and quantitative approaches* (Vol. 46): Sage.
- Taubenböck, H., Kraff, N., & Wurm, M. (2018). The morphology of the Arrival City-A global categorization based on literature surveys and remotely sensed data. *Applied Geography, 92*, 150-167.
- Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International journal of medical education, 2*, 53.
- Terpstra, T., Lindell, M. K., & Gutteling, J. M. (2009). Does communicating (flood) risk affect (flood) risk perceptions? Results of a quasi-experimental study. *Risk Analysis: An International Journal, 29*(8), 1141-1155.
- Terrell, S. R. (2012). Mixed-methods research methodologies. *The qualitative report, 17*(1), 254-280.
- Terwel, B. W. (2015). Public participation under conditions of distrust: invited commentary on 'Effective risk communication and CCS: The road to success in Europe'. *Journal of Risk Research, 18*(6), 692-694.
- Texier, P. (2008). Floods in Jakarta: when the extreme reveals daily structural constraints and mismanagement. *Disaster Prevention and Management: An International Journal, 17*(3), 358-372.
- Thevissen, E., De Bruyn, H., & Koole, S. (2017). The provision of oral hygiene instructions and patient motivation in a dental care system without dental hygienists. *International Journal of Dental Hygiene, 15*(4), 261-268. doi:10.1111/idh.12211
- Thrush, D., Burningham, K., & Fielding, J. (2005). *Flood warning for vulnerable groups: measuring & mapping vulnerability*: Bristol: Environment Agency.

- Titsworth, S., Mazer, J. P., Goodboy, A. K., Bolkan, S., & Myers, S. A. (2015). Two meta-analyses exploring the relationship between teacher clarity and student learning. *Communication Education, 64*(4), 385-418.
- Tomkins, C. (2001). Interdependencies, trust and information in relationships, alliances and networks. *Accounting, organizations and society, 26*(2), 161-191.
- Trombetta, J. J., & Rogers, D. P. (1988). Communication climate, job satisfaction, and organizational commitment: The effects of information adequacy, communication openness, and decision participation. *Management Communication Quarterly, 1*(4), 494-514.
- Tsinda, A., Abbott, P., Chenoweth, J., Pedley, S., & Kwizera, M. (2018). Improving sanitation in informal settlements of East African cities: hybrid of market and state-led approaches. *International Journal of Water Resources Development, 34*(2), 229-244.
- Tuler, S., Golding, D., & Kasperson, R. E. (2012). Social Distrust as a Factor in Siting Hazardous Facilities and Communicating Risks. In *Social Contours of Risk* (pp. 44-65): Routledge.
- Tullos, D. (2018). Opinion: How to achieve better flood-risk governance in the United States. *Proceedings of the National Academy of Sciences, 115*(15), 3731-3734.
- Turner, M. M., Rimal, R. N., Morrison, D., & Kim, H. (2006). The role of anxiety in seeking and retaining risk information: Testing the risk perception attitude framework in two studies. *Human Communication Research, 32*(2), 130-156.
- Twigg, J. (2003). The human factor in early warnings: risk perception and appropriate communications. In *Early warning systems for natural disaster reduction* (pp. 19-26): Springer.
- Twigg, J., Christie, N., Haworth, J., Osuteye, E., & Skarlatidou, A. (2017). Improved methods for fire risk assessment in low-income and informal settlements. *International journal of environmental research and public health, 14*(2), 139.
- Twumasi, Y., & Asomani-Boateng, R. (2002). *Mapping seasonal hazards for flood management in Accra, Ghana using GIS*. Paper presented at the Geoscience and Remote Sensing Symposium, 2002. IGARSS'02. 2002 IEEE International.
- Tzavella, K., Fekete, A., & Fiedrich, F. (2018). Opportunities provided by geographic information systems and volunteered geographic information for a timely emergency response during flood events in Cologne, Germany. *Natural Hazards, 91*(1), 29-57.
- Ullman, J. B., & Bentler, P. M. (2012). Structural equation modeling. *Handbook of Psychology, Second Edition, 2*.
- Ulmer, R. R., Sellnow, T. L., & Seeger, M. W. (2017). *Effective crisis communication: Moving from crisis to opportunity*: Sage Publications.
- Umansky, D., & Fuhrberg, R. (2018). Improving risk communication and public participation through mutual understanding: A coorientation approach. *Journal of Communication Management, 22*(1), 2-13.
- UNISDR, G. (2009). Global assessment report on disaster risk reduction. In: United Nations International Strategy for Disaster Reduction Secretariat Geneva, Switzerland.
- Usamah, M., Handmer, J., Mitchell, D., & Ahmed, I. (2014). Can the vulnerable be resilient? Co-existence of vulnerability and disaster resilience: informal settlements in the Philippines. *International journal of disaster risk reduction, 10*, 178-189.
- Van Dijk, H., Houghton, J., Van Kleef, E., Van Der Lans, I., Rowe, G., & Frewer, L. (2008). Consumer responses to communication about food risk management. *Appetite, 50*(2-3), 340-352.
- van Manen, S., Avard, G., & Martinez-Cruz, M. (2015). Co-ideation of disaster preparedness strategies through a participatory design approach: Challenges and opportunities experienced at Turrialba volcano, Costa Rica. *Design Studies, 40*, 218-245.

