

Understanding flood risk perceptions and motivations for damage mitigation: The case of Kampala, Uganda

Simbarashe Chereni



# UNDERSTANDING FLOOD RISK PERCEPTIONS AND MOTIVATIONS FOR DAMAGE MITIGATION: THE CASE OF KAMPALA, UGANDA

DISSERTATION

to obtain the degree of a doctorate at the University of Twente, on the authority  
of the rector magnificus, prof.dr.ir. A. Veldkamp, on account of the decision of  
the Doctorate Board, to be publicly defended on the 22<sup>nd</sup> day of June 2022 at  
1445 hrs

by

Simbarashe Chereni  
born on 06 April 1982.  
in Zaka, Zimbabwe

This thesis has been approved by  
**Prof. dr. Richard Sliuzas**, First supervisor  
**Emeritus Prof. dr. Martin van Maarseveen**, Second supervisor  
**Dr. Johannes Flacke**, Co-supervisor

ITC dissertation number 414  
ITC, P.O. Box 217, 7500 AE Enschede, The Netherlands

ISBN 978-90-365-5389-6  
DOI 10.3990/1.9789036553896

Cover designed by Job Duim  
Cover photos by Inge Kok Postma, Richard Sliuzas, and Simbarashe Chereni  
Cartoon by Dave Granlund  
Printed by ITC Printing Department  
Copyright © 2022 by Simbarashe Chereni



**UNIVERSITY OF TWENTE.**

**ITC**

FACULTY OF GEO-INFORMATION SCIENCE AND EARTH OBSERVATION

Graduation committee:

**Chairman/Secretary**

Prof.dr.ir. F van der Meer

**Supervisors**

prof. dr. Richard Sliuzas

Emeritus prof. dr. Martin van Maarseveen

**Co-supervisor**

dr. Johannes Flacke

**Members**

prof. dr. K. Pfeffer

Universiteit Twente, ITC, Department of Urban and Regional Planning and Geo-Information Management

prof. dr. V.G. Jetten

Universiteit Twente, ITC, Department of Applied Earth Sciences

prof. W.J.W. Botzen

Vrije Universiteit Amsterdam

prof. E.B. Zoomers

Universiteit Utrecht

dr. S. Lwasa

Makerere University



## Acknowledgements

Yes, at last, this project is coming to an end! Reaching such a milestone is always a demanding task, which requires support in different ways. I feel indebted to many, who contributed to this milestone in various ways, and I would like to take this opportunity to appreciate them.

First, I would like to thank the almighty God for enabling me to accomplish this work over the past five and a half years. It was a time full of diverse challenges for me, and I cannot imagine what I would have become without God's divine enablement.

I am also greatly indebted to my supervisors - Professor Richard V Sliuzas, Emeritus Professor Martin van Maarseveen, and my daily supervisor Dr Johannes Flacke; for tirelessly guiding me through this journey. As I write, I feel highly transformed and equipped - ready to make a lasting footprint in the land, planning, and urban resilience research and development domains. Your questioning, probing, and suggestions during our meetings always left me with new or additional insights regarding my work.

I would also like to acknowledge the Department of Urban and Regional Planning and Geo-Information Management at the Faculty of Geo-Information Science and Earth Observation, the University of Twente for waiving my fees and providing a research grant for this thesis. I would also like to appreciate the Faculty ITC for providing me with a subsistence allowance in my third year.

This work was not going to be possible without the help of local contacts in Kampala. Thank you, Professor Shuaib Lwasa, for connecting me to a great team of research assistants and helping in the first briefing session in which we discussed translation and logistic issues. I would also like to appreciate my team of research assistants in Kampala - Hakim, Teddy, Isaac K, Isaac N, Susan, Juliet, Daniel, and Lilian. Thank you for the sterling job you did in administering questionnaires that needed translation 'on the fly,' in places that either had poor accessibility or required walking for long distances on foot. Hakim, thank you once more for sharing with me the Uganda shapefiles.

The KCCA deserves a big applause for allowing me to do this study and also because some of their employees participated in my interviews. This work would not have succeeded without gaining access to the case study areas. Special thanks to Harriet, Isaac, Jude, and Abel. Flavia, thank you so much for the Uganda shapefiles which you shared with us in 2015 – they were again very helpful in this project.

Community leaders in Bwaise III, Natete, and Ntinda permitted us to carry out the study in their areas and I am grateful for their cooperation and understanding. Special mention goes to the Slum Dwellers Federation committee in Bwaise III for introducing research assistants to the community and helping them to find walkways in the area. In Natete, the Chairperson for Central B helped in the same manner and I would like to thank him for the fantastic job!

My sincere appreciation also goes to my wife, Emerita who, over and above the usual support and encouragement, had to work to keep us afloat financially, when changes in the economy in Zimbabwe resulted in a drastic reduction in our income in value terms. Words fail to adequately express my appreciation for you Emerita.

The PhD journey can be very lonely, but that was not the case with me, thanks to my colleagues who kept me company in diverse ways. Special mention goes to my officemates – Adish, Lydia, Rosa, Zaid, Deepshika, Sven, Sergio, and Vicky. Thank you, guys, for sharing ideas and resources, and for the encouragement. I would also like to appreciate Alice – having graduated with the same MSc. Class and going ahead to PhD studies in the same department meant that we exchanged notes at various stages of our PhD research projects.

To reach this level, there are many stages that I accomplished. I would, therefore, like to appreciate all the people who contributed to my entire education career to date. I would like to thank my Brother, Dr Admire, for being an inspiration and for encouraging me throughout my studies. Special mention goes to my parents who sacrificed their resources and energy to send me to school. I still vividly remember how my mother Mary sold her only goat when I was sent away from school because of school fees, in my 4th year in secondary school. I will also not forget how my father Jameson Alex, would travel distances, buying and selling, even though he was slowly losing his sight.



# Table of Contents

List of Abbreviations.....	vii
List of figures.....	ix
List of tables.....	x
Chapter 1: Introduction, background, and research design.....	1
1.1 Flood risk in cities of the Global South .....	2
1.2 Conceptualizing flood damage mitigation .....	4
1.3 Definition of concepts .....	7
1.3.1 Threat appraisal.....	8
1.3.2 Coping appraisal .....	8
1.3.3 Risk perception and risk attitudes .....	8
1.3.4 Flood knowledge/experience and its impact.....	9
1.3.5 Government effort .....	9
1.3.6 Flood damage mitigation.....	9
1.3.7 Other hypothesized factors of risk perception .....	9
1.4 Knowledge gaps in flood damage mitigation .....	10
1.5 Study aim and objectives.....	11
1.6 Research design .....	11
1.6.1 Research approach.....	12
1.6.2 Background to the case study - Kampala .....	13
1.6.3 The three case study locations.....	14
1.6.4 Sampling strategy.....	18
1.6.5 Data collection and analysis .....	20
1.7 Thesis outline .....	22
Chapter 2: Governance framework for flood risk management in Kampala.....	25
2.1 Introduction .....	26
2.2 Trends in governance and flood management.....	27
2.2.1 Conceptual and evaluative frameworks .....	28
2.3 Methods.....	31
2.3.1 Description of study area .....	31
2.3.2 Data and analysis methods .....	33
2.4 Findings.....	34
2.4.1 Governance rearrangements .....	34
2.5 Discussion.....	42
2.6 Conclusions and areas for further research.....	45
Chapter 3: A case for cross country/language mixed-methods research in flood damage mitigation studies and a tool for enhancing data quality.....	47
3.1 Introduction .....	48
3.1.1 Aim and structure .....	48

3.1.2	The briefing and debriefing technique (BDT).....	48
3.1.3	The research context and pre-fieldwork design .....	49
3.1.4	Potential pitfalls.....	51
3.1.5	Key quality concepts: data accuracy, reliability, and validity.....	51
3.2	Applying and extending the briefing and debriefing technique .....	56
3.2.1	Recruiting Research Assistants .....	57
3.2.2	Training.....	61
3.2.3	Transect walks .....	61
3.2.4	Reflect.....	62
3.2.5	Briefing .....	63
3.2.6	Assign .....	63
3.2.7	Monitor.....	64
3.2.8	Debrief .....	64
3.3	Conclusion and discussion.....	65
Chapter 4: Factors influencing households' flood perceptions of risk and threat appraisal in three neighbourhoods of Kampala, Uganda.....		67
4.1	Introduction .....	68
4.2	Literature review .....	69
4.2.1	Theoretical underpinning.....	69
4.2.2	Past studies on risk perception .....	70
4.3	Conceptual scope and research methods.....	72
4.3.1	Conceptual scope.....	72
4.3.2	Data and analysis methods .....	74
4.4	Findings.....	76
4.4.1	Households' perceptions of the causes of flood risk .....	76
4.4.2	Perception of the LFPD.....	77
4.4.3	Relationship of explanatory variables and perceived likelihood of property damage.....	79
4.4.4	Factors of Perception of the LFPD.....	81
4.4.3	Relationship of explanatory variables and perceived likelihood of property damage.....	82
4.5	Discussion.....	88
4.6	Conclusions.....	91
Chapter 5: Factors influencing flood coping appraisal among homeowners and residents in Kampala, Uganda.....		93
5.1	Introduction .....	94
5.2	Theoretical framework and literature review .....	95
5.2.1	Theoretical framework.....	95
5.2.2	Past studies on homeowners and residents' coping appraisals .....	97
5.3	Data and analysis methods .....	99
5.4	Findings.....	99

5.4.1	Association between explanatory variables and coping appraisal elements in the five hypotheses .....	99
5.4.2	Regression analyses of flood coping appraisals .....	119
5.5	Discussion.....	128
5.6	Conclusions and recommendations.....	129
Chapter 6: Flood damage mitigation behaviour of micro, small and medium enterprises in Kampala.....		131
6.1	Introduction .....	132
6.2	The Protection Motivation Theory .....	133
6.2.1	Threat appraisal.....	134
6.2.2	Coping appraisal .....	134
6.2.3	Business characteristics .....	134
6.2.4	Risk attitudes .....	135
6.2.5	Flood experience and its impact.....	135
6.2.6	Government efforts .....	135
6.2.7	Flood mitigation behaviour .....	135
6.3	Methodology .....	136
6.3.1	Research design and setting.....	136
6.3.2	Sampling .....	136
6.3.3	Data collection.....	136
6.3.4	Data analysis.....	138
6.4	Findings.....	140
6.4.1	Business characteristics as factors for flood mitigation behaviour .....	140
6.4.2	Influence of flood experience on flood mitigation behaviour .....	141
6.4.3	Risk attitude and flood risk perception as factors of flood mitigation behaviour .....	142
6.4.4	Influence of threat appraisal on flood mitigation behaviour .....	143
6.4.5	Influence of coping appraisal on flood mitigation behaviour .....	144
6.5	Discussion.....	146
6.6	Conclusions.....	150
Chapter 7: Synthesis, conclusions, and future research directions.....		151
7.1	Research problem and aim .....	152
7.2	Methodological sythesis and hypothesis .....	154
7.3	Answers to research objectives and questions .....	154
7.3.1	Influence of governance rearrangements on flood mitigation behaviour .....	154
7.3.2	A methodological framework for ensuring data quality .....	155
7.3.3	Factors of risk understanding and threat appraisal among households.....	155
7.3.4	Factors of flood coping appraisal among households.....	156

7.3.5 Factors influencing adoption of flood damage mitigation measures among micro to medium-sized businesses in Kampala.....	162
7.4 Innovative contributions .....	163
7.4.1 Methodological contributions .....	163
7.4.2 Disciplinary knowledge contributions .....	163
7.5 Policy and societal implications .....	164
7.6 Reflections on the key findings .....	165
7.7 Limitations and future work.....	167
Bibliography .....	169
Appendices.....	182
Summary .....	224
Samenvatting .....	228

## List of abbreviations

AMREF	African Medical and Research Foundation
APL	Adaptable Program Loan
BDT	Briefing and Debriefing Technique
CEMR	Council of European Municipalities and Regions
CRED	Centre for Research on the Epidemiology of Disasters
EBDT	Extended Briefing and Debriefing Technique
GDP	Gross Domestic Product
GoU	Government of Uganda
IC	Implementation Cost
IPCC	Intergovernmental Panel on Climate Change
KASTI	Kampala Slum Transformation Initiative
KCC	Kampala City Council
KCCA	Kampala Capital City Authority
KIIDP	Kampala Institutional and Infrastructure Development Program
LCs	Local Councils
LFPD	Likelihood of Flood-Induced Property Damage
MoLHUD	Ministry of Lands Housing and Urban Development
NGO	Non-Governmental Organisation
NPG	New Public Governance
NPM	New Public Management
NSDFU	National Slum Dwellers Federation of Uganda
PMT	Protection Motivation Theory
PPM	Progressive Public Management
RE	Response Efficacy
SACCO	Savings and Credit Cooperative
SE	Self-Efficacy
SFR	Strategic Framework for Reform
SSA	Shelter Settlement Alternative
SUDS	Sustainable Urban Drainage Systems
UN habitat	United Nations Human Settlements Programme
UNDP	United Nations Development Programme
UNISDR	United Nations International Strategy for Disaster Reduction

USA	United States of America
WGAF	Water Governance Assessment Framework

## List of figures

Figure 1. The Modified framework of the Protection Motivation Theory	6
Figure 2. Research approach	13
Figure 3. Map of study locations in Kampala	15
Figure 4. A street at the Business centre in Bwaise III	16
Figure 5. The widened Nsooba-Lubigi channel passing through Bwaise III	17
Figure 6. Unplanned housing units in Natete	17
Figure 7. Part of Ntinda – the affluent neighbourhood	18
Figure 8. Driving and enabling factors for implementation of flood risk management	29
Figure 9. The extended briefing and debriefing technique	57
Figure 10. Extended Protection Motivation Theory	73
Figure 11. Data analysis steps	75
Figure 12.a. January 2015 image - clearing of the wetland for construction	78
Figure 12b. November 2016 image showing the landfill extent	78
Figure 12c. June 2017 image indicating the area in figure 8e	78
Figure 12d. December 2019 image showing some erected structures	78
Figure 12e. Ground photograph 2 - part of the construction site on a wetland in Nsimbiziwoome - August 2017	78
Figure 13. Perception of the likelihood of property damage	79
Figure 14: Extended protection motivation theory	96
Figure 15 Modified Protection Motivation Theory for businesses.	134
Figure 16 perceptions of businesses about future flood probability	144

## List of tables

Table 1. Summary characteristics of the cases	15
Table 2. Overview of interview respondents	19
Table 3. Explanation of variables	21
Table 4. Governance scoreboard	34
Table 5. Qualifications and strategic roles of research assistants	59
Table 6. Summary of literature on risk perception factors	71
Table 7. Association between explanatory variables and perceived likelihood of property damage - Spearman's Rho	80
Table 8. Perceived likelihood of property damage model fitness	82
Table 9. Bwaise III parameter estimates - perception of the likelihood of property damage.	83
Table 10. Natete parameter estimates - perception of the likelihood of property damage.	84
Table 11. Natete parameter estimates - perception of the likelihood of property damage.	87
Table 12 Relationship between our findings on flood risk perception and our findings	89
Table 13. Descriptive statistics for selected explanatory variables of coping appraisal	100
Table 14. Correlations of predictor variables with elements of coping appraisal in Bwaise III.	102
Table 15. Correlations of predictor variables with elements of coping appraisal Natete.	105
Table 16. Correlations of predictor variables with elements of coping appraisal in Bwaise Ntinda	109
Table 17. Correlations of predictor variables with elements of coping appraisal in Bwaise III.	120
Table 18. Correlations of predictor variables with elements of coping appraisal in Natete.	122
Table 19. Correlations of predictor variables with elements of coping appraisal in Ntinda	126
Table 20 Variables relevant to business measured in the data	137
Table 21 Classification of MSMEs	138
Table 22 Relationship of business size and status of premises	141



Table 23 impacts of property damage, health problems, and flood-related financial problems, on mitigation behaviour	142
Table 24 Cross-tabulation of mitigation behaviour and willingness to spent on mitigation	143
Table 25 Influence of future flood probability on mitigation behaviour	144
Table 26 Relationship between having looked for and/received flood information, and implementation of mitigation measures , among businesses	146
Table 27 Summary of findings about businesses across the three case study areas	149



## **Chapter 1: Introduction, background, and research design**

Flooding is the world's most frequent, widespread, and catastrophic natural hazard (Bashir, Oludare, Johnson, & Bongwa, 2012). Flood hazards are also becoming more frequent and unpredictable, leading to increased exposure all over the world. In 2020, flood events increased by 23% from the annual average of 163 over the last two decades, and the percentage of flood-induced deaths among all disaster-induced deaths is higher (52%) than the annual average of 44%. (CRED, 2021).

The impacts of flooding are more pronounced in urban areas because of the high population density and the high value of assets. As urbanization continues to rise, the situation continues to worsen. "The world's urban population is estimated at 4.4 billion, 3,4 billion of which are in the Global South cities. Globally, it is expected to grow by 1.56 billion between 2020 and 2040, and about 90% of this growth is expected in Africa and Asia (Satterthwaite, 2020)." Cities in these continents accommodate a significant proportion of this population in environmentally sensitive areas, where development does not satisfy the minimum standards, thereby putting people and assets at risk of flooding.

This chapter provides a general introduction to the topic of the thesis. It traces the key theoretical and methodological developments and the associated improvements to flood damage mitigation knowledge. Subsequently, a knowledge gap that this work addresses, is identified. The chapter is organized into four main sections. First, it explains the background to the flooding problem in cities of the global South. Second, it traces the paradigms and conceptual frameworks used to identify relevant variables and their relationships in risk perception studies. Third, it identifies knowledge gaps in flood damage mitigation studies. Fourth, the overall objectives of the thesis are outlined and lastly, it explains the research methodology and the thesis outline.

## ***1.1 Flood risk in cities of the Global South***

The current and projected demographic trend poses a serious challenge in Global South cities because of poor planning, often the weak implementation of development control regulations, and insufficient resources (Devex, 2020). In these cities, governments fail to keep pace with this growth by providing risk-reducing infrastructure, resulting in millions of their residents living in unplanned underserved settlements, often in risky areas (Devex, 2020). This situation is also a result of contradictions between the city and national administrators, corruption, colonial legacies, a lack of governance capacity, and contested urban development processes (Fraser, 2017). In Africa for example, these processes often result in a dualized urban development, with sound planning and development in former European

neighbourhoods, making them distinct from former African neighbourhoods which were often crowded and underdeveloped. As a result, it is estimated that about 62-70% of the urban population live in informal settlements (Simiyu et al., 2019).

The conditions in these settlements often amplify the impacts of climate change, which normally manifests in tropical storms and floods. Flooding is usually caused by just less extreme rainfall, let alone intense storms that often occur in the city, because of poor drainage, poor waste management, and the crowded nature of informal settlements. Because of this situation, floods represent 69% and 47% of all disasters in Africa and Asia respectively (Tazen et al., 2019). Although the proportion of flood-induced damage is low in Africa (17%) compared to 46% and 49% in Europe, and Asia respectively (CRED, 2021), their impact on livelihoods and the wider economy is high because of high levels of vulnerability. For example, it is estimated that around 70% of the urban population in Sub-Saharan Africa live in informal settlements, engaging in mostly informal trading and living on less than a dollar per day (Richmond et al., 2018). In Sub-Saharan Africa, the informal sector provides about 72% of all employment, yet it mainly comprises Micro, Small, and Medium Enterprises (MSMEs), which either rent or operate on the open, and lack collateral to access finance for scaling up their operations (Thompson et al., 2017). Consequently, both households and businesses are vulnerable to the growing flooding risk in many parts of Sub-Saharan African cities.

The vulnerability of households and businesses exerts a heavy burden on local governments, especially given the high level of inequality in these cities (Satterthwaite, 2020; Satterthwaite et al., 2020; Simiyu et al., 2019). The burden of flood resilience building is enormous, to an extent that even after implementing city-wide mitigation measures, a big amount of flood risk often remains. Therefore, there is an urgent need for more flood resilience building in these areas. In the quest for this, local governments in the global South are increasingly realizing the significance of household/business level flood mitigation efforts (Frazer 2017). The role of government in such instances will be to provide city-wide public protection while putting up policy instruments that empower households and businesses to implement mitigation measures on their own.

Developing such policies to stimulate property level damage mitigation requires knowledge about the motivating factors of the residents and business owners. It, therefore, comes as no surprise that establishing the motivating factors for local-level flood resilience-building efforts has been a key research agenda in the past 2 decades, which also motivated the work presented in this thesis.

## **1.2 Conceptualizing flood damage mitigation**

The quest to generate knowledge on flood damage mitigation has driven efforts to improve both the conceptual frameworks and the methodological approaches used. Understanding of flood risk has evolved over the years from an engineering focus to a more holistic view (Birkholz, Muro, Jeffrey, & Smith, 2014). The engineering focus entailed quantitative measurement of flood risk through hydrodynamic modelling, which often resulted in the production of maps and graphs showing flow velocities, water depth, and areas that are likely to suffer damages and losses. This positivist approach, therefore, inspired structural mitigation approaches mainly at city-wide or neighbourhood level. Although a city-wide flood modelling approach has been useful in determining the boundaries of flood susceptibility areas and regions to guide evacuations, and construct flood defence mechanisms among others, they could not/cannot account for the complete set of drivers of protective human actions. Yet flood risk challenges proved to be more related to human behaviour. This opened a niche for flood risk perception studies (Jasanoff, 1998).

Earlier attempts to account for human behaviour were mainly targeted at understanding why people settled on flood plains despite flood threats, and the strategies they adopted to cope with floods (Burton, Kates, & White, 1968; Kates, 1963; White, 1945). Since these scholars were abstracting their thinking from engineering approaches that dominated risk management during those years, their conceptualisation of human behaviour tended to be rational. Consequently, the conceptual and methodological approaches were inclined toward cost-benefit analysis of risk and expected utility modelling. A key finding of these studies was that individuals are prepared to settle in flood-prone areas if the benefits of doing so outweigh the potential damage and losses. This gave birth to the psychometric paradigm of risk, leading to a realisation that the “problem lies at the interface between social and natural systems” (Birkholz et al., 2014, p. 15).

A shortfall of this conceptualisation was that it assumed a rational individual, yet in practice, people are differently influenced by social interactions, government policy, and risk communication, among others. Such influences have been proven to offset the objective judgment of risk. Therefore, the psychometric paradigm was criticised for focusing on the individuals outside environmental, social, cultural, and economic contexts that shape and reshape their judgments (Shreve et al., 2014).

The realisation of the potential misjudgement of risk and benefits triggered the evolution of the rational theory to bounded rationality, with the same scholars setting the pace (Kates, 1971; White, 1961). Bounded rationality considers human limitations in understanding flood potential and consequences, which limits their view of the actual risks they may face in a specific context (Birkholz et al., 2014). This, in turn, forces them to make decisions that are not completely rational from a utilitarian perspective. Such an understanding opened a niche for heuristics and judgement epitomised by the prospect theory (Kahneman & Tversky, 1979). Under the prospect theory, humans are believed to rely on heuristics and judgement to build mental maps of the probability of uncertain events (in this case flooding) and their severity. Individuals' mental maps have therefore been found to influence their mitigation decisions.

Prospect theory borrowed much from Expected Utility Theory and consequently ended up using econometric models. This knowledge was later improved by Johnson & Tversky (1983) who established that individuals' mental maps about potential hazards are influenced by personal characteristics such as mood, which according to them, causes misjudgements of potential hazards.

More recently, post-positivist formulations presented risk as both physically determined and socially constructed. Accordingly, risk perception is both realistic and constructivist (Kellens, Zaalberg, Neutens, Vanneuville, & De Maeyer, 2011; Wachinger & Renn, 2010). Examples include the political ecology and social construction of risk theory, the cultural theory of risk, and the social amplification of risk framework (Kasperson et al., 1988). The political ecology and social construction of risk focus more on the relationship between society and risk. Specifically, it seeks to link risk to structural constraints and political frameworks that shape differential access to resources and create different vulnerability levels (Short, 1984). Similarly, cultural theory relates risk perception to the social organisation (Kingston, Douglas, & Wildavsky, 1982). Further, the social amplification of risk asserts that risk is communicated through social conduits, which can result in misjudgement of its severity (Kasperson et al., 1988). As these scholars mainly used qualitative methods, mathematical modelling of the envisaged processes was not possible.

Building on the psychometric paradigm, an idea of establishing what influences households to take precautionary measures was hatched. This led to the adoption of the Protection Motivation Theory (PMT) (Rogers, 1975) from health sciences into hazard management studies. According to PMT as adapted in flood risk mitigation, individual efforts to mitigate against flood damage depend much on their understanding of flood risk. Recently, modelling psychometric processes and they are

## Introduction and Background

contextual social and political factors led to the modification of the PMT to include social interaction, socio-economic status, and government policy, among other factors (e.g., Poussin et al., 2014). As illustrated in figure 1, PMT provides that households are motivated to mitigate against flood damage by two main groups of drivers of perceptual change – threat appraisal and coping appraisal. Under threat appraisal, households consider the probability of a flood event and its related consequences. On the other hand, they also consider their perceptions of their ability to protect themselves (self-efficacy); coping costs; and effectiveness (response efficacy) of mitigation alternatives. Consequently, behaviour against/in response to a threat is a function of the knowledge about or experience of a disaster, and two aforementioned appraisal components.

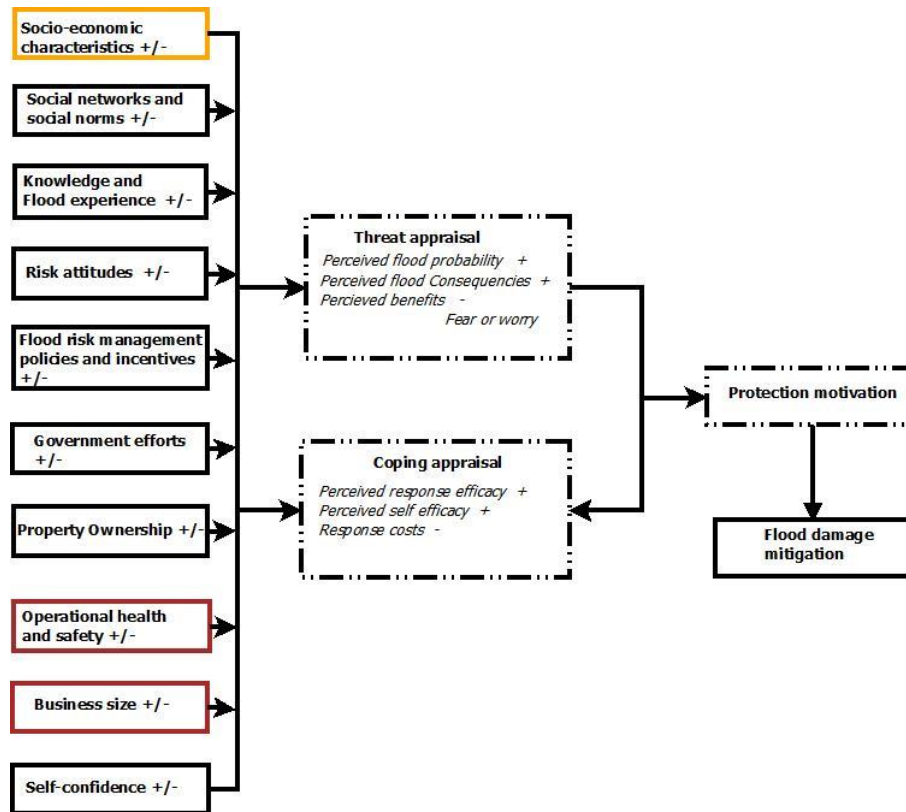


Figure 1: Modified framework of the Protection Motivation Theory  
Source: adapted from Poussin et al., (2014)

The boxes in broken lines represent the original formulation of the protection motivation theory. Those in solid black lines represent concepts that apply both to households and businesses. The concepts that apply to households only are presented in yellow boxes while the



ones exclusively for businesses are shown in maroon boxes. All concepts in the framework and the debates surrounding them are explained in more detail in the other chapters of this thesis.

The work of Poussin et al., (2014) was a realization that factors other than a threat and coping appraisal also affect flood damage mitigation. However, a critical look at their modified conceptual framework generates more questions about the relationship between the newly added variables and flood risk perception. Second, the use of linear regression alone was not adequate for modelling a process involving uncertainty. This was improved by Haer et al., (2015) who used Bayesian modelling in connection with Agent-Based Modelling, to simulate human responses under different policy (insurance) scenarios. This approach enabled the simulation of uncertainty in household reactions to insurance and subsidy policy. What Haer et al., (2015) failed to capture were other determinants of risk perception besides social interaction, media, and flood experience. As a result, the perception of households about risk was not adequately modelled. For example, the influence of government mitigation measures and planning regulations was not considered. Additionally, other agents such as businesses were also not considered.

Using the PMT framework, recent scholarship, (for example Botzen, Aerts, & van den Bergh, 2013; Bubeck, Botzen, Kreibich, & Aerts, 2013; Bubeck, Botzen, Kreibich, & Aerts, 2012; Grothmann & Reusswig, 2006; Osberghaus, 2014; Poussin, Botzen, & Aerts, 2014; Wachinger & Renn, 2010) identified flood risk perception, government policy, socio-economic status, social capital, flood experience and risk attitude as the main motivation factors of property level damage mitigation among households. In this research, PMT suggests that a household, business, community, business, and/or government's perception of floods results in either adoption or non-adoption of flood damage mitigation measures. Earlier adaptations of PMT focused on threat and coping appraisal as the determinants of mitigation behaviour (Grothmann & Patt, 2005; Grothmann & Reusswig, 2006). The major contribution of these studies was a scientific connection between risk perception and the adoption of mitigation measures which previous frameworks had not done adequately (Bockarjova, van der Veen, & Geurts, 2009). These early PMT applications were more directed by the psychometric paradigm, they could not include the social dimension of risk.

### **1.3 Definition of concepts**

In this section, I define all the key concepts from the PMT, which also sheds light on how the variables used in this study are derived.

### **1.3.1 Threat appraisal**

Threat appraisal is the ex-ante evaluation of a hazard about the damage or loss it is likely to cause. It assesses the magnitude of the threat about the vulnerability one finds him/herself in, subtracting what he/she might get from the disaster experience. It describes how a household or business assesses the threat posed by a certain hazard. In this study, it is composed of the variable 'perceived likelihood of property damage,' which is linked to the level of perceived risk and the associated amount of fear or worry (Bubeck et al., 2012; Poussin et al., 2014).

### **1.3.2 Coping appraisal**

A coping appraisal is a process in which households/businesses consider the advantages of available actions to cope with the threat, and assess their ability to execute them. It concerns the perceptions that they have towards the available coping measures. This comprises three variables: perceived response -efficacy (the expected effectiveness and usefulness of a protective measure); perceived self-efficacy (perception of a household/business about their capacity to implement the measures); and perceptions of response costs-costs (expectations of the financial and time costs required to implement a specific protective measure) (Grothmann & Reusswig, 2006).

### **1.3.3 Risk perception and risk attitudes**

Although risk perception encompasses the above appraisal elements, it has a broader meaning. The Cambridge English dictionary defines perception as, "a belief or opinion, often held by many people and based on how things seem" (<https://dictionary.cambridge.org/dictionary/english/perception>). In risk management studies, it has also been used to describe opinions about: the causes of risk; who is responsible for managing risk, and the meanings attached to risky situations and events (Patel & Fatti, 2013; Ziervogel et al., 2016).

Risk attitudes are strong feelings that one develops towards a threat posed by a hazard. These feelings include self-confidence that one's property does not need protective investment (Crichton, 2006). It usually shows up in an individual/business' level of willingness to self-protect.

### ***1.3.4 Flood knowledge/experience and its impact***

Flood knowledge is the awareness and understanding of the existence of a risky situation. An individual/business can come to know about flood risk either by experiencing it or hearing about it. Flood experience is a process of going through a flood event (direct experience) or seeing others going through it (indirect experience).

### ***1.3.5 Government effort***

Government efforts include both national and local government's direct help to residents at risk or their mitigation activities such as dredging and widening drainage channels.

### ***1.3.6 Flood damage mitigation***

Flood damage mitigation includes the efforts by households/businesses to reduce the impact of flooding on the properties and resources that sustain their daily operations. In the literature, the variable has been conceptualized as including structural mitigation, non-structural mitigation, emergency measures, and intentions to mitigate (Poussin et al., 2014).

### ***1.3.7 Other hypothesized factors of risk perception***

Other potential factors of flood risk perception include Socioeconomic status, size of social networks, property tenure, business characteristics, and safety and health policies.

Social status is attributes that explain the status of households in the society/community, for example, household size, income, employment status, gender, and age of respondent, among others. Social networks are relational and/or friendship lines. I provide more about these variables in Chapters 4 and 5.

Property tenure is the condition under which a household/business derives rights to use the property. It explains whether a household/business uses a property on freehold tenure, leasehold tenure, or on a usufruct basis. In Chapters 4, 5, and 6, I further discuss this variable.

Business characteristics include business type, number of employees, and age of business, and safety and health policies are internal principles and guidelines that companies put in place to reduce emergencies at work. More details on these factors are provided in Chapter 6.