- Van Teijlingen, E. R., & Hundley, V. (2001). The importance of pilot studies.
- Veach, P. M., Bartels, D. M., & LeRoy, B. S. (2007). Coming full circle: a reciprocal-engagement model of genetic counseling practice. *Journal of genetic counseling, 16*(6), 713-728.
- Velez, A. L. K., Diaz, J. M., & Wall, T. U. (2017). Public information seeking, place-based risk messaging and wildfire preparedness in southern California. *International Journal of Wildland Fire, 26*(6), 469-477. doi:10.1071/WF16219
- Venkatesh, V., Brown, S. A., & Bala, H. (2013). Bridging the qualitative-quantitative divide: Guidelines for conducting mixed methods research in information systems. *MIS quarterly, 37*(1).
- Viratkapan, V., & Perera, R. (2006). Slum relocation projects in Bangkok: what has contributed to their success or failure? *Habitat International, 30*(1), 157-174.
- Vuong, Q.-H., & Nguyen, T.-K. (2015). Vietnamese patients' choice of healthcare provider: in search of quality information. *International Journal of Behavioural and Healthcare Research, 5*(3-4), 184-212.
- Wachinger, G., Renn, O., Begg, C., & Kuhlicke, C. (2013). The risk perception paradox—implications for governance and communication of natural hazards. *Risk analysis, 33*(6), 1049-1065.
- Walker, B., de Vries, H. P., & Nilakant, V. (2017). Managing legitimacy: The Christchurch post-disaster reconstruction. *International Journal of Project Management, 35*(5), 853-863.
- Wallerstein, N., & Bernstein, E. (1994). Introduction to community empowerment, participatory education, and health. In: Sage Publications Sage CA: Thousand Oaks, CA.
- Walliman, N. (2017). *Research methods: The basics*: Routledge.
- Wang, S.-L., & Kuo, M.-X. (2017). *The role of visual/verbal cognitive styles and self-efficacy in online searching behaviors and performance in the text-based learning environment*. Paper presented at the Advanced Applied Informatics (IIAI-AAI), 2017 6th IIAI International Congress on.
- Warah, R. (2004). Slums and Housing in Africa. *UN CHRONICLE, 40*(4), 19-19.
- Waugh, W. L. (2015). *Living with Hazards, Dealing with Disasters: An Introduction to Emergency Management: An Introduction to Emergency Management*: Routledge.
- Weinstein, N. D., Lyon, J. E., Rothman, A. J., & Cuite, C. L. (2000). Changes in perceived vulnerability following natural disaster. *Journal of Social and Clinical Psychology, 19*(3), 372-395.
- Wekesa, B. W., Steyn, G. S., & Otieno, F. F. (2011). A review of physical and socio-economic characteristics and intervention approaches of informal settlements. *Habitat International, 35*(2), 238-245.
- West, D. M. (2001). *The rise and fall of the media establishment*: Bedford/St. Martin's Boston, MA.
- West, D. M., & Orr, M. (2007). Race, gender, and communications in natural disasters. *Policy Studies Journal, 35*(4), 569-586.
- Westen, D., & Rosenthal, R. (2003). Quantifying construct validity: two simple measures. *Journal of Personality and Social Psychology, 84*(3), 608.
- Westland, J. C. (2010). Lower bounds on sample size in structural equation modeling. *Electronic Commerce Research and Applications, 9*(6), 476-487.
- Wilhite, D. A. (2016). *Droughts: A Global Assesment*: Routledge.
- Williams, B., Onsmann, A., & Brown, T. (2010). Exploratory factor analysis: A five-step guide for novices. *Australasian Journal of Paramedicine, 8*(3).