## **1.4 Knowledge gaps in flood damage mitigation**

In section 1.3, I argued that studies that follow PMT thinking are concentrated in the USA and Europe, with few studies in Africa. Moreover, studies that document flood risk perception and mitigation by businesses are still very few. Further, very few studies provide detailed insights on measure-specific coping appraisals, which are critical to local governments when they prioritise mitigation actions.

This research, therefore, addresses these gaps first by establishing whether the important factors in the PMT literature (which mainly documents household experiences and very little on businesses) also apply in Africa, using the case of Kampala, Uganda, as a different socio-economic, cultural and policy context. It assumes that dominant drivers may be different from those established in Europe, Asia, and the USA, or at least the same factors may have a different impact because of contextual differences (e.g., in risk culture, risk levels, and vulnerability).

Further to this, the majority of drivers and barriers to household mitigation in the literature are different from those established for business flood damage mitigation though. These include cost-benefit of implementation; operational health; safety obligations and the best norms (Gissing, Molino, & Edwards, 2005). Crichton (2006) added to the above-mentioned: scepticism, self-confidence, time, and trust in state emergency services. Kreibich, Müller, Thieken, & Merz, (2007) documented business size and previous experience as additional factors that determine property level damage mitigation. Implementation cost, awareness of options available, trust, and property ownership are also significant as noted by Dahlhamer & D'Souza, (1997). Crichton, (2005) adds insurance to the list.

As one can observe, there is still need a to ascertain which factors are important in the sub-Saharan African context, to enable context-specific policy recommendations. Further, such information on households and business motivation factors may help to improve the application of PMT in Disaster Risk Reduction practice.

A previous exploratory study in Kampala, using a modified PMT model that includes these additional variables (figure 1) suggested that a more elaborate investigation of its usefulness was warranted (Chereni, 2016)

From a conceptual perspective, previous studies on drivers of flood damage mitigation predominantly used the PMT framework as the guiding conceptual map to identify drivers of flood damage mitigation

(Bubeck et al., 2013; Chereni, 2016; Grothmann & Patt, 2005; Poussin et al., 2014; Reynaud, Aubert, & Nguyen, 2013). As one explores these studies, an incremental modification of the framework can be noted as more and more cases incrementally provide insights on risk perception and motivations for flood damage mitigation. Studies which establish flood risk perceptions of households and businesses, at the same time providing factors influencing flood mitigation measure-specific appraisals in African cities are scarce, which motivated the undertaking of this study.

The scarcity of such studies is related to limited research funding earmarked for flood mitigation in the continent, reminiscent of other regions in the Global South. Therefore, from a methodological standpoint, methodologies that enable foreign researchers to undertake rapid studies of this nature, at the same time producing quality data are needed.

## ***1.5 Study aim and objectives***

This study aims to improve the understanding of factors that influence risk perception and coping appraisal of households and businesses, and their implications on flood mitigation in a Global South city, using Kampala as an African case. To operationalise it, I use the following research objectives:

- a. To establish the influence of governance rearrangements on flood damage mitigation in Kampala City.
- b. To design a methodology to ensure the quality of data from a cross-language survey of households and business owners.
- c. To determine the factors influencing households' flood risk perceptions in selected areas of Kampala.
- d. To determine the factors influencing households' flood coping appraisals in selected areas of Kampala.
- e. To determine the factors influencing the adoption of flood damage mitigation measures among micro to medium size businesses in Kampala.
- f. To discuss how the insights drawn from the Kampala cases can be used to improve the future application of the PMT.

## ***1.6 Research design***

The study followed a maximum variation case study design (Flyvbjerg, 2006), and focuses on three locations in Kampala City in Uganda. Kampala is located in the central region of Uganda and covers an area of approximately 195 sq. km. Kampala was purposively chosen from 20

cities in Uganda because this study was a follow-up to the Integrated Flood Management in Kampala Project (IFMK) - a UN-Habitat funded flood management research, simulation, and a consultative project which provided, among others, recommendations that included business flood damage mitigation measures

### **1.6.1 Research approach**

Flood risk mitigation research has evolved from a positivist stance to a constructivist stance, and consequently to a mixture of the two. However, very few flood risk mitigation studies combine positivist and constructivist approaches. Consequently, the existing conceptualisation and methodological approaches require further improvement if they are to generate more accurate and useful results.

In line with the aforementioned, this study follows a mixed-methods design, applied in three localities of Kampala City, to investigate the influence of governance rearrangements on municipal level flood mitigation and community/property level flood risk perceptions, and these and other factors on flood risk perception and mitigation behaviour at the local level. Given the differing results obtained in other studies which employed the PMT framework, the mixed-methods design helped us to unravel some context-specific dynamics that help to explain some of the variability in the findings. Figure 2 below, illustrates our research approach.

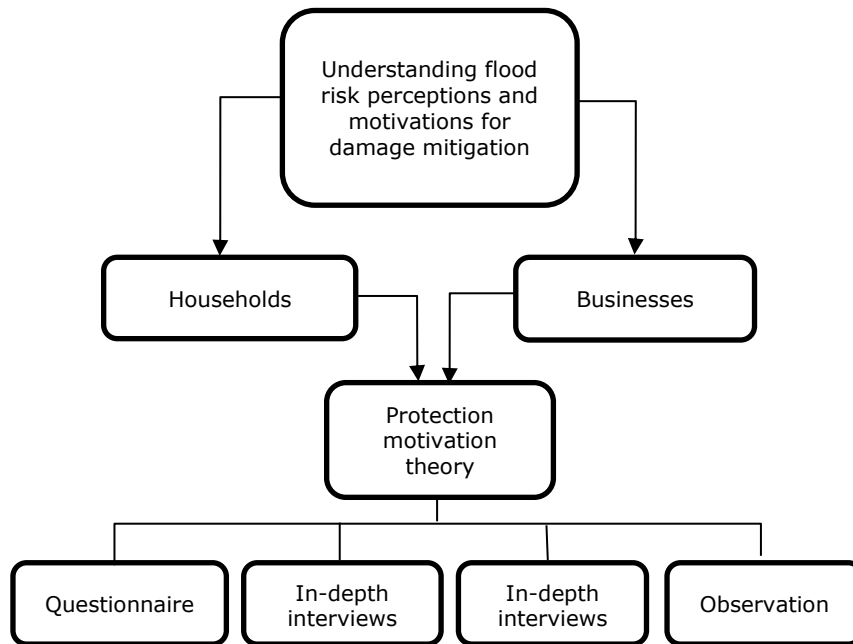


Figure 2: Research approach

Below we explain the characteristics of the localities, our sampling approach, and the data collection and analysis methods we used.

### **1.6.2 Background to the case study - Kampala**

Kampala, the capital city of Uganda, lies on the Northern shores of Lake Victoria at 0 15° 32 30'E (Muinde, 2013). It is one of Africa's rapidly growing cities (Vermeiren et al., 2012) has a population of about 1.9 million inhabitants (Aryampa et al., 2019). The city faces recurrent flash floods because of its relief and physical development that encroaches into sensitive areas such as wetlands and swamps (Twinomuhangi et al., 2021).

Flash floods hazards cause property losses, escalating maintenance costs for drainage and road networks, waterborne disease, and loss of life (Lwasa 2016). Although the floods mainly affect low-lying areas, their domino effects on health, transportation, livelihoods, and waste management impact the wider urban economy.

Owing to this, the responsible authority – Kampala Capital City Authority (KCCA) has proposed and taken a myriad of measures and strategies to ameliorate flood risk. The implemented strategies include

a city-wide flood risk assessment exercise in collaboration with UN-Habitat, some research institutes, and non-governmental organisations (Sliuzas et al., 2013). Recommendations like broadening primary channels, grassing of yards, capturing rainwater, and building water retention ponds, were made from this exercise and other studies (Githinji, 2014; Nadraiqere, 2014; Pérez Molina, 2014; Sliuzas et al., 2013). KCCA treats these issues with much urgency that they feature under the 'City Resilience and Drainage Management' strategic plan 2014-2019 (KCCA, 2014). They are also in line with Sustainable Development Goal number 11 – "to make cities and human settlements inclusive, safe, resilient and sustainable" (Sustainable Development Solutions Network (SDSN), 2014).

For evidence-informed policy and decision making, KCCA would need to understand where such and other measures are already implemented, under what conditions, and with what implications. The implications of increasing public measures, like widening drainage channels and creating retention ponds, have been partly assessed with a focus on runoff and flood modelling (Nadraiqere, 2014; Sliuzas et al., 2013). However, private mitigation measures have been ignored. Moreover, a critical question that still needs to be ascertained is whether private mitigation drops if effective public mitigation increases and is sustained over time? It is also crucial to establish how Kampala residents perceive the effectiveness and affordability of such measures in relation to their experiences and socio-economic status. Consequently, more insights on property level mitigation levels that are likely to result from certain policy trajectories such as awareness campaigns, physical planning enforcements, and government mitigation efforts, are needed. Moreover, the flood is perceptions of businesses and their mitigation efforts, are also invaluable given their importance to the economy.

### ***1.6.3 The three case study locations***

We purposively chose three cases (Bwaise III, Natete, and Ntinda) within Kampala based on flood occurrence (figure 3).



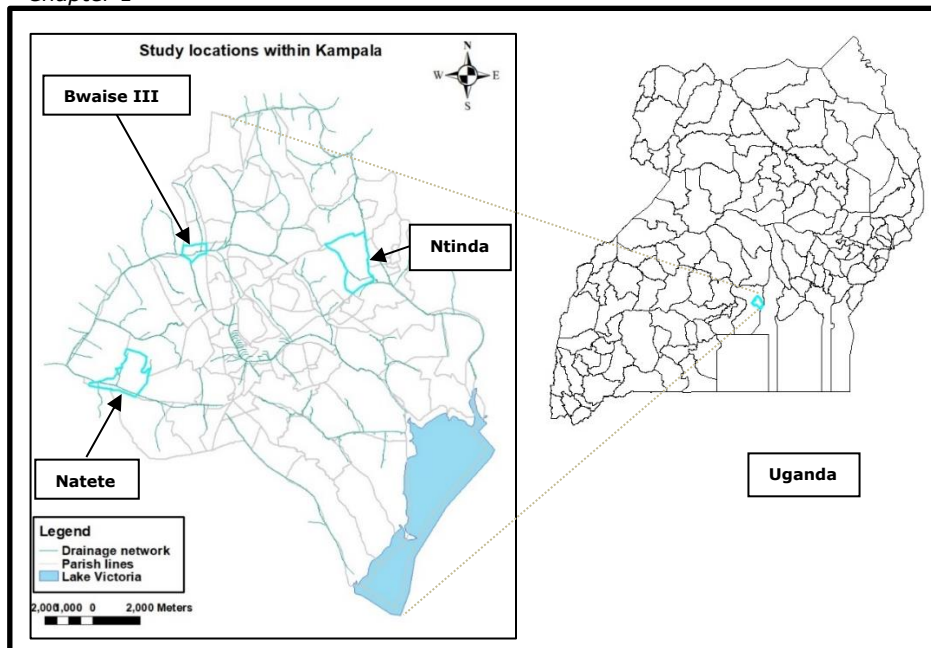


Figure 3: Map of study locations in Kampala and the location of Kampala in Uganda

Table 1: Summary characteristics of the cases

<b>Characteristics</b>	<b>Cases</b>		
	Bwaise III	Natete	Ntinda
Type of neighbourhood	Slum	Mixed-planned high density and slum	Affluent low density
Year of establishment	1960	1900	1960
Population	22000 (4000 households) (ACTogether Uganda, n.d.)	45000 (9000 households) (ACTogether, 2014)	35000 (KCCA, 2011)
Average household Size	5	5	3.6
Sample size (n)	154 households	248 households	210 households
Average Household Size (own survey)	4.94 (one-sample t-test: $p < 0.05$ )	3.93 (one-sample t-test: $p < 0.05$ )	3.7 (one-sample t-test: $p < 0.05$ )
Year of establishment	1960	1900	1960
Flood and damage experience	Many years of flooding and flood damage to property and loss of a few lives	Many years of flooding and flood damage to property and loss of a few lives	Not much flooding – floods in low-lying parts. Other areas experience runoff
Widening of primary drainage and desilting of secondary channels	Yes in 2013-2014	No widening of the primary channel and less desilting	No widening of the primary channel and less desilting of secondary channels

The cases are parishes with different socio-economic, and geographical characteristics that are expected to generate different insights into the determinants of risk perceptions (Table 1), thereby providing an

### Introduction and Background

---

opportunity to test the possible impact of the differences on flood risk perception and mitigation behaviour.

*Bwaise III* is an informal settlement that developed in 1960 on a swamp and has become an epicentre of informal development in neighbouring areas. It occupies about 19 hectares of land which is owned by the Buganda Kingdom and administered by the Buganda Land Board. The settlement has 5 administrative zones inhabited by approximately 22000 people and roughly 4000 households. The households are mainly involved in informal activities like welding, and vending, among other activities (ACTogether Uganda, n.d). The area also has a vibrant business centre with micro, small and medium enterprises (MSMEs). Figure 4 below shows a street with some of the business premises. *Bwaise III* has been suffering from frequent flash floods for many years. Within the government's efforts to reduce floods, the Nsooba-Lubigi primary drainage channel passing through the settlement was widened in 2013-2014. Figure 5 below shows a segment of the drainage channel. However, dredging has proved difficult, leading to gradual siltation and recurrent flood risk. The widening of this drainage channel enabled us to establish implications of government flood mitigation measures on flood risk perception by comparing results for *Bwaise III* to those of Natete, where such measures have not yet been undertaken.



Figure 4: A street at the business centre in Bwaise III.



Figure 5: The widened Nsooba-Lubigi channel passing through Bwaise III.

*Natete* is an informal settlement of about 45 hectares, which is also subject to frequent flash floods. The majority of the land (80%) is owned by the municipality while the remainder is owned privately.



Figure 6: Unplanned housing units in Natete

It is inhabited by approximately 45,000 people, constituting about 9000 households. Figure 6 below shows the unplanned housing units

### Introduction and Background

---

in Natete. There are about 4000 structures, 25% of which are residential and 63% mixed-use, 11% are business premises, and 1% other. Natete has several factories that attract a lot of urban migrants seeking jobs in the city (ACTogether Uganda, n.d.)

*Ntinda* is an affluent suburb located in Nakawa Division which grew in the 1960s as a residential area for railway company workers (Chrysestom, 2012). It has grown into a suburban business district with industries, shops, and wholesale activities (Maganda, 2012). One part of Ntinda is known as a residence of rich politicians, while some low-lying parts experience flash floods though not as severe as those in Bwaise III and Natete. Figure 7 below shows part of the Ntinda neighbourhood where low-lying premises experience flooding. Ntinda was chosen to better analyse the effect of higher incomes on flood risk perception.



Figure 7: Part of Ntinda- the affluent neighbourhood

#### **1.6.4 Sampling strategy**

Primary data was collected via a combination of expert interviews and a survey, administered to households and businesses. Twenty-six experts from Kampala Capital City Authority (KCCA), an NGO ACTogether, officials from the Prime Minister's Office (Disaster Management Section), community leaders, and several residents, were interviewed in September 2015 (table 2 below).

Table 2: Overview of interview respondents

Organisation	Type of Organisation	Office designation	purpose of interview:	
			Initial fieldwork	Validation
KCCA	Urban governing authority	Director of Gender, Community Services, and Production	✓	
		Head of the preventive section of the public health department	✓	Appointed his junior
		The town clerk of the Kawempe division	✓	✓
		Physical planner at the LC4 level	✓	✓
		Ward coordinator of Bwaise III	✓	✓
		Ward Councillor for Bwaise III	✓	✓
Min of Land, Housing, and Urban development	Central Government ministry	Urban development commissioner	✓	
Uganda Prime Minister's office	Executive government arm	Commissioner for disaster preparedness and management	✓	
Act Together	Non-Governmental Organisation	Executive Director	✓	His successor validated
		Head of Department, Profiling, Enumerations, and Mapping	✓	
		Administrator and Documenting Officer	✓	
Bwaise Slum Dwellers Association	Civil Society Organisation	Chairperson	✓	
		Secretary	✓	
Makerere University	Academic	Associate Professor		✓
		Student researcher		✓
		Student researcher		✓
Independent	Urban development Consultancy	Consultant		✓
AMREF	Non-governmental	Chairperson		✓
Bwaise residents		Nine households	✓	
		Five Households		✓
		Five businesses		✓

For the household/business survey, we used systematic random sampling to select respondents. Owing to the irregular morphology of Bwaise III, a fishnet grid of 100x100m overlaying a topographic map.

The map was used to sample households and businesses - every house/business coinciding with a fishnet centroid was selected (for a

detailed explanation, see chapter 3. In cases of multiple households/businesses per building, only one household/business was selected. In Ntinda and Natete, we picked every 2<sup>nd</sup> and 3<sup>rd</sup> house/business premise in a row, respectively, because of the difference in spatial granularity between the two neighbourhoods. However, since businesses tended to be more concentrated along main roads, in other places we picked more businesses and more houses in other areas. In total, the sample of households was larger than the sample of businesses.

### **1.6.5 Data collection and analysis**

The initial data were collected in September 2015 and a more elaborate survey was conducted in 2017. The interviews conducted in 2015 generated data on governance arrangements and risk framing during the previous Kampala City Council regime and the current KCCA regime, and how the governance change influenced resource raising, planning, and implementation capacity of flood risk management measures. Questions to guide the interviews were adapted from the Water Governance Assessment Framework (WGAF) (Bressers et al. 2013). The WGAF was appropriate for guiding this research because it enabled the assessment of an innovative, hybrid system of governance without preoccupation with traditional 'good governance principles. To assess the governance dimensions (Chapter 2), I used the matrix of questions to generate rank data on different governance dimensions, levels, and scales, together with the local government's performance on risk mitigation activities (Appendix 3).

The rank data was analysed in excel to produce governance quality scores that were used to make a scoreboard. Qualitative data were coded into themes whose characteristics were inter-subjectively (Zanotti and Aquino 2007) used to put government dimension scores on the scoreboard. The interviews also generated data on household perceptions about floods and government flood management actions and the level of participation in community cleaning activities.

In August 2017, we administered 612 *semi-structured household questionnaires* (154 in Bwaise, 248 in Natete, and 210 in Ntinda) and 311 semi-structured business questionnaires with the help of nine multi-lingual research assistants. The survey generated data on household/business characteristics, flood severity, flood information, threat appraisal, coping appraisal, and flood mitigation measures. Respondents were asked to answer questions about their experiences over the period 2015-2017. Most questions were either binary or ordinal (four levels were used, to avoid the temptation for respondents, of choosing the average (Moors, 2008). The questions



Table 3: Explanation of variables

Main PMT concept	Variable	Explanation
<i>Hazard related factors</i>	<b>Willingness to mitigate</b>	An ordinal variable ranked from 1 (not willing) to 4 (Highly willing) measured per year over the three years.
	<b>Distance from the drainage channel</b>	Ordinal variable ranked from 1 (1-50) to 7 (301m+)
	<b>Flood Experience (severity)</b>	An ordinal variable ranked from 0 (no flooding) to 4 (Extremely high) Solicited per mitigation measure.
	<b>Duration of residency</b>	Ordinal variable ranked from 1 (1 year) to 6 (20+ years)
<i>Socio-economic, governance, and cultural factors</i>	<b>Property tenure status</b>	An ordinal variable ranked from 1 (Owner) to (Usufruct)
	<b>Size of social network*</b>	An ordinal variable ranked from 1 (no household) to 4 (6+ households)
	<b>Education level*</b>	An ordinal variable ranked from 1 (Communitarian) to 4 (Structural level 2)
	<b>Household Income*</b>	An ordinal variable of salary brackets ranked from 1 (0-40000UGX) to 10 (360001+)
	<b>Household size*</b>	An ordinal variable ranked from 1 (one person) to 6 (Large family)
	<b>Mitigation measures before 2017</b>	Binary variable ranked from 1 (yes) and 2 (no) solicited per measure
	<b>Age</b>	An ordinal variable ranked from 1 (15-24yrs) to 6 (65+yrs)
<i>Coping appraisal</i>	<b>Perceived self-efficacy (SE)</b>	An ordinal variable ranged from 1 (Not able) to 4 (highly able) – Solicited per mitigation measure.
	<b>Perceived response efficacy (RE)</b>	An ordinal variable ranked from 1 (none) to 4 (more) Solicited per mitigation measure.
	<b>Perceived Implementation costs (IC)</b>	An ordinal variable ranged from 1 (none) to 4 (more) Solicited per mitigation measure.
<i>Threat appraisal and</i>	<b>Perceived likelihood of damage</b>	An ordinal variable ranked from 1 (no) to 4 (high), Solicited per mitigation measure.
	<b>Flood-related financial loss</b>	A binary variable with 1 (yes) and 2 (no) Solicited per mitigation measure.
	<b>Received information about flooding</b>	A binary variable with 1 (yes) and 2 (no), Solicited per mitigation measure.
<i>Business characteristics(profile)#</i>		-Number of employees -Age of business -Type of business
<i>Occupational health and safety policy#</i>		A nominal variable (yes/no)

NB: Variables marked with \* are peculiar to households and the variables marked with # are peculiar to businesses.

## *Introduction and Background*

---

were also consistently bipolar to balance the impact of the negative/positive inclination in responses to related questions (Kamoen et al., 2013). Table 3 above shows the variables measured in the questionnaire survey.

At the beginning of each data collection session, the research assistants were randomly assigned to a route on a map where they would pick every other house/business for an interview, in case the fishnet grid was difficult to follow in that area. Via a *WhatsApp* group, the author could reassign assistants to specific households depending on the particular household's preferred language. During daily briefing and debriefing sessions, refinements to the data collection were made if required (Chereni, Sliuzas, & Flacke, 2020). In so doing, we reduced social desirability bias and loss of meaning, which could arise where non-ethnic interviewers are used (Adida et al., 2016).

Transect walks in each case area allowed direct observations of flood-water marks on walls and flood mitigation measures implemented by households and businesses. We also observed the state of garbage dumping in drainage channels which had been mentioned as a serious concern during several interviews. Two transect walks were conducted in Bwaise in 2015 and two more in Natete and Ntinda in November 2018, twenty-four more structured interviews were conducted with the same or similar respondents from the 2015 interviews, to validate the initial results (see table 2 above).

Documentary sources, in the form of annual reports, Ministerial reports, audit reports, and strategic planning documents from the KCCA and an NGO ACTogether, were used to understand changes in risk framing, resource raising capacity, and flood management projects, including refuse collection. I also reviewed The World Bank reports related to the funding and implementation of the Nsooba-Lubigi drainage channel, to gain insights into the impact of governance dynamics on its implementation. Academic papers were also reviewed both for embedding this study and to support and augment the general fieldwork findings.

## **1.7 Thesis outline**

The chapters identify important factors of flood damage mitigation (perception) among households and Micro, Small, and Medium Enterprises (MSMEs) in Kampala, in detail, by zooming into task-specific appraisals of different groups of respondents, guided by the objectives listed in 1.6 above. Below we describe how the thesis is organised. Chapter one has introduced the flood risk management issue



## *Chapter 1*

---

in contemporary cities with an inclination towards cities of the Global South. It also provided the background to the- conceptualisation of risk and explained the rationale for choosing PMT in this research. Last, it explained the research methodology used in this study.

## *Chapter 2*

This chapter assesses the impacts of local government (re)arrangements on flood mitigation. We adapted a Water Governance Assessment Framework (WGAF) and conducted 22 in-depth interviews with stakeholders, searched documentary sources, and carried out transect walks. We generated qualitative data on stakeholder experiences and perceptions regarding governance quality and flood mitigation pre-and post-reform. The data were analysed using thematic content analysis to produce a scoreboard measuring changes in governance dimensions against progress in flood mitigation. In a follow-up survey, 24 structured interviews were conducted to validate the data.

## *Chapter 3*

This chapter provides a comprehensive method/procedure for enhancing data quality in challenging mixed-methods research contexts building on the Briefing and Debriefing Technique (Mackenzie 2002; Marshall 1979). We describe in detail how we adapted the Briefing and Debriefing Technique (BDT) to overcome potential pitfalls in our study on flood damage mitigation in Kampala and proffer insights on how research fieldwork in related contexts can be better managed to improve data quality. We perceive the briefing and debriefing process as one that starts not in the field but the pre-fieldwork phase when the researcher consults about the chosen area how and who best to recruit, and ends after fieldwork when the researcher seeks clarity on some recorded data during analysis.

## *Chapter 4*

This chapter documents the factors of households' flood risk perceptions in the three neighbourhoods of Kampala, Uganda. We used semi-structured questionnaires with 612 households, in-depth interviews, and observations to generate data on the socio-economic situation of respondents and risk-related data in 2017.

### *Chapter 5*

Chapter five analyses homeowners' and residents' coping appraisal factors related to flooding mitigation measures in three neighbourhoods of Kampala. Using survey data from 612 households, analysed using the correlation of flood risk and social vulnerability variables, with coping appraisal elements, and 72 measure-specific ordinal regression coping appraisal models, it documents the factors affecting different coping appraisal elements in Kampala.

### *Chapter 6*

Chapter six uses data from a survey of 311 MSMEs, analysed using descriptive statistics and binary regression modelling, to establish the influence of flood experience, threat appraisal, coping appraisal of business characteristics, operational health and safety policies, risk attitudes, risk communication, and past mitigation measures on the decision to mitigate against flooding.

### *Chapter 7*

This chapter discusses the insights drawn from the Kampala cases about flood risk perception and implementation of mitigation measures, and how the insights can be used to inform policy and improve the future application of the PMT

## **Chapter 2: Governance framework for flood risk management in Kampala**

The chapter is based on Chereni, S., Sliuzas, R. V., Flacke, J., & van Maarseveen, M. V. (2020). The influence of governance rearrangements on flood risk management in Kampala, Uganda. *Environmental Policy and Governance*, 30(3), 151-163. <https://doi.org/10.1002/eet.1881>

## **2.1 Introduction**

Flooding is one of the most dangerous disasters in the world. In 2015, floods caused 3,310 deaths and affected more than 27 million people (UNISDR, USAID, and CRED 2015). Although Africa accounts for only 5% of the deaths, situated statistics depict worrying trends, especially in the wake of climate variability (Guha-Sapir, Hoyois, and Below 2017). In these studies, governance has been seen as critical in providing an enabling environment for disaster risk management (Matczak et al. 2015; Alexander, Priest, and Mees 2016; Perry et al. 2014; Renn 2008; Tullos 2018a; Plummer et al. 2018). Governments in many countries across the globe have therefore re-worked their institutions to prevent, mitigate and help communities to recover from a flood disaster. This process, in some cases, has brought about hybridised governance regimes (Plummer et al. 2018). However, critical questions arise about how these governance re-arrangements support or constrain flood management efforts (Alexander, Priest, & Mees, 2016, pg. 38). This question has been extended to the whole disaster risk management community since governance improvement has proved to be a potential way to reduce disaster risk (Renn 2008; Matczak et al. 2016; Scolobig et al. 2015).

Theoretically, these dynamics have been viewed with a lens of governance regime shifts from Progressive Public Management (PPM) – top-down approach, to New Public Management (NPM) – consumerism, and recently to New Public Governance (NPG) – co-production (Wiesel and Modell 2014). Consequently, governance evaluation frameworks have evolved from being results-based under PPM, to citizen satisfaction-based under NPM and network efficiency-based under NPG. Because these processes are never perfectly linear, in some cases iterative processes have ushered in hybrid governance systems (Wiesel and Modell 2014; Plummer et al. 2018). Within the NPM and the NPG, principles of good governance have dominated both discourse and methodology.

Good governance principles are mainly linked to governance assessment frameworks from international development agencies such as the UN Habitat's Urban Governance Index and the UNDP'S

Methodological guidelines for Local Government Analysis (UNDP 2009) in measuring governance reform progress. Governance assessment frameworks have also been used by the World Bank and

other international development agents to diagnose governance systems in countries where reforms or aid was/have been targeted (ODI 2007). These frameworks mainly hinge on the assumed benefits of decentralising authority to lower levels and ensuring accountability, transparency, and popular participation. Popular participation is believed to result in the legitimacy of central institutions and their actions (Pettersson et al. 2017)

Following these frameworks, much of the literature on governance re-arrangements follow principles of good governance through the decentralisation philosophy, as pillars of their analytical frameworks and their conclusions are critical of the re-emerging centre–local relationships (Madinah et al. 2015; Lambright 2014; Matczak et al. 2016; Kaufmann and Wiering 2017; Alexander, Priest, and Mees 2016).

As it turns out, besides the costs of monitoring local level institutions and lack of resources at the local level (Jensen and Meckling 1976; Lacruz 2016; Scolobig et al. 2015; Stelman 2012; Crona 2014; Wild et al. 2012), elective democracy in Africa may be creating divided lines of authority which limit flood risk management and service delivery capacity in more decentralised systems. (Resnick 2014a; Resnick 2014b). This trend is causing governments to re-arrange institutions of governance by re-rolling out the state to improve service delivery including flood mitigation. In such instances, innovative approaches to evaluate governance performances without romanticising the conventional 'principles of good governance are needed.

Our research was, therefore, guided by two questions:

- 1) How best can we assess the impacts of governance rearrangements on flood mitigation where democratic space is reduced?
- 2) What are the impacts of such re-arrangements on flood mitigation?

## ***2.2 Trends in governance and flood management***

Several governments across the world are re-arranging institutions of governance to improve service delivery (CEMR 2013; Kostka and Nahm 2017; Akilli and Akilli 2014; Jonga 2014).

Research on the impact of these trends is still in its infancy, especially as it relates to flood mitigation (Driessen et al. 2018; Matczak et al. 2015; Mees et al. 2018; Alexander, Priest, and Mees 2016; Wiering et al. 2017; Tullos 2018b). Issues related to participation, efficiency, policy, legislation, and diversification have been at the core of debates surrounding flood risk management. Key questions often asked in the light of the current consensus that diversification results in a holistic flood management approach where actor collaboration is promoted (Hegger et al. 2014; Renn 2008) are: i) How can we make informed decisions to foster institutional re-arrangements for diversification? ii) Which factors drive the desired change and which ones stabilize the status quo? Wiering et al. (2017) identified drivers of change in the form of the European Union's Floods Directive, climate change, and the ecological turn in different forms in six European countries. In many of these countries, these drivers tended to encourage diversification and an integrated approach. However, these scholars do not delve deeply into the quality of governance regimes and performance.

Using the Bwaise III case in Kampala, Uganda, we add methodological diversity to this growing literature on governance rearrangements for risk management by using a different methodological framework – the Water Governance Assessment Framework. A modified version of this framework was applied by Vinke-de Kruijf, Kuks, and Augustijn (2015) in Romania but without necessarily contrasting governance quality and flood risk management performance. Assessing drivers and stabilisers of change was also outside their scope. By examining the relationship between institutional reform where representatives of the centre are put in lower-level governance structures, we provide empirical evidence on the positive impacts of the roll-out of the state on integrated flood mitigation as a driver of change via a viz other stabilisers and factors of change.

### ***2.2.1 Conceptual and evaluative frameworks***

#### ***a. The Conceptual Framework for comparing governance arrangements***

The Framework was used as a methodological tool applied with conceptual guidance from Matczak et al. (2016) conceptual framework for comparative analysis of governance arrangements and flood mitigation that was done within the EU StarFlood project.

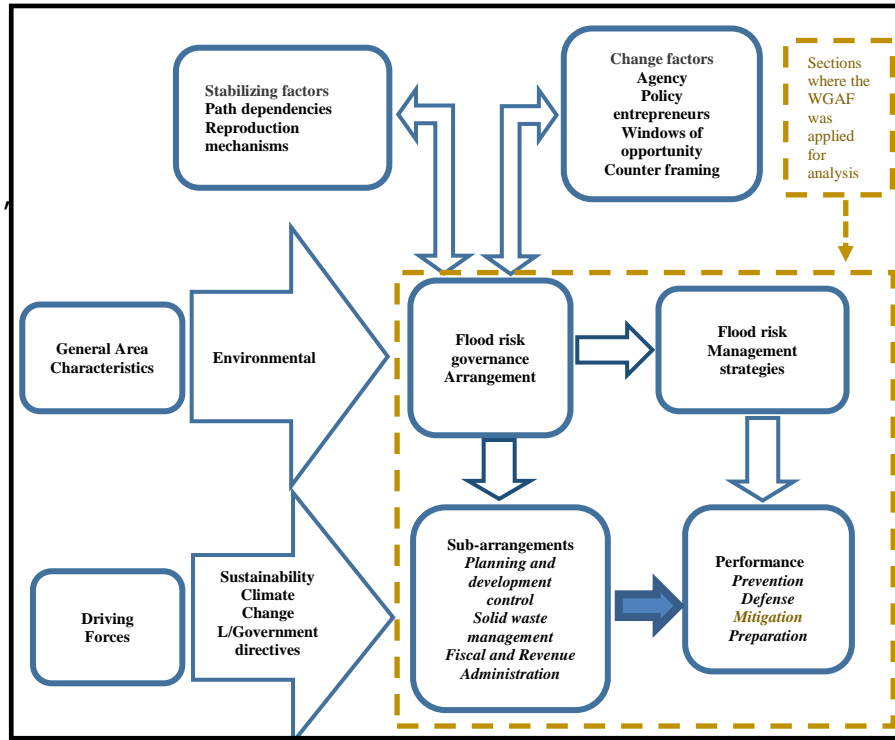


Figure 8: Driving and enabling forces for the implementation of flood risk management adapted from Wiering et al. (2017).