- Williams, B. D., Valero, J. N., & Kim, K. (2018). Social media, trust, and disaster: Does trust in public and nonprofit organizations explain social media use during a disaster? *Quality & Quantity*, 52(2), 537-550.
- Williams, D. C. (2012). *Global urban growth: A reference handbook*: ABC-CLIO.
- Wirtz, P. W., & Rohrbeck, C. A. (2018). The dynamic role of perceived threat and self-efficacy in motivating terrorism preparedness behaviors. *International journal of disaster risk reduction*, 27, 366-372. doi:10.1016/j.ijdr.2017.10.023
- Wisner, B., Paton, D., Alisic, E., Eastwood, O., Shreve, C., & Fordham, M. (2018). Communication With Children and Families About Disaster: Reviewing Multi-disciplinary Literature 2015–2017. *Current Psychiatry Reports*, 20(9), 73.
- Wogalter, M. S., & Mayhorn, C. B. (2008). Trusting the internet: Cues affecting perceived credibility. *International Journal of Technology and Human Interaction (IJTHI)*, 4(1), 75-93.
- Wolf, E. J., Harrington, K. M., Clark, S. L., & Miller, M. W. (2013). Sample size requirements for structural equation models: An evaluation of power, bias, and solution propriety. *Educational and psychological measurement*, 73(6), 913-934.
- Wood, M. M., Mileti, D. S., Kano, M., Kelley, M. M., Regan, R., & Bourque, L. B. (2012). Communicating actionable risk for terrorism and other hazards*. *Risk Analysis: An International Journal*, 32(4), 601-615.
- Xu, Z., Cheng, T., & Ren, M. (2017). Farewell to urban flooding: A brief discussion on the functions and features of Sponge City. *China Flood & Drought Management*, 27(5), 64-66.
- Yankson, P. W., & Bertrand, M. (2012). Challenges of urbanization in Ghana. *The Mobile City of Accra*, 25.
- Yeomans, K. A., & Golder, P. A. (1982). The Guttman-Kaiser criterion as a predictor of the number of common factors. *The Statistician*, 221-229.
- Yin, R. K. (2003). Case study research design and methods third edition. *Applied social research methods series*, 5.
- Yin, R. K. (2013). Validity and generalization in future case study evaluations. *Evaluation*, 19(3), 321-332.
- Yin, R. K. (2017). *Case study research and applications: Design and methods*: Sage publications.
- Yong, A. G., Lemyre, L., Pinsent, C., & Krewski, D. (2017). Risk Perception and Disaster Preparedness in Immigrants and Canadian-Born Adults: Analysis of a National Survey on Similarities and Differences. *Risk analysis*, 37(12), 2321-2333.
- Yoon, K., Pinkleton, B. E., & Ko, W. (2005). Effects of negative political advertising on voting intention: An exploration of the roles of involvement and source credibility in the development of voter cynicism. *Journal of marketing communications*, 11(2), 95-112.
- Zaalberg, R., Midden, C., Meijnders, A., & McCalley, T. (2009). Prevention, adaptation, and threat denial: Flooding experiences in the Netherlands. *Risk Analysis: An International Journal*, 29(12), 1759-1778.
- Zahari, R. K., & Ariffin, R. N. R. (2013). Risk communications: flood-prone communities of Kuala Lumpur. *Procedia Environmental Sciences*, 17, 880-888.
- Zaman, S., Ashraf, R. N., & Martines, J. (2008). Training in complementary feeding counselling of healthcare workers and its influence on maternal behaviours and child growth: a cluster-randomized controlled trial in Lahore, Pakistan. *Journal of health, population, and nutrition*, 26(2), 210.
- Zamora-Medina, R., & Zurutuza-Muñoz, C. (2014). Campaigning on Twitter: Towards the “personal style” campaign to activate the political engagement during the 2011 Spanish general elections.