### *Flood risk governance arrangements and sub-arrangements*

In the framework above, flood risk governance arrangements (FRGAs) and sub-arrangements occupy a central position and act as the intermediary variable. Governance refers to the interaction between civil society, the private sector, and the government in determining governmental action (Wilson 2000). Wiering et al., (2017, pp 17) define FRGAs as “institutional constellations resulting from an interplay between actors and actor coalitions involved in all policy domains relevant for flood risk management; their dominant discourses, formal and informal rules of the game; and the power

and resource base of the actors involved.” In this chapter, we consider sectoral constellations related to flood risk management as FRGAs: e.g., in fiscal and revenue administration, disaster management, spatial planning, and water and sanitation. Over the years, the state and municipal departments have evolved in search of effectiveness and efficiency in delivering flood risk measures and service delivery in other in general (Runya, Qigui, and Wei 2015) and this applies to Kampala as well.

In practice, flood risk governance can be observed and assessed by looking into the FRGAs and sub-arrangements related to water management. Therefore, we hypothesised that administrative re-arrangements in Kampala have contributed to a positive thrust on the delivery of flood risk management measures in the slum settlement of Bwaise III. We assume that flood management strategies and measures are an outcome of forces at work in governance processes (Kaufmann and Wiering 2017; Matczak et al. 2016; Wiering et al. 2017) and measure these dynamics using the Water Governance Assessment Framework (WGAF) as indicated in table 1.

#### *Flood risk management strategies*

These are the actual measures and strategies implemented in the area to reduce flood risk, which, in this case, are dependent on the risk situation (hydro-physical setting, climate change discourses), and how it is perceived by responsible institutions depending on how these institutions respond to stabilising factors or change factors. These strategies and measures are related to the frame of the disaster management cycle, i.e., prevention, mitigation preparation, response, and recovery (Matczak et al. 2015; Plummer et al. 2018).

#### *Stabilising factors and Change factors*

Stabilising factors and change factors are the elements and characteristics of a governance system and its environment that either give stability or promote change in the adoption of flood risk governance strategies and instruments. They include path dependencies (for example ongoing programs and projects) and reproduction mechanisms (Fig 1). Reproduction mechanisms are fixed costs, opportunity costs or growing returns, and strong/institutionalised priority associated with certain FRGs measures and ways of working in divisions of responsibilities for producing FRG measures (Wiering et al. 2017).

Change factors include agency, policy entrepreneurs, windows of opportunity, and counter framing. Agency means acting in place of another – a principal (Jensen and Meckling 1976). Policy entrepreneurs are entities or individuals who sell policy ideas and consequently influence policy direction (Bakir and Jarvis 2017). Windows of opportunity are situations that create a need for change, e.g., gaps in service delivery. Counter framing refers to the process in which politicians' policy ideas and/or those of interest groups compete about an issue (Chong and Druckman 2013).



### *General area characteristics*

Environmental factors affect the type of flood risk governance arrangements that can be put in place since the form and magnitude of the risk at hand, in terms of hazard frequency, intensity, exposure, and vulnerability, determines to an extent the organisational infrastructure required.

### *Driving forces*

Driving forces are the push factors that compel a governance system to implement/enforce flood management strategies and instruments, for example; climate change, sustainability discourses, and local government directives.

### ***b. The Water Governance Assessment Framework***

The WGAF is a matrix of governance dimensions (5 rows) and quality criteria (4 columns). The governance dimensions are: i) Levels and scales; ii) Actors and Networks; iii) Problem perspectives and goal orientation; iv) Strategies and instruments, and; v) Responsibilities and resources. Levels and scales can be defined as the institutional (administrative, legal, and policy) tiers while actors are stakeholders involved. Problem perspectives are perceptions about the nature of the problem among the different stakeholders. Strategies and instruments are the methods used to address problems; and last, responsibilities resources are the roles and money, people, and goods used in service delivery respectively: in this case delivering flood mitigation measures. In the columns (governance quality criteria), extent refers to the adequacy of the dimensions in relation to the problem at hand and coherence is the rhythm of operation in a governance dimension; flexibility is the tolerance of various ways of dealing with the problems, and intensity refers to commitment and thoroughness in operation in a governance dimension. For further detail regarding questions asked in each cell please refer to appendix A. The questions are related to a combination of viewpoints from PPA, NPA, and NPG.

## ***2.3 Methods***

### ***2.3.1 Description of the study area***

#### ***a. Kampala flooding***

The flash floods in Kampala City have over the years induced economic losses and deaths. Kampala's hilly terrain, coupled with rapid urban growth and encroachment into wetland areas have contributed to increasing flood events, from 5 in 1993 to 8 in 2007 (Lwasa 2010). The city has a resident population of about 2 million, and its population

growth rate exceeds the national average, standing at 3.9% per annum in 2014 (World Bank 2014). Its growing population, high level of informality, and service delivery problems are typical of many African cities.

Poor service delivery is manifested in poor drainage systems, the poor state of roads, fiscal problems caused by lack of a strong vision, "...human resource incapacities, political interference and poor internal control systems which are at the core of governance. These issues directly impacted on the areas of procurement, fiscal management, and public disclosure, and subsequently affected Kampala City Council's public image" (World Bank, 2014 pp 2). By 2015, flood events per year had increased significantly due to increased unplanned development, causing more economic losses in assets, labour time, and the spreading of water-borne diseases (Lwasa 2016). Such flood losses and service delivery problems were identified as early as the late 90s. These triggered the central government of Uganda to re-arrange administrative structures in Kampala, following reform calls by development partners (Lambright 2014).

### ***b. Governance rearrangements in Kampala***

Municipal reforms started as early as 1997 in Kampala through the first Strategic Framework for Reform (SFR) which aimed at administrative restructuring; privatisation of some service delivery; and financial and fiscal reform (World Bank 2014). As the first phase of the SFR yielded little results, the Government of Uganda (GoU) developed a second phase coupled with a request for technical assistance from the World Bank, to speed up the reform process and, in turn, service delivery. To this effect, the World Bank in conjunction with the GoU and Kampala City Council (KCC), established the Kampala Institutional and Infrastructure Development Programme (KIIDP) through an Adaptable Programme Loan (APL). This project was implemented between January 2008 and December 2017 in three phases. Its objective was to first strengthen institutions, laying a foundation for the delivery of infrastructure in the later phases. Its targets included reducing liabilities, increasing own-source revenue, and improving service delivery.

In 2010 the GoU enacted the Kampala Capital City Act, replacing KCC with the Kampala Capital City Authority (KCCA) in response to calls for reform (Lambright 2014). On top of KCC's four local administration levels (LCs), KCCA's organisational structure includes a Minister for Kampala (Ojambo 2012; Lambright 2014; Onzima 2013; Muriisa 2008; Madinah et al. 2015). There are also an Executive Director at the rank of a Permanent Secretary (instead of a Town Clerk) and a Deputy

Executive Director, both appointees of the President. They are supervised directly by the central government and have overriding powers over lower-level structures (Stelman 2012; World Bank 2014). Consequently, the mayor's role can be seen as purely ceremonial (Madinah et al. 2015). These re-arrangements can be viewed as an act of re-centralization which created a hybrid governance system.

### ***c. Bwaise III case study***

Bwaise III is one of the 24 parishes under the Kawempe Division of Uganda's capital city, Kampala - a low-lying area with around 1,600 housing units on 57 hectares of land. Its population is around 22,035 people constituting about 4,081 households mainly involved in informal activities (ACTogether Uganda). The settlement is one of the 57 informal settlements in Kampala (Richmond, Myers, and Namuli 2018). We purposively selected Bwaise III for study because it is one of the worst affected areas by floods in Kampala City.

The settlement also epitomises pockets of African informal settlements that are home to 37.4% of the urban population in Sub-Saharan Africa and 51.4% in North Africa (UN-Habitat 2002). Discussing evidence on governance re-arrangements and service delivery using such a case, therefore, contributes more insight into debates on governance and resilience building in such communities.

### **2.3.2 Data and analysis methods**






















Data from interviews, transect walks, and documentary sources were analysed using thematic content analysis mainly looking for signals of change in the governance criteria in the WGAF (table 2) and the conceptual framework (figure 1). Changes in different dimensions were visualised in an initial version of table 2 – Scoreboard visualisation of qualitative governance context and flood management performance in section 4.1. Data from the validation questionnaire were analysed in excel to produce clustered column graphs comparing different dimensions in the evaluative criteria. Please refer to Appendix A. The graphs were compared with the visualisation from our initial thematic analysis of qualitative data. Differences between results from the initial fieldwork and those from the validation survey were noted in six governance-quality dimension matches in table 2. These are the extent of actor-networks number (extent) of policy instruments; coherence of levels and scales; coherence of problem perspectives and goal orientation; flexibility of levels and scales; flexibility of actors and networks, and; flexibility of problem perspectives. These differences caused us to revisit our interview data to look for new patterns. The new patterns were fed into the governance quality visualisation scoreboard, to produce table 2 below.

## 2.4 Findings

### 2.4.1 Governance rearrangements

This section describes changes that were made in the configuration of actors, policies, and rules of the game in the Kampala City administration. Since we embedded the WGAF into the conceptual framework (figure 4), we discuss each governance dimension in connection with the evaluative criteria (table 2) (Bressers et al. 2013), but also in connection with sub-arrangements for governance. In this case, Revenue and Fiscal Management, Spatial Planning, Roads and Works, Water and Sanitation, as identified in figure 1. However, since Revenue and Fiscal Management as a sub-arrangement overlaps with the 'resources' dimension in the WGAF, it is discussed both as a dimension and as a sub-arrangement.

Table 4: Governance scoreboard

Governance dimension	Quality of the governance regime				Performance
	Extent	Coherence	Flexibility	Intensity	
Levels and scales					
Actors and Networks					
Problem Perspectives and goal orientation					
Instruments					
Responsibilities And Resources					
Colours Red: not yet at the comfortable level; Orange: Neutral; Green: At/above the comfortable level					
Arrow up: Positive trend from KCC to KCCA time; Down: negative trend; White arrow: Slight change; No arrow: no change					

Source: Adapted from Bressers et al, (2013)

Table 4 is a visualisation of changes in qualitative governance context as explained in section 2.5, and how they compare to the performance in flood risk management in Kampala.

Upward and downward pointing arrows indicate improvement or reduction in the governance quality, respectively. In our case, we relate the improvement or weakening of the governance regime to the

implementation of flood mitigation strategies and measures, in line with the assumption that governance (re)arrangements impact flood mitigation. A detailed description of the noted changes in the governance dimension quality is given in the sections below.

### **Levels and scales**

In terms of extent, KCCA's governance levels and scales are largely the same as those of KCC but, the administrative authority has been altered. Under KCC there were four administrative levels, each having both a technical wing and a political wing. The first and lowest was the village (LC I), which comprised about nine community representatives headed by a chairperson. The second was the Parish (LC II), principally an administrative council made up of village chairpersons, a councillor on the political side, and a parish chief/ward administrator on the technical side. It was run by a chairperson and an elected executive committee, chosen from among the chairpersons. The third was the Division/Town level (LC III), chaired by a directly elected Town Clerk and consisting of councillors from parishes, other government representatives from line ministries, and NGO representatives. The fourth was the municipality (LC IV), which comprised the executive members of affiliate divisions. From among themselves, they elected an executive committee. At the city municipality level (LC IV), the Mayor chaired and worked with the Executive Committee and the council. Under KCC, local councillors made technical decisions in a system that was riddled with corruption (Interview with Bwaise Ward Administrator). Under KCCA, the four lowest administrative levels were maintained but overseen by the newly created Minister for Kampala, Executive Director, and Deputy Executive Director at a new LC V level. Flooding in Bwaise III was discussed at all levels in both regimes but the direct involvement of the Minister for Kampala increased the political weight in flood reduction and in other issues which affect the city.

The appointment of a Mayor and an Executive Director for Kampala City also boosted coherence among actors. According to the ward administrator, this arrangement "has brought sanity to the city because the directorate monitors activities of the council while the Minister monitors it. "These changes yielded power in the technical wing and have created a quick avenue for the Minister to discuss issues affecting Kampala at the central government level. At lower levels, the ward administrator (LC II chief) is a non-voting member of the LC III council and can discuss development issues with the ward councillor and table technical issues that fundamentally need the full council's attention. To synchronise development issues such as flood management, ward coordination committees are chaired by the Kawempe Town Clerk. There is, therefore, an increase in trust between the technical wing and

the political wing. For example, the ward administrator of Bwaise III showed a high degree of understanding and mutual dependence between him and the councillor, in executing their tasks. Commenting on his working relationship with the councillor, he said, *"... our relationship is mutual; if I have development concerns that I would want to be discussed, I speak through the councillor since I do not speak in council."* This finding strengthens Madinah et al.'s, (2015) finding that the new governance arrangement increased both bottom-up and top-down accountability and reduced misuse of resources. Consequently, it sped up the implementation of flood mitigation measures such as the widening of drainage channels.

However, the ward administrator pointed out an operational gap between the division level Town Clerk and the ward administrators under KCCA. This concern, linked with the slight difference in scores on the existence of gaps in levels and scores between the two regimes, resulted in a small improvement in the governance quality scoreboard.

Flexibility was noted in both KCC and KCCA regimes. For example, the Lubigi-Nsooba primary drainage plan was managed at the city level under both KCC and KCCA, even though the most affected areas were Bwaise III and other informal settlements. By contrast, some other issues were completely dealt with at the local level, e.g., community cleaning campaigns which are coordinated by LC 1 Chairpersons as a preventive measure. However, intensity is higher under KCCA than in the former regime because of more recognition of the technical wing. This has led to a waste management policy reform orchestrated by the Directorate of KCCA, resulting in behavioural change and less garbage dumping, among other changes.

### **Actors and networks**

Actors involved either directly or indirectly in Bwaise III flood mitigation include international development agencies, Non-Governmental Organisations (NGOs), KCCA, and the Buganda Kingdom. The NGOs include ACTogether, World Vision, and AMREF. Although these organisations operate more at the grassroots (mainly parish) level, KCCA headquarters is their entry point for approval purposes. They have also formed a consortium to synchronise their activities. At the time of the initial fieldwork, their consortium was headed by AMREF (interview with an ACTogether official). As noted above, the NGOs and community representatives also meet the KCCA representatives in council meetings, mainly at the LC III level. In such meetings, development matters including flood mitigation are discussed. On assessing the actors and networks extent, we found that actor types and numbers did not change much from the KCC regime but networks increased because of the municipal development fora initiated by KCCA

around 2015. These fora are periodic and sometimes ad hoc; for example, if much rain is expected or after very high rainfall stakeholders are gathered for information dissemination. For example, the forum held on 24 August 2016 was attended by:

MoLHUD (Ministry of Lands Housing and Urban Development) Lord Mayor, Minister for KCCA, Town Clerks, KCCA Directors, Municipal mayors, URA, Municipal Development Forum presidents from the different municipalities of Kampala with their committee members, members of the National Slum Dwellers Federation of Uganda (NSDFU), Kampala Slum Transformation Initiative (KASTI) partners; Shelter and Settlement Alternatives (SSA), Environmental Alert, ACTogether, Water Aid and Uganda National Housing Cooperative Union, (ACTogether Uganda, 2016)

Different ideas are shared on how to prepare for, mitigate, and recover from floods and other issues (interview with the emergency and disaster preparedness commissioner, Prime Minister's Office, ACTogether 2015). All interviewees perceived an improvement in networking during the KCCA regime. In terms of coherence, we established an improvement from consultation with high-interest stakeholders to consultation with both stakeholder types and a slight move in innovation and collaboration – co-creation with high-interest stakeholders. Overall, this quality dimension shows a remarkable improvement.

Both regimes show flexibility, for example, by giving space for civil society organisations and NGOs to operate in Bwaise III, and even lead some projects. For example, the Buganda Kingdom leads the Bulungi Bwansi (for the good of everyone) cleaning campaign, while ACTogether in collaboration with the National Slum Dwellers Federation, are encouraging savings groups thereby capacitating them to put up on-site flood mitigation measures like small dykes on their properties. In the validation survey, both regimes ranked high in sharing of social capital. The only change is that there is intensity in behavioural change campaigns in the KCCA regime and more stakeholder engagement in the municipal development fora. However, there is still a need to increase household participation.

Although current flood mitigation efforts are diverse and encourage participation at all levels, as was also the case in the KCC era, the current authority also uses some top-down coercion with minimal grassroots consultation. This compromises the effectiveness and sustainability of some flood risk mitigation measures. A case in point is the Lubigi-Nsooba primary drainage channel which, after its widening, is now difficult to dredge and consequently may increase

the probability of flooding in the future. Furthermore, the widened channel does not have safety barricades on its banks, creating even more hazards when it rains strongly (ACTogether Uganda 2016)

### ***Problem perspectives and goals***

Under both regimes, there was some disagreement on the causes of flooding in Bwaise III. Both KCC and later KCCA viewed informal development as a root cause of flooding. According to them, settlement in sensitive areas, coupled with illegal garbage dumping, results in increased runoff and blockage of drainage channels which eventually cause flash floods to occur (interviews with ward administrator and health department official). By contrast, respondents in Bwaise III blamed the flooding on the KCC/KCCA (interview with community leader). According to him, the construction of the Northern Bypass and other developments upstream are the major causes of flooding in their area. He claimed there was no environmental impact assessment before the adoption of the Northern Bypass project, a claim supported by an opposition political activist in Bwaise III. Therefore, different problem perspectives are considered from a very low extent. For example, although the Health and Sanitation Supervisor for Kampala agreed that the problems of flooding in Bwaise are partly caused by the construction of the Northern Bypass, he largely blamed settlement in the swamps for the flooding problems.

While KCCA and KCC have similar perceptions of the flood problems in Bwaise, the former has increased the level of community engagement and sensitisation on the issue. However, we should stress that by community engagement we do not imply popular participation since KCCA uses a relatively command-driven governance approach. Nevertheless, goal ambitions improved from 'vote protection' under KCC to sustainable development in the current regime (interview with ward administrator). Regarding flexibility, all interviewees indicated that politics still hinders objectivity in addressing flood problems in some way. Although municipal development fora, the settlement fora, and the ward coordination committees provide opportunities to re-assess and alter development goals, the top-down approach used by KCCA closes out different angles of viewing the flooding problem in Bwaise. This governance quality shows a slight improvement. Validation results also confirm this with 20 out of 24 respondents indicating a slight growth of opportunity to re-assess goals with KCCA establishing more ambitious development goals than KCC. Moreover, KCCA pursues these goals with greater intensity.



### ***Strategies, measures, and instruments***

Our findings show an increase in types of measures/instruments from four during the KCC era to five during the KCCA era. Privatisation of solid waste management is the new measure which, together with the other four, is explained below:

#### **a. Revenue reform**

The appointment of an Executive Director with revenue management experience helped in the implementation of revenue reform. An in-house, independent revenue collection directorate that relegated inefficient private revenue generation enterprises was put in place as part of the reform process. The new directorate concentrates solely on revenue collection and has three departments: revenue collection, research and analysis, and audit and compliance. Through these departments, the directorate identified a large taxpayer base and applied the 80:20 principle to identify the 20% of taxpayers with 80% tax contribution. These were given their own client relations office. Moreover, educating taxpayers has led to more compliance. This, coupled with flexible payment arrangements (possibility to pay in instalments), acceptance of mobile money payments, and adoption of a digital revenue administration environment has led to a big upsurge in tax revenue.

The digital revenue environment (e-citie) automatically generates a taxpayer's number once they make a payment and creates an account that the client can access through a mobile phone. The system also reminds the client when a payment is due and flags the same for management to see and target collection follow-ups (Andema and Haas 2017). Owing to these changes, the Ward Administrator for Bwaise III estimated an increase of 200% in tax revenue. Some sources also claim over 100% increase in 4 years of the new administration (Andema & Haas, 2017; Kompanyi, 2015). Waiswa (2015) asserts that Own Source Revenue increased by over 270% from UGX 28 billion in 2010/2011 to UGX 75 billion in 2015, rising from 40% to above 60% compared to government transfers, and 30% of all revenues including donor funding (Kompanyi, 2015). Part of this revenue was used in flood management and its increase raised trust from international development partners, unlocking more funding for the cause.

#### **b. Privatisation of solid waste collection**

As a flood preventive measure, KCCA was also able to put in place an integrated solid waste management system with assistance from the International Finance Corporation. Consequently, garbage collection also increased by 95% from 16,000 metric tonnes in April 2011 to

31,246 metric tonnes in December 2012. KCCA also increased secondary channel desilting activities, especially in flood-prone areas like Bwaise, by forming Community-Based Organisations with the view of forming a Savings and Credit Cooperative (SACCO) using garbage collecting teams (KCCA, 2013). This was confirmed by both KCCA officials and residents in Bwaise III. The principal researcher also observed extensive drainage cleaning activity in secondary and tertiary drains in Bwaise. Such efforts by KCCA also helped to create awareness among communities about the adverse effects of illegal garbage dumping and the benefits of a new requirement to pave the yards. However, as previously mentioned, siltation in the primary channel remains of concern.

c. Community activities and awareness

Both regimes embraced the Bulungi Bwansi, Buganda Kingdom's culturally-based cleaning rituals, which shows the flexibility in both governance systems. However, there has been increasing sensitisation of communities under KCCA as compared to KCC (interviews with the Director of Gender, Production and Community Service, Physical planner of KCCA Kawempe division, and the Ward Administrator of Bwaise 3). As mentioned above, KCCA convened municipal development fora to generate more awareness and synchronise development efforts. During fieldwork in September – October 2015, one such forum was held in preparation for a cyclone that was forecasted. Here, specific stakeholders were tasked to act in their capacity to mitigate flood effects. For example, the works and engineering department of the KCCA was encouraged to dredge channels while civil society organisations were tasked with cleaning rubbish and raising public awareness.

d. Spatial planning instruments and development control

Both KCCA and KCC used the same spatial planning and development control instruments in preventing and mitigating flooding. However, the KCCA administrative framework enables more effective enforcement and integrity of the governance system. For example, both regimes used Statutory Instrument 246-1 (SI 246-1) of the Regional Town and Country Planning Act, specifically Part 1, Section 2, Subsection 1 to control development (Government of Uganda, 1951). The administrative framework created through the KCCA Act 2010 re-invigorated development control using the statutory instrument and other related instruments while promoting zero-tolerance to corruption, leading to improved revenues. In turn, the frequency of development control visits increased from one per month to one per fortnight (Interview with Kawempe division physical planner).

There is also a requirement for property yards close to drainage channels to be paved, to reduce siltation of the channel. The roads authority has moved to comply by installing perforated concrete blocks to sieve out garbage from stormwater entering the drainage channels close to the main roads.

Therefore, under KCCA instruments and strategies show more coherence and are applied with more intensity than under KCC. The Town Planner at KCCA headquarters also indicated innovations in procedures to obtain permits to build on land leased by the Buganda Kingdom, which resolved tenure security problems that previously caused illegal development. Considering this, the KCCA governance arrangement also shows more flexibility in the adoption of planning and development control instruments.

#### e. Engineering solutions

The engineering projects to curtail flooding that were planned for Bwaise III and surrounding areas under the Kampala Master Plan included widening the Lubigi primary channel, upgrading secondary channels, repairing black spots on tertiary channels, and dredging and maintaining the channels. The implementation of the Kampala Institutional and Infrastructure Development Project (KIIDP) was a key driver of the engineering projects and it also provided some path dependence. Although governance rearrangements were nested within the KIIDP, one can identify the impact of governance re-centralization or hybridization in that the World Bank prioritised institutional reform in the initial stages of KIIDP, as a way of creating a conducive environment for implementing the engineering measures. Before governance reconfiguration, few of the engineering projects under KIIDP were implemented. Consequently, KIIDP's mid-term review date was moved from April 2009 to December 2010, leading to an extension of the project by 24 months. Some key targets were readjusted; for example, works to improve the tributary secondary and tertiary channels to the Lubigi - Nsooba primary channel was dropped, while only 3.6 km of the primary channel was finally upgraded. The KIIDP project report cites problems such as the failure of the GoU and KCCA to fulfil their financial obligations to the project, long procedures for budget approval, red tape in procurement, inadequate human resources, capacity, and transition friction (from KCC to KCCA) as major causes of such delays (World Bank, 2014).

Results from the validation survey strengthen the view that the use of governance instruments and measures improved under KCCA. Eighteen respondents felt that there were opportunities to combine different instruments under KCCA compared to thirteen respondents who said the same for KCC. The difference is constituted by households and

businesses that indicated a negative rating for the KCC administration. One of them mentioned that under KCCA enforcement is done by the national police service and municipal police service showing a one-size fits all approach to enforcement, which naturally combines all instruments. This signifies a degree of authoritarianism which may also detract from the gains of synergy. Owing to the two balancing views, the flexibility of strategies and instruments in the scoreboard shows neither an improvement nor a deterioration, but it is stable and in a good state. On the other hand, the intensity increased through more monitoring and enforcement of regulations. The validation exercise also shows that with regards to implied behavioural deviation, eighteen respondents (mostly local government officers, community leaders, and academics) felt that there was either unclear deviation with an unclear mandate or clear deviation with an unclear mandate under KCC, compared to only ten such cases under KCCA.

f. Responsibilities and resources for implementation

A noticeable change in responsibilities under KCCA is the re-appropriation of technical tasks to the technical wing alluded to previously. In terms of extent, responsibilities and resources scored higher under KCCA than under KCC. Results indicate positive changes in clarity of responsibility and resource allocation together with monitoring and enforcement. Nineteen out of twenty-four respondents in the validation survey confirmed the inclusion of monitoring and enforcing instruments under KCCA and eighteen respondents (mainly KCCA officers, NGO officials, businesses, and households) confirmed clarity in the assignment of roles and resources compared to ten respondents under KCC. Under KCCA, there are more resources for the implementation of flood management strategies and instruments due to increased own-source revenue and a great increase of possibilities to pool resources (fifteen respondents in the validation exercise indicated a greater possibility of pooling of resources under KCCA – the majority being KCCA officials, NGO officials and community leaders - compared to three respondents who indicated the same under KCC) as shown in appendix 3.

## **2.5 Discussion**

The main questions that we sought to answer were: (i) How best can we assess the impacts of governance re-arrangements on flood mitigation where democratic space is reduced; and (ii) what are the impacts of such re-arrangements on flood mitigation?

By adding a flood risk performance cell on the WGAF scoreboard, and using governance dimensions and quality elements of the pre-and post-

reform regimes as assessment criteria for activities and measures in different municipal sectors related to flood risk management, we provide a robust methodological approach for evaluating the implications of both decentralised governance and re-centralised governance on flood risk management. This adds to the work of Driessen et al. (2012); Driessen et al. (2018); Hegger et al. (2014); and Paavola and Gouldson (2009) in two ways. First, by demonstrating that shifts in modes of environmental governance can take the form of re-centralisation, which when combined with existing decentralised structures, results in hybridised regimes. Second, by providing a modified framework to evaluate such regimes.

The study established that the appointment of an Executive Directorate and Minister for Kampala empowered the technical wing of the city administration and improved both bottom-up and top-down accountability, culminating in improved revenue collection, spatial planning, waste management, and stakeholder engagement. The increase in networks through the municipal development fora and the flexibility shown by the new regime at lower levels of governance led to increased resilience-building by encouraging more community cleaning activities and encouraging saving which, in turn, culminated in increased property level mitigation measures.

The findings invoke a discussion on the successes and failures of decentralisation in African cities. Contrary to the findings of Thiel (2014), in the Guadalquivir River basin in Spain, political appointees in Kampala did not directly take technical responsibilities but they empowered the technical wing administratively and financially. At the centre of the decentralisation – recentralisation debate is the need to improve service delivery. Decentralisation is believed to promote popular participation, bottom-up accountability, transparency, and equity, which improves service delivery (Rondinelli 2006; Cheema and Rondinelli 2007) and it has been promoted by international development agencies like the World Bank for some time. On the other hand, re-centralisation is seen as violating ‘good governance principles’ resulting in poor service delivery (World Bank 1999; Kim et al. 2016). However, as is evident from our results, a largely decentralised KCC regime had more service delivery problems than the re-centralised KCCA regime. This supports other evidence that decentralisation has largely failed to improve service delivery in Africa (Jonga 2014; Resnick 2014b) because of corruption at lower levels of governance and high monitoring costs at the centre.

Public administration scholars attribute this failure to the often-conflicting meanings of ‘good governance’ which results in disagreement about the meaning of the value itself and the

development dimension it must foster (Oldenhof, Postma, and Putters 2014; Cowell, Downe, and Morgan 2014; Lawton and Macaulay 2014; Perry et al. 2014; Neshkova 2014; Mandeli 2016). Is it equal to economic and administrative efficiency or something leading to such efficiency? Should it be applied universally or rather be contextualised to different administrative cultures? (Rothstein and Teorell 2012). Efforts to answer these questions have raised more questions than answers. For example, Neshkova, (2014 pg. 65) documents some “tension between economic efficiency and democratic legitimacy” in the United States of America. Such questions related to good governance led Perry et al., (2014 pg. 27) to conclude that, “the concept of good governance is both appealing and annoying.”

From the foregoing, one can conclude that, as governments are modifying governance arrangements to better manage floods, recentralisation of some functions may help to bolster efficiency. Contrary to the conventional belief that centralisation causes inefficiency, in the case of Bwaise III, sharp revenue increases and extensive flood mitigation activities were reported due to acceleration in the implementation of KIIDP following the appointment of representatives of the centre.

However, questions of legitimacy (acknowledgement of upper-level institutions’ right to lead and broader acceptance of strategies and measures) have been raised where the centre takes more responsibility (Matczak et al. 2015; Alexander, Priest, and Mees 2016; Bevir 2010; Neshkova 2014; Mees et al. 2016). While Madinah et al, (2015) expressed concern that recentralisation in Kampala threatened bottom-up accountability, we argue that the high levels of corruption and illegal development before reform points to a lack of capacity in lower-level authorities to ensure that politicians and local officials are accountable. Theoretically, this finding raises questions about the universal applicability of recent developments in Public Management. The use of markets and tendering for resource allocation in risk management and service delivery espoused in the New Public Management (Osborne 2009), can result in corruption where central governments (principals) do not have enough resources and political power to monitor the local government officials (agents). Although New Public Management has led to efficiency in service delivery in some contexts, in Kampala it has been ineffective in providing public goods, such as roads, solid waste management, drainage expansion, and maintenance. While the New Public Governance has been promoted as a solution to such challenges, it has not managed yet to deal with the problem of relatively weak governance systems. As we have seen, in Kampala and perhaps in other developing world cities, some form of traditional Public Administration with a degree of re-centralisation and executive power may be more

effective than decentralisation. Consequently, we argue that in the management of flooding, 'good governance' must be contextualised with regard to resource availability and maturity of the administration system.

By providing evidence of flood management success, owing to the hybridisation of governance systems in Kampala, our results reaffirm a growing voice in literature (Onzima 2013; Porras 2007; Wiesel and Modell 2014; Baker and Schuler 2004; Runya, Qigui, and Wei 2015; Jonga 2014; Davoudi et al. 2014; Resnick 2014a; Resnick 2014b), which has noted a re-centralisation trend associated with service delivery improvements in African cities. Although our claims that the relationship between changes in the governance system and flood management is clear, as evidenced by perceptions of all stakeholder types interviewed, we acknowledge that other factors might also have played a part. However, we perceive them to be secondary and therefore beyond the scope of our analysis.

## **2.6 Conclusions and areas for further research**

By applying the WGAF (Bressers et al. 2013), we have provided a methodology to assess the quality of centralised or hybridised governance regimes at the same time assessing the flood management impacts (or any other service delivery front), which can be helpful for policymakers working in areas where the principle of subsidiarity is failing to yield desired goals.

Therefore, we recommend that politicians and municipal officers in the global South, where the cost of monitoring lower-level institutions is high, adopt hybridised governance systems when dealing with urgent problems like flood risk. However, in doing so they should be more flexible to allow different viewpoints. This ensures the legitimacy of institutions from the centre and guarantees the sustainability of risk management strategies and measures.

### **Areas for further research**

Further research is needed both in terms of theoretical development and empirical studies. Review studies can examine governance re-arrangements in flood management from different parts of the world - identifying patterns and linking them to public administration theories. In search of broader recommendations, empirical studies can relate governance re-arrangements to performance in flood risk management (as in this study), taking note of different contexts in which, the re-arrangements occur.

## *Chapter 2*



## **Chapter 3: A case for cross country/language mixed-methods research in flood damage mitigation studies and a tool for enhancing data quality.**

This Chapter is based on, 'Chereni, S., Sliuzas, R. v., & Flacke, J. (2020). An extended briefing and debriefing technique to enhance data quality in cross-national/language mixed-method research. *International Journal of Social Research Methodology*, 23(6), 661-675, Doi: <https://doi.org/10.1080/13645579.2020.1731992>.