- Ziervogel, G., Waddell, J., Smit, W., & Taylor, A. (2016). Flooding in Cape Town's informal settlements: barriers to collaborative urban risk governance. *South African Geographical Journal*, 98(1), 1-20.
- Zwick, W. R., & Velicer, W. F. (1982). Factors influencing four rules for determining the number of components to retain. *Multivariate behavioral research*, 17(2), 253-269.

Appendix 1: Human Ethic Research Council Approval

HUMAN RESEARCH ETHICS COMMITTEE



Notification of Expedited Approval

To Chief Investigator or Project Supervisor:	Doctor Thayaparan Gajondran
Co Co-investigators / Research Students:	Mr Matthew Abunyahwah Mrs Kim Maund
Re Protocol:	Influence of risk communication on intention to prepare for flood hazard in informal settlements
Date:	16-Aug-2016
Reference No:	H-2016-0256
Date of Initial Approval:	16-Aug-2016

Thank you for your **Response to Conditional Approval (minor amendments)** submission to the Human Research Ethics Committee (HREC) seeking approval in relation to the above protocol.

Your submission was considered under **Expedited** review by the Ethics Administrator.

I am pleased to advise that the decision on your submission is **Approved** effective **16-Aug-2016**.

In approving this protocol, the Human Research Ethics Committee (HREC) is of the opinion that the project complies with the provisions contained in the National Statement on Ethical Conduct in Human Research, 2007, and the requirements within this University relating to human research.

Approval will remain valid subject to the submission, and satisfactory assessment, of annual progress reports. *If the approval of an External HREC has been "noted" the approval period is as determined by that HREC.*

The full Committee will be asked to ratify this decision at its next scheduled meeting. A formal *Certificate of Approval* will be available upon request. Your approval number is H-2016-0256.

If the research requires the use of an Information Statement, ensure this number is inserted at the relevant point in the Complaints paragraph prior to distribution to potential participants You may then proceed with the research.

Conditions of Approval

This approval has been granted subject to you complying with the requirements for *Monitoring of Progress, Reporting of Adverse Events, and Variations to the Approved Protocol* as [detailed below](#).

PLEASE NOTE:

In the case where the HREC has "noted" the approval of an External HREC, progress reports and reports of adverse events are to be submitted to the External HREC only. In the case of Variations to the approved protocol, or a Renewal of approval, you will apply to the External HREC for approval in the first instance and then Register that approval with the University's HREC.

- *Monitoring of Progress*

Other than above, the University is obliged to monitor the progress of research projects involving human participants to ensure that they are conducted according to the protocol as approved by the HREC. A progress report is required on an annual basis. Continuation of your HREC approval for this project is conditional upon receipt, and satisfactory assessment, of annual progress reports. You will be advised when a report is due.

• *Reporting of Adverse Events*

1. It is the responsibility of the person first named on this **Approval Advice** to report adverse events.
2. Adverse events, however minor, must be recorded by the investigator as observed by the investigator or as volunteered by a participant in the research. Full details are to be documented, whether or not the investigator, or his/her deputies, consider the event to be related to the research substance or procedure.
3. Serious or unforeseen adverse events that occur during the research or within six (6) months of completion of the research, must be reported by the person first named on the **Approval Advice** to the (HREC) by way of the **Adverse Event Report form** (via RIMS at <https://rims.newcastle.edu.au/login.asp>) within 72 hours of the occurrence of the event or the investigator receiving advice of the event.
4. Serious adverse events are defined as:
 - Causing death, life threatening or serious disability.
 - Causing or prolonging hospitalisation.
 - Overdoses, cancers, congenital abnormalities, tissue damage, whether or not they are judged to be caused by the investigational agent or procedure.
 - Causing psycho-social and/or financial harm. This covers everything from perceived invasion of privacy, breach of confidentiality, or the diminution of social reputation, to the creation of psychological fears and trauma.
 - Any other event which might affect the continued ethical acceptability of the project.
5. Reports of adverse events must include:
 - Participant's study identification number;
 - date of birth;
 - date of entry into the study;
 - treatment arm (if applicable);
 - date of event;
 - details of event;
 - the investigator's opinion as to whether the event is related to the research procedures; and
 - action taken in response to the event.
6. Adverse events which do not fall within the definition of serious or unexpected, including those reported from other sites involved in the research, are to be reported in detail at the time of the annual progress report to the HREC.