## **3.1 Introduction**

### **3.1.1 Aim and structure**

This chapter provides a comprehensive method/procedure for enhancing data quality in challenging mixed-methods research contexts building on the Briefing and Debriefing Technique (Mackenzie 2002; Marshall 1979). We describe in detail how we adapted the Briefing and Debriefing Technique (BDT) to overcome potential pitfalls in our study on flood damage mitigation in Kampala and proffer insights on how research fieldwork in related contexts can be better managed to improve data quality. We perceive the briefing and debriefing process as one that starts not in the field but the pre-fieldwork phase when the researcher consults about the chosen area how and who best to recruit, and ends after fieldwork when the researcher seeks clarity on some recorded data during analysis. This section introduces the BDT, providing its background and application, explains the research context and associated fieldwork management problems and potential pitfalls, and provides philosophical debates related to the challenges. Section 2 describes how we adapted and applied the BDT, and section 3 discusses and concludes the paper.

### **3.1.2 The briefing and debriefing technique (BDT)**

Briefing is orienting someone to a task or an experience before its execution. "It includes instructions about goals, procedure, and rules within which to participate and achieve intended goals and learning outcomes" (Mackenzie 2002 pp 83). "Debriefing is a deliberate reflection, by an individual or a group, to discuss and work through ideas, issues, feelings or concerns which are generated by individual or group experience during the execution of a task" (Mackenzie 2002 pp 83) for informed decisions to improve future actions. The (BDT) originated in Military Science (Marshall 1979) as pre-mission briefs and After-Action Reviews (Allen et al. 2018) and has been adopted in Educational Science, Aviation, Marine Science, and Health Science (Raths 1987; Mackenzie 2002; Lee, Sulaiman-Hill, and Thompson 2014; Sellberg 2017). As one can observe, the technique has been applied and developed further mostly in High-Reliability Organisations (HROs) where teams should minimise errors by monitoring and efficiently reacting to risky and tempestuous environments in which errors are costly (Allen et al. 2018). In Educational Science, the BDT is mainly used in enhancing students' understanding of the link between theory and what they experience during practice or simulated situations. In the above contexts, key strategic uses of the technique

have been summarised as crew/team coordination, learning, sense-making ambiguity (in mixed methods research this also relates to understanding polyvocality of texts); and team reflexivity (Allen et al. 2018).

BDT has been applied in research fieldwork (Lee, Sulaiman-Hill, and Thompson 2014; Brod, Tesler, and Christensen 2009). Lee et al. (2014) used BDT in research fieldwork supervision. The supervision they discussed was mainly to augment some research participants' lack of disciplinary knowledge and language skills. However, we argue that there is more to supervision/monitoring in research fieldwork than assessing the disciplinary knowledge and skills levels of assistants. Additional potential issues include incorrect sampling procedures where recognisance visits are not affordable; different interpretations by research assistants due to multiple positionalities; loss of meaning through translation; (de)motivation of research assistants over time; (un)trustworthiness, (dis)honesty, research assistants' and local leaders' relationship with respondents. All these issues can reduce data accuracy, reliability, and validity. Regarding the above issues, Wallin and Ahlstrom (2006) suggested a framework for fieldwork competence that include: considering the number of assistants/interpreters; their background and competence; styles of interpreting/assisting; extent of assistant/interpreter participation; trustworthiness; interpreter visibility/invisibility in the research process. This framework can be more effective when integrated into a systematic methodological tool.

Therefore, the what (what has to be briefed and with what aim and targeted impact on data quality); when (When is the best stage in the fieldwork processes can briefing and debriefing best be done, and how can more lessons be generated and fed into the research process), how (how can the adoption of social media platforms help researchers to effectively manage the research process through briefing and debriefing) questions that should be answered about the technique are not adequately answered. Furthermore, the technique has been documented with the practical fieldwork experience as a 'black box' to the principal researcher, especially when research is done in unfamiliar language territories and bi/multi-lingual research assistants are used. In these instances, the nitty-gritty processes that define contact between the research assistant and the respondents are not given much attention, yet they are invaluable in shaping the micro-contexts in which data is generated. Next, we describe the research context we worked in bringing to light how the above challenges can arise.

### ***3.1.3 The research context and pre-fieldwork design***

Many social science methodology scholars have converged on the idea that the context in which research is done can affect the quality of

results if proper precautionary measures are not put in place (Elam & and Fenton 2003; Shimpuku and Norr 2012; Meleis 1996; Hanna, Hunt, and Bhopal 2008; Temple 2006). Examples of such contexts include research on sensitive issues like sexuality (Elam & and Fenton 2003) and children's issues (Walker et al. 2010); research in crisis or post-conflict situations (Shesterinina 2019), research in the developing world context (Mathee et al. 2010); time and resource bound contexts (Kirkpatrick and Van Teijlingen 2009); and cross-cultural and cross-language contexts (Small et al. 1999), among others.

We applied BDT in a rapid (because of a limited budget, the study which targeted over one thousand questionnaire respondents had to be completed in 24 working days) mixed-methods research project with multilingual research assistants in three neighbourhoods of Kampala, Uganda, namely Bwaise III, Natete, and Ntinda. The first two are informal settlements where houses and businesses co-exist with high density presenting accessibility and security challenges, coupled with potential low response rates due to response fatigue because they have been frequently studied. The third is an affluent suburb which in sharp contrast presented the challenges of long walking distances for the research assistants. Another general challenge about research in Kampala is that it is a politically charged city where the central government had, a few years before our study, appointed an authority to oversee the running of the city on allegations of corruption by elected officials.

The study was aimed at establishing the relationship between flood risk, government risk reduction efforts, household/business characteristics, and risk perceptions on one side (independent variables) and flood damage mitigation (dependent variable) on the other. We prepared a semi-structured questionnaire in the English language for a largely Luganda-speaking population which was administered as a structured interview as in Kirkpatrick and Van Teijlingen (2009). Cognisant of the literacy levels of targeted respondents, different measuring orientations of both research assistants and respondents, key measurement scales, for example, flood levels, coping appraisal, response efficacy, and socio-economic variables in the questionnaire were presented with simple annotations and structure. For example, we opted for structured qualitative measurements of flood levels, i.e., 'covering feet, knee height, waist level, above waist level, instead of using meters to avoid confusion in estimation (Peters-Guarin, McCall, and Van Westen 2012). Moreover, realizing the potential mixture of annotations in shop, office, and warehouse areas among businesses (for example; square meters or square feet), we left the respondent to choose what annotation to put and we later standardised the measurement in square meters and meters. These variables were modelled using Bayesian modelling and

Agent-Based Modelling. To ensure integrity in these models, the data gathering process was aligned to key scientific methodological principles – accuracy, reliability, and validity. The main question answered in this chapter is; how can we get more value from rapid mixed methods research, bearing in mind potential challenges and pitfalls.

Another layer of complexity (Shimpuku and Norr 2012) was that the principal researcher was a foreigner with limited understanding of the study area and unskilled in the main local language - Luganda.

### **3.1.4 Potential pitfalls**

Because of the above-mentioned characteristics of the research area, the nature of research and budget, and the principal researcher's lack of local language skills, there were several potential issues related to data quality. These included possible data fabrication, recording errors, low response rates, sampling bias, social desirability bias, loss of meaning and thickness due to translation, low motivation of respondents, multiple positionalities, and subjectivities of both field assistants and respondents, and patronization of research. Although quality in quantitative and qualitative research is often addressed (for example, Babbie, 2013), rather little attention has been given to threats to quality encountered during household surveys in cross-language mixed methods research in situations in which deviation from pre-fieldwork research design is imperative. Furthermore, few scholars discuss the detailed "nuts and bolts" (Brod, Tesler, & Christensen, 2009; Shenton, 2004) of research fieldwork with multilingual field assistants and relate them to data accuracy, validity, and reliability. Our extension and application of the briefing and debriefing technique is unique in that it creates a practical method and criteria to interrogate many quality principles during fieldwork. We use the four Ps acronym (Paradigm, People, Process, and Presentation) to describe the philosophical and conceptual basis of the approach and demonstrate how it enhances data quality during fieldwork. However, mathematical computing of quality criteria is outside the scope of this chapter.

### **3.1.5 Key quality concepts: data accuracy, reliability, and validity**

Efforts to improve data quality in socio-economic surveys date back to the 18th century, (Kilss and Jamerson 1990), and were structured in Deming's (1944) work – 'On errors in surveys' (McNabb, 2018). Deming (1944) listed 4 groups of errors: (i) variability in response about the same thing from the same respondent or different respondent; use of a different canvas; and errors from the interviewer; (ii) bias from the

use of different methods and imperfections in the tool; and the difference between the time of research and the time of tabulation plus reporting of results; (iii) non-response, unrepresentativeness of date/period investigated; unrepresentative selection of respondents and other sampling errors; and (iv) other sampling errors.

From this summary, one can conclude that a research output value can be true or untrue (Kish 1965; Juran and Godfrey 1998). An untrue value can result from sampling error, survey mode related errors, interviewer error, coverage error, respondents related errors and their interaction, and measurement error (Anderson, Kasper, and Frankel 1979; Biemer and Lyberg 2003; Groves et al. 2004; Krosnick, Visser, and Lavrakas 2000). To deal with these types of errors, Hansen and Hurwitz, (1966) structured the research process into requirements, specifications, and operation. This view has given rise to the total survey quality model, which is now being conflated with total quality management, by putting effort to ensure data accuracy, reliability, and validity (Beullens et al. 2014).

Reliability/dependability is the adherence to research quality conventions that guarantee repeatability (Pandey & Patnaik, 2014; Shenton, 2004, Drost 2011), reminiscent of Denning's 4 groups. We demonstrate in this chapter, practical measures that can be achieved through briefing and debriefing during socio-economic surveys.

Validity is achieved when we measure 'the intended' (Drost 2011). Denzin, Lincoln, & Guba, (1994) assert that "unlike objectivity, validity is a more irritating construct, one neither easily dismissed nor readily configured by new-paradigm practitioners" (p. 178). Although there are "clear strong theoretical, philosophical, and pragmatic rationales" for the former, it is different from validity. We however concur with the argument that the vitality of validity is in its ability to answer the question of the trustworthiness of research output, both for theory and policy (Denzin et al., 1994; Pandey & Patnaik, 2014; Shenton, 2004). Denzin et al. (1994) argue that one key issue regarding validity is the conflation between method and interpretation, which brings us to the importance of the research paradigm in the data quality debate.

Paradigms are world views about the nature of reality/truth (Kuhn, 1970) which have been competing ontologies of truth for a long time (Alcoff, 1991). While objectivity dominated criteria for validity for some time, a counter-argument has developed since Kant and Hegel (Mills, 2017) – that truth cannot be completely detached from the human interpretation given that this definition makes it inaccessible. Denzin et al. (1994) argue that: 'Objectivity is a chimera: a mythological creature that never existed save in the imaginations of those who believe that the process of knowing can be separated from the knower'

(p. 181). Since this realization, subjective elements that include historical specificities of human knowledge production are no longer seen as irrelevant nor as threats (Alcoff, 1991; Campbell & Machado, 2013). They form an important constituency of knowledge production. Consequently, post-positivists, constructivists, and pragmatists view assistants as co-researchers rather than mechanical components, and how they are integrated into the research process and their decisions debated is key in enhancing credibility (Berman and Tyyskä 2011; Temple 2006;).

The conflation between method and interpretation requires innovative research fieldwork techniques that enable departure from pre-occupation with pre-fieldwork designs and quantitative description of human phenomena (Fine, Weist, Weseen, & Wong 2003) - what Schwandt (1996) calls, "bidding farewell to criteriology" and others call pragmatism (Denscombe 2008; Greene 2007; and Morgan 2007). Schwandt (1996) envisages a social research ideology that views practice goals both as moral critique and as practical philosophy. A question arises about how to ensure validity in 'pragmatic research' that is "bidding farewell to criteriology." Denzin, Lincoln, and Guba's, (1994) suggestion of three dimensions of validity - validity as authenticity, validity as resistance/validity as post-structural transgression, and validity as an ethical relationship further 'opens up a hole into which we can fit a wedge' - the Briefing and Debriefing technique as a practical strategy for enhancing data quality in mixed methods fieldwork.

Under authenticity, Denzin et al. (1994) list three criteria: (i) fairness in stakeholder selection which relates well to the fieldwork design discussed above; (ii) ontological and educative authenticity - awareness of research participants of their surroundings resulting in responses that reflect the reality; (iii) catalytic and tactical authenticities - the researcher's/research assistant's ability to trigger action from respondents and to train them where necessary. While the first relates to the design process, the second relates to both person and paradigm while the third relates to both person and process.

Validity as resistance/post-structural transgression relates well to pragmatic approaches. It is an intentionally divergent form of validity which Richardson (1997) metaphorically termed 'the crystalline,' which can be turned in many and reflects and refracts light (multiple layers of meaning). Through the light, the researcher sees both human currents and elements of truth, feels connected - a process of research with elements that 'flow' together.' This demonstrates the interwovenness of "discovery, telling, storying and re-representation" in research (Denzin et al., 1994, p. 181). Research methods and field techniques must therefore enable social scientists to unearth hidden assumptions and determinants of action, bringing together morals and epistemology,

thereby guaranteeing neo-pragmatic/situated validity (Lather 1986; Palmer 1987). Therefore, quality criteria embedded in the connection between ethics and epistemology (Noddings 1986) should take note of the,

‘positionality, or standpoints, judgements; specific discourse communities and research sites as arbiters of quality; voice or the extent to which a text has the quality of polyvocality; critical subjectivity (or what might be termed intense self-reflexivity); reciprocity or the extent to which the research becomes reciprocal rather than hierarchical’ (Denzin et al., 1994, p. 182).

The researcher’s and the respondent’s positionality, polyvocality, and reciprocity of the research process make flexibility, learning, and process adjustment [rather than just reading the fieldwork design script (Qu and Dumay 2011)] pre-requisites for quality mixed-method research output. The main reason is that in mixed methods, abduction is the reasoning criteria in theory building as opposed to deduction and induction (Morgan 2007). Because of this, the research process is cyclical/iterative (where field experiences are allowed to feed back to the conceptualisation and design in the same research project) rather than linear and hierarchical. This brings us to the importance of presentation - the fourth key dimension of research where quality issues must be considered. When planned methods and design are changed or modified in the field, researchers should explain it in detail and the implication it has on the data (Squires, 2009). Those phases we have explained under section 2.4.

Questions arise about the implications of this on research done with research assistants because how they are integrated is critical when interrogating mixed methods research integrity. Several scholars assert that the researcher must introspect oneself in line with philosophical background, location, gender, etc., and that research assistants are co-producers of knowledge rather than just workers (Alcoff, 1991; Creswell, 2014; Guba, 1994; Rubinstein-Ávila, 2009; Temple, 2002; Turner, 2010) – bringing up more issues that relate to multi-lingual research assistants.

First, are multiple ‘reflexivities’ that must be ensured by the principal researcher for each research assistant to debate assistants’ different viewpoints of the same concepts on asking questions and coding the responses (Alcoff, 1991; Travis, 2017; Turner, 2010) and related subjectivities (Denzin et al., 1994; Harris & Brown, 2010; Kwan & Ding, 2008; Morrow, 2005a). One cause of differences in viewpoints is the background and disciplinary training of assistants which according to Stanley (1990) and Temple (2006), should be part of the methodological explanation to demonstrate the trustworthiness of the research process.



Second and related to the above, is the knowledge and familiarity of the research assistants with the research problem, conceptualization, and method employed. Researchers are emphasizing the significance of research assistants' acquaintance with the conceptual framework and hypothesis/assumptions, especially where the research crosses national and linguistic borders (Baumgartner, 2012; Gibbert & Ruigrok, 2010; Lee et al., 2014; Morrow, 2005a; Rubinstein-Ávila, 2009; Squires, 2009; Temple, 2002; Turner, 2010). In such contexts, the position of research assistants as cultural/language brokers/experts requires that they be competent to gauge conceptual (non)equivalence during data gathering to avoid bias (Small et al. 1999; Meleis 1996; Kirkpatrick and Van Teijlingen 2009; Beck, Bernal, and Froman 2003; Temple 2002; Hanna, Hunt, and Bhopal 2008) bearing in mind that concepts do not cross cultures without some form of manipulation (Temple 2006). Additionally, research assistants as cultural brokers understand normative ways of communication (Briggs 1986) but do not have this ability equally among them and constant sharing of ideas is integral.

The third is language proficiency. Baumgartner (2012) identifies four code-names of languages in different cross-national and cross-language research. These are; inquiry language, source language, mediating language, and target language. Choice of the inquiry language has implications on the detail and authenticity of data acquired and the assistant/interpreter's skills to correctly code concepts from the inquiry language to the source language and then to the mediating language are critical. The same can happen on the informant/respondent's side; when compelled to respond in a language that he/she is not comfortable with, it can limit the expression of emotional issues, (Baumgartner, 2012). Godard (1986) summarizes this process of translation as an ongoing appeal to one's mental dictionary – an endless ping-pong of concepts and words between the translator's mind, the translation source, and the target, which can affect detail and meaning where the person involved is not well skilled. This is worse when the respondent or assistant use analogous or colloquial expressions (Temple 2006) which are not easy to understand even to a person from a different dialect of the same language.