• *Variations to approved protocol*

If you wish to change, or deviate from, the approved protocol, you will need to submit an **Application for Variation to Approved Human Research** (via RIMS at <https://rims.newcastle.edu.au/login.asp>). Variations may include, but are not limited to, changes or additions to investigators, study design, study population, number of participants, methods of recruitment, or participant information/consent documentation. **Variations must be approved by the (HREC) before they are implemented except when Registering an approval of a variation from an external HREC which has been designated the lead HREC, in which case you may proceed as soon as you receive an acknowledgement of your Registration.**

Linkage of ethics approval to a new Grant

HREC approvals cannot be assigned to a new grant or award (ie those that were not identified on the application for ethics approval) without confirmation of the approval from the Human Research Ethics Officer on behalf of the HREC.

Best wishes for a successful project.

Professor Allyson Holbrook
Chair, Human Research Ethics Committee

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RIMS website - <https://rims.newcastle.edu.au/login.asp>

Linked University of Newcastle administered funding:

Funding body	Funding project title	First named investigator	Grant Ref
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Flood

SURVEY FOR RESEARCH PROJECT:

Influence of risk communication on intentions to prepare for flood hazards in informal settlements

Thank you for participating!

This survey consists of eleven (11) sections. Each section contains variables that inform the study. We are interested in your perceptions on a number of issues relating to flood hazards.

By answering the questions in this survey, you will provide valuable information about risk communication and how it influences people's preparation to flood risk. Your responses will be used to develop a framework that may improve flood risk preparedness in Accra Metropolitan Assembly (AMA). For most answers, tick/cross the box(es) most applicable to you or fill in the blanks. There are no correct or incorrect responses; we just want your personal point of view. All data gathered through the survey will be use purely for academic purpose and will be treated with the strictest confidence.

The completion of the questionnaire will take approximately **30-35 minutes**.
Again, thank you for participating.

Research **STUDY**



THE UNIVERSITY OF
NEWCASTLE
AUSTRALIA

Section 1

Q1. Please provide information on the following

1. Sex Male Female Others specify
2. Age 18-26 27-35 36-44 45-53 54-62 63+
3. Education Primary Middle/JHS SHS Vocational/Technical University undergraduate
 Polytechnic diploma Postgraduate Never
4. Marital Status Single Married Separated Divorced Widowed
5. What is your employment?
6. For analysis purpose, please indicate your total monthly income after tax in Ghana Cedis (¢)
 0-300 301-600 601-900 901-1200 1201-1500 1501+

Q2. Please rate your agreement with the following statements: (PLEASE SELECT ONE ANSWER PER ROW)

	5 Strongly Agree	4 Agree	3 Neither Agree or Disagree	2 Disagree	1 Strongly Disagree
1. I have the freedom to decide on how to protect myself from flood hazard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I am creative in finding solutions to flood hazard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. I have a lot of control in finding solutions to flood hazard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I make my own decisions about how to protect myself from flood hazard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I find my own solutions to flood hazard most of the time	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. I am personally responsible for flood hazard decisions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. I am responsible for the results flood hazard decisions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. I take responsibility for the results of flood hazard protection	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. I am responsible for the outcomes of flood hazard protection actions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Section 2

Q3. Please rate the amount of flood risk information you receive? (PLEASE SELECT ONE ANSWER ON EACH ROW)

	5 Very High	4 High	3 Medium	2 Low	1 Very Low
1. Access to flood risk information	<input type="checkbox"/>				
2. Knowledge about flood risk	<input type="checkbox"/>				
3. Quantity of flood information you receive from communicators	<input type="checkbox"/>				
4. Quality of flood information you receive from communicators	<input type="checkbox"/>				
5. Level of information needed to deal with flood hazard	<input type="checkbox"/>				

Section 3

Q4. How many sources do you receive flood risk information from and state the main source?

No of sources:

Main Source

Q5. Regarding your **MAIN** source of flood risk information, rate its credibility on a scale of 1-5 (5 being the highest rating)? **(PLEASE SELECT ONE ANSWER ON EACH ROW)**

	1	2	3	4	5
1. How reliable is the main source of risk information?	<input type="checkbox"/>				
2. How valuable is your main communication source to you?	<input type="checkbox"/>				
3. How informed is the main source of risk information?	<input type="checkbox"/>				
4. How popular is your main communication source	<input type="checkbox"/>				
5. How qualified is the main source of risk information?	<input type="checkbox"/>				
6. How honest is your main communication source?	<input type="checkbox"/>				
7. How friendly is your main communication source?	<input type="checkbox"/>				
8. How expertise is your main source of risk information?	<input type="checkbox"/>				

Section 4

Q6. Could you indicate the clarity of flood risk information you receive from the **MAIN** communicator? (PLEASE SELECT ONE ANSWER ON EACH ROW)

	5 Strongly Agree	4 Agree	3 Neither Agree or Disagree	2 Disagree	1 Strongly Disagree
1. Flood risk communicator's answers to questions are clear	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Flood risk communicator is straightforward in his/her messages	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Communicator of flood risk uses relevant and clear examples	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Flood risk communicator is explicit in his/her instructions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Communicated flood risk messages have clear guidelines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. In general, risk messages from main communicators are clear	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 5

Q7. Could you indicate how regularly you participate in flood risk discussions? (PLEASE SELECT ONE ANSWER ON EACH ROW)

	5 Always	4 Often	3 Sometimes	2 Seldom	1 Never
1. I join others to discuss flood issues	<input type="checkbox"/>				
2. My input is solicited in flood hazard planning	<input type="checkbox"/>				
3. I am involved in taking flood hazard decisions that affect me	<input type="checkbox"/>				
4. I take part in activities toward flood risk preparation	<input type="checkbox"/>				
5. I am involved in taking flood hazard decisions that affect me	<input type="checkbox"/>				
6. My ideas and inputs towards the planning of flood risk is valued	<input type="checkbox"/>				

Section 6

Q8. Could you please rate your vulnerability to flood hazard? (PLEASE SELECT ONE ANSWER ON EACH ROW)

	5 Very High	4 High	3 Medium	2 Low	1 Very Low
1. Rate the chances of being affected by flood	<input type="checkbox"/>				
2. Rate the chances of the location of your house being affected by flood	<input type="checkbox"/>				
3. Rate how worried you are about getting flooded	<input type="checkbox"/>				
4. Rate the chances of your house getting flooded within the next one (1) year	<input type="checkbox"/>				

Section 7

Q9. To what extent will you rate the impact of flood hazard? (PLEASE SELECT ONE ANSWER ON EACH ROW)

	5 Very High	4 High	3 Medium	2 Low	1 Very Low
1. What do you think is the financial consequences of flood hazard on you as well as neighbours?	<input type="checkbox"/>				
2. Rate the consequences of Flooding on your life?	<input type="checkbox"/>				
3. How do you see the level of difficulty flood causes for your neighbours and relatives?	<input type="checkbox"/>				
4. What is likely to be the consequences of flood hazard on you years to come?	<input type="checkbox"/>				

Section 8

Q10. How efficient is your ability to respond to flood hazard impacts? (PLEASE SELECT ONE ANSWER ON EACH ROW)

	5 Strongly Agree	4 Agree	3 Neither Agree or Disagree	2 Disagree	1 Strongly Disagree
1. I am confident that I could deal efficiently with unexpected flood events?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I cannot do much to change the impacts of flood hazard on my life?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. When I am confronted with flood issues I can find several solutions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. I can remain calm when told about an Incoming flood hazard?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. The impacts of flood hazard on my life get solved themselves?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 9

Q11. Please describe the extent to which you agree or disagree with each of the following statement (PLEASE SELECT ONE ANSWER ON EACH ROW)

	5 Strongly Agree	4 Agree	3 Neither Agree or Disagree	2 Disagree	1 Strongly Disagree
1. I believe that any advice from flood experts could help reduce flood impacts?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I think that recommended actions from flood experts can reduce flood impacts?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Any strategy I prescribe for myself effectively deal with flood hazard impacts?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Recommended actions from neighbours and family members reduce the impact of flood?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Section 10

Q12. Rate your experience with each of the following? (PLEASE SELECT ONE ANSWER ON EACH ROW)

	5 Very High	4 High	3 Medium	2 Low	1 Very Low
1. Rate your experience about flood hazard impacts in general?	<input type="checkbox"/>				
2. Rate your experience of flood hazard impacts on your family or neighbours life?	<input type="checkbox"/>				
3. Rate your experience about the impact of flood on property?	<input type="checkbox"/>				

Section 11

Q13. Please Rate your level of flood preparedness on a scale Of 1-5 (5 being the highest) (PLEASE SELECT ONE ANSWER PER ROW)

1	2	3	4	5
<input type="checkbox"/>				

Q14. Could you please indicate the extent to which you prepare for flood hazards: (PLEASE SELECT ONE ANSWER PER ROW)

	5 Monthly	4 Quarterly	3 Bi-Annually	2 Annually	1 Never
1. How often do you check your level of preparedness?	<input type="checkbox"/>				
2. How often do you increase your level of preparedness	<input type="checkbox"/>				
3. How often do you become involved with a local group to discuss how to reduce flood damage or losses?	<input type="checkbox"/>				
4. How often do you seek information on flood risk	<input type="checkbox"/>				

5. How often do you seek information on things to do to prepare?

<input type="checkbox"/>				
<input type="checkbox"/>				

THANK YOU SO MUCH FOR PARTICIPATING.

Appendix 3: Resident Interview Scripts

Flood Risk Hazard, Communication and Preparedness Interview in Ghana

Date of Interview: day...../month...../2016

Time of Interview: am/pm

Section A

1. How long have you lived in this locality?
2. How many times do you experience flooding in this community a year?
3. How would you describe your exposure and vulnerability to floods?
4. What is your most pressing worry relating to flood hazard in this community?
5. How and when do you receive information about flood hazard?
6. When and how are community meetings on flood organized?
7. What do flood experts tell you during community discussions on flood?
8. Can you describe the source and their credibility of the sources?
9. Do you think the message you receive is clear?
10. Do you think the information provided is sufficient to prepare for floods?
11. What role does source credibility, information sufficiency and message clarity play?
12. Do you receive conflicting information making it difficult to prepare for floods?
13. How do you respond to the recommended action from the information sources?
14. Are you able to easily embark on the actions recommended by the information source?
15. When and how do you prepare towards flood?
16. What do you think are the key challenges in getting relevant and accurate information?
17. What is the best communication approach to provide information?

Appendix 4: Institutional Interview Scripts

Flood Risk Hazard, Communication and Preparedness Interview in Ghana

Name of organisation:.....

Date of Interview: day...../month...../2016

Time of Interview: am/pm

Section A

1. How long have you been working with this organisation and the communities?.....
2. Describe flood vulnerability in each of the following locations
 - a) Old Fadama
 - b) Nima
 - c) Kotobabi
3. Describe the severity of flood strike in each of the locations above?
 - a) Old Fadama
 - b) Nima
 - c) Kotobabi
4. What has been done or being done to reduce vulnerability and severity of flood hazards in these locations?
5. What is the protocol in your institution relating to providing flood hazard information to informal settlements? (is it only emergency stage or to assist with preparedness well before the event)
6. Can you describe the information sources and their credibility?
7. Can you describe the communication methods used to convey information?
8. How do you evaluate the clarity of the message provided to residents?
9. Do you think the information provided is sufficient to make informed judgments by the residents?
10. How do residents respond to your information or messages?
11. How effective is the information provided by your institution in influencing the intention to prepare for floods by the residents?
12. What factors impact on the effective translation of your message by the residents for the intention to prepare? (e.g. trust)
13. What programs have been implemented to ensure residents preparedness towards flood hazards?