Fourth, are socio-psychological issues among research assistants, which can reduce their effectiveness in data gathering and the credibility of the data. These include demotivation, untrustworthiness/dishonesty, courtship advances, nervousness about being involved in 'high profile research,' ethnic patronization, and unfamiliarity with specific fieldwork locations, (Turner, 2010). Additionally, some research assistants/translators can juggle fieldwork

and their other commitments. Some of their commitments can end up overriding their fieldwork roles.

In the light of the above, a question arises as to what the implications of abduction on the desired quality of research assistants are in terms of recruitment, training, and language skills? In doing all this, how will the validity criteria, including reflexivity, be incorporated where the principal researcher is using assistants and there is potential for multiple positionalities? Should research assistants be active or passive (Lee, Sulaiman-Hill, & Thompson, 2014; Scheyvens & Storey, 2003), and to what extent? We try to answer these questions using our experience with the briefing and debriefing technique in Kampala.

The above section has raised pertinent data quality-related questions that are answered in the remainder of this chapter: (i) how to deal with multiple ontologies of the truth in mixed methods studies with research assistants, (ii) How to effectively select and work with research assistants bearing in mind their inevitable agency and cultural brokerage during data gathering, (iii) How multiple positionalities and subjectivities affect consistency in drawing meaning from the field and (iv) potential loss of meaning due to translation.

### ***3.2 Applying and extending the briefing and debriefing technique***

We planned to use BDT as a quality control measure but realized from the onset of fieldwork that it was inadequate in scope in its formulation and use in the social research methods literature. Cognizant of the four sequential horizons of research, we added more stages and clarified procedural connections between stages as they apply to survey research. Figure 5 below shows the stages in the EBDT:

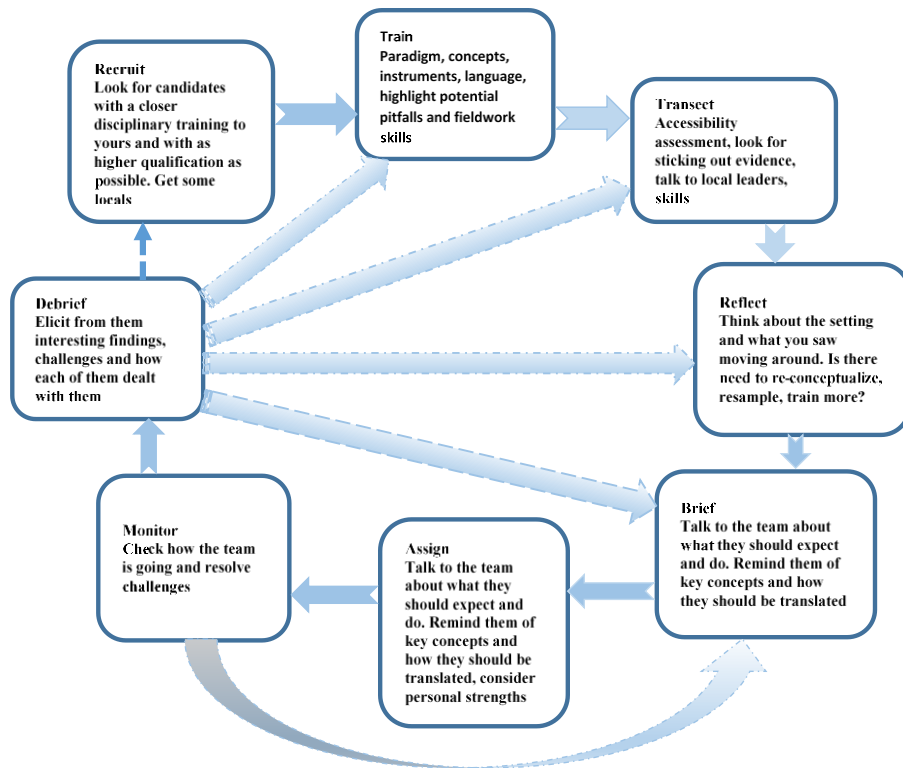


Figure 9: The Extended Briefing and Debriefing Technique

### 3.2.1 Recruiting Research Assistants

Since the subjectivity of research assistants undoubtedly played a part in the coding and packaging of the message in the questions, their origin, background, and orientation were crucial components in the process. Therefore, vigilance in averting potential pitfalls started in the selection of research assistants. At least two assistants were familiar with each case for example two of the research assistants had contact with Bwaise III through a different research project under the Urban Action Lab spearheaded by Makerere University. This was critical in guaranteeing both epistemic, internal, and external validity since it created a comfortable environment for honesty disclosure (Meleis 1996) by the respondents. Appreciation of urban flood risk and mapping was also a critical consideration in the process. Although it was not easy to find all the desired qualities in the research assistants, we ended up recruiting, we ensured that at least there were adequate skills to facilitate interactive learning among them. This was crucial for

intersubjective judgements and the ability to capture new frames of understanding from respondents. We also considered parts of Kampala they were living in. This, coupled with skills levels determined the strategic roles (Squires 2008) that they were assigned in the field. In this arrangement, fellow research assistants could turn to a colleague comfortable with a respondent's language and culture they lacked competence in. It also involved training others to use GPS point receivers and introducing the team to local leaders by those who lived in case areas or had contacts. Those with research experience in closer topics and good language skills were used to train, supervise others, and help in translating difficult concepts. Table 5 below gives detail on this strategic arrangement.

Table 5: Qualifications and strategic roles of research assistants

Research Assistant	Qualifications	Research experience	Language skills	Strategic role
<b>Jenny From Mukono but with extensive experience working with communities in Bwaise and Natete</b>	BA in Urban Planning, MSc Land use and Regional development – thesis stage, Training in Applied Statistics and Scientific writing	Thesis research on flood risk induced relocation in Kampala, Research assistant with researchers from the Bartlett Development Planning Unit, University College London and contributed to the final research report writing, Volunteer research assistant with students from the Norwegian University of Science and Technology collaborating with Slum-dwellers Uganda, Makerere University and Act together Kampala, Research intern at Makerere University working on Kampala land use map, vulnerability and adaptability to climate change among others	<b>Runyakitara</b> -Native user <b>English</b> – Advanced user <b>Luganda</b> – Intermediate user	Oversee other research assistants and helping in GPS points reading and translating key concepts into Luganda. Taking over where others encounter Runyakitara speaking respondents
<b>Japheth</b>	Bachelor of Arts in Geography	Research and mapping Worked with us in our previous research in 2015	<b>Luganda</b> – Native User <b>English</b> – Advanced user	Help with training other research assistants and overseeing logistical issues
<b>Martin From Makerere</b>	Bachelor of Arts majoring in Geography Short training in GIS and Remote Sensing Short training in Resource Economics and Environment	Research assistant in the Department of Geography, Geo-informatics, and Climate change at Makerere University. Had experience carrying out surveys, interviews in Environmental Science research	<b>Lusonga</b> – Native user <b>Luganda</b> – Excellent user <b>English</b> – Advanced user	Help with overseeing other research assistants and being a point of contact for help on GPS receiver use and maintenance. Also helping in translating difficult concepts from the questionnaire and those coming in answers Taking over where others experience Lusonga speaking respondents
<b>Hillary</b>	3 <sup>rd</sup> -year student, Bachelor of Arts, majoring in Geography	Undertaken research in Katanga slum settlement in Kampala on socio-economic and environmental problems. Community profile coordinator	Runyankole – Native user <b>English</b> – Advanced user <b>Luganda</b> – intermediate user	Since she was on holiday, she helped work overtime to help beat the deadline Taking over where others encounter Runyangole-speaking respondents.

*The extended briefing and debriefing technique (EBDT)*

Table 5 cont'd: Qualifications and strategic roles of research assistants

Melody	3 <sup>rd</sup> -year student, of Bachelor of Commerce in Purchasing and supply	Field assistant with AMREF Uganda, collecting data in Kabale district	Runyoro – Native user Luganda – Advanced user English – Advanced user Kiswahili – intermediate user	Taking over interviewing Runyoro and Kiswahili speaking respondents
<b>Nathan</b>	Bachelor of Arts in Geography	Thesis research	English – Advanced user Luganda – Beginner	Assisting with GPS receivers
<b>Jim From Natete</b>	Diploma in Business studies	Intern at Luwero town council	Luganda – Native user Kiswahili – intermediate user English – Advanced user Arabic – intermediate user	Point of contact in Natete
<b>Sandra From Ntinda</b>	Diploma in cosmetology		Luganda – Native user English - Advanced	Contact person for Ntinda
<b>Claudia From Ntinda</b>	Diploma in cosmetology	Nil	Luganda – Native user English – Advanced	2 <sup>nd</sup> contact person for Ntinda

### **3.2.2 Training**

The training we gave to research assistants was more than questionnaire administering skills. It included the theoretical reasoning behind the questions together with the objectives of the research. Additionally, it was a moment of mutual reflexivity, where we exchanged our mental frames (Maestre and Rudolph 2015) through which we understood the key concepts guiding the study. This, coupled with language training, strengthened epistemological and linguistic grounding to ensure that research assistants acquire data in line with our requirements.

To ensure the correctness and adequacy of responses, we trained the research assistants to intertwine the questionnaire with observation. For example, on questions about flood mitigation measures, they could also probe using what they could see on the property. This also applied to the question on flood depth as they could see the water markings on the house walls, and use it as the starting point to probe. We also trained assistants in Global Positioning System points reading and recording.

Some questions had the potential to generate social desirability bias (Sanzone et al., 2013). For example, it might have been hard for some men to give correct income to female research assistants. In such situations, research assistants were taught to use other related questions like monthly expenditure and savings to ascertain the daily income.

We also took this opportunity to motivate research assistants by stressing that outside the monetary appreciation we had agreed on, the study was an opportunity for them to gain skills that would be crucial in their careers. By so doing we made them own' the research project thereby reducing the potential for cheating during data gathering.

### **3.2.3 Transect walks**

The tradition of transect walks preceding questionnaire/interview administration is not new; in the literature, it is documented as an armchair walkthrough (Morse, 2016). The principal researcher used them to assess: i. accessibility (availability, pattern, and state of access roads and footpaths) of points selected on the map; ii. deprivation levels from the state of buildings. First is the state of access roads and footpaths; ii. the drainage network; and iv. flood damage mitigation activities in the area.

In Ntinda and Natete, these observations caused us to reconsider our sampling approach from the fishnet grid centroids to picking every nth number in a row of houses because not every chosen unit was easily accessible. Many studies do not document such practical deviations of design, yet they are crucial in assessing quality and transferring ideas to deal with such issues in the field (Baumgartner, 2012).

#### *Harmonizing accessibility and representativeness*

One scientific guiding principle in selecting objects/subjects for investigation is to ensure sample representativeness. In Ntinda the process of choosing the nth household/business was not easy. The road arteries of the Nsimbiziwoome area do not make a regular pattern. This was also the case in Bwaise and Natete. Somehow the normative regular pattern on the fishnet grid was harmonized with the irregular network of roads and footpaths that characterized the study areas.

In harmonizing the two, there was potential for generating a non-representative sample. For example, choosing units that are not spatially spread. Additionally, there was a possibility to skip other types of units by choosing sampling units along the roads which was the easiest way to go. This could have generated roadside bias – choosing more business units in some areas since shops are mainly found along the roads.

#### **3.2.4 Reflect**

Observing the state of access roads and footpaths; and pattern together with drainage, helped the principal researcher to judge the accessibility of points indicated on the map. This helped in deciding whether we treat some less accessible points as invalid cases. As already highlighted, we also through this process, changed the sampling strategy for units in Ntinda and Natete. In these cases, reflection happened simultaneously with walking through and talking to community leaders. On our first encounter with key contacts, we got a well-informed view of the exact areas that experienced a lot of flooding, which we had not gathered when we

consulted an expert from Makerere University during the research design phase. As we were discussing with community leaders, we already reflected on the applicability of our sampling plan and the need to adjust.



### **3.2.5 Briefing**

We reminded research assistants of the key research concepts in the questionnaire and how they should be translated into the Luganda language. We also briefed them about the findings from our transect walk. These findings included the route network, sticking out evidence of mitigation, and strategic meeting places for additional questionnaires and/or GPS receiver batteries. Additionally, every morning, we discussed new challenges, new evidence, and new opportunities, new frames of understanding by respondents solicited in the debriefing session of the previous day. This was, as Gibbert & Ruigrok (2010); Baumgartner (2012); Squires (2009), suggested - a constant struggle to improve the credibility of the research as fieldwork unfolded. This constant struggle was not about field etiquette only, it also enabled abduction.

### **3.2.6 Assign**

Information obtained from debriefing also helped in assigning assistants to sections of the study area respective to their strengths. There were cases in which female research assistants were afraid of taking paths with risky bridges and drains. In such cases, more non-responses or data fabrication in the worst case were likely. Therefore, the assignment of areas to cover was sensitive to gender dynamics. Gender dynamics in working with research assistants were discussed in the literature (Scheyvens & Storey, 2003) but more towards male assistants offering security to female principal researchers. Balancing research assistants' differential fitness and courage, with challenge levels of the routes, was an additional precaution in our study. On assigning routes, we also considered language and cultural competence among research assistants. One of our research assistants was not very fluent in the Luganda language. Since in every zone, we requested local administrative chairpersons who moved around with us helping research assistants access sample units and introduce them to respondents, we also used the same to assist one research assistant who had little Luganda language fluency. However, we were careful enough to manage power dynamics where sometimes the respondents would be forced to respond in a certain way because of the chairperson's presence.

### **3.2.7 Monitor**

To ensure alignment with integrity/quality principles, monitoring played an integral role. Although some scholars have argued against monitoring research assistants, arguing that it is oppressive and akin to viewing assistants as neutral mechanical components (Berman and Tyyskä 2011), we believe that for research credibility and smoothness of the process some form of monitoring is integral. This exercise was aimed at: (i) assessing challenges in terms of questionnaire interview administration; assessing the trustworthiness of research assistants; updating interviewers about new developments, and distributing additional fieldwork resources such as questionnaires and GPS receiver batteries. The process helped us to solve several issues which could threaten the integrity of our study.

First, is a case in Ntinda where one Local Council (LC) chairperson doubled escorting us with her administrative job and started lashing out at respondents who had not slashed grass on their compounds. This we thought would directly intimidate respondents and put them in a bad space to respond to our questions. When the principal researcher witnessed this, he found a way of excusing the chairperson and briefed the field assistants on how best to deal with such challenges.

Second, is when one of our research assistants was below the adequate Luganda language proficiency as already discussed in section 2.6. Although he had indicated it before, the principal researcher did not realize that his level required assistance. On assigning sections to cover and routes to follow, the principal researcher realized that the research assistant would take the last assignment to negotiate with the local chairperson for assistance. Good as it was, it meant that the local chairperson had to concentrate on helping this assistant and neglect his colleagues who also needed help with introductions to some household heads or business heads who were sceptical. It also meant an additional role to the chairperson that did not resonate with the appreciation token we had agreed on. To avoid this, we looked for an additional local person to help.

### **3.2.8 Debrief**

At the end of every day, the team gathered to give feedback on their experience in the field. Such sessions necessitated a continuous fine-tuning of interpretation skills through an interactive process of sharing challenging words and phrases that each of the research assistants

encountered both from the inquiry language to the source language and vice versa. Moreover, it helped gather different frames through which respondents understood the concepts in the questionnaire, which had not been captured in the pilot survey. Such knowledge helped equip assistants for deeper orientation of respondents to the requirements of the survey.

It was also an opportunity to share the 'highs and lows' of each researcher's day. In this process, those who would have encountered more informed respondents or new/interesting findings were able to share. For example, in Natete – Kigaga village, a research assistant generated a rich narrative from a respondent, which helped us to appreciate the flood experience of the residents and how limited their mitigation options were. The feedback was given as an example to other research assistants of what they were not supposed to ignore on account of strictly following the questionnaire which would be akin to 'reading the script,' (Qu & Dumay, 2011). On the other hand, challenging experiences were reported, for example; in Ntinda, a female research assistant was chased away and had stones thrown at her. This incident had the potential to instil fear and lead to the skipping of all the suspicious housing units. In response to this, the principal researcher paired male and female researchers to recover the confidence of the female research assistant using security from the male assistant.

### **3.3 Conclusion and discussion**

We have argued that the integrity of Social Science Research revolves around the astute management of the 4 Ps of Social Science Research – Paradigm, Person/People, Process, and Presentation. Entrenching a research method in a world view about knowledge helps the researcher (as exemplified in our research experience) to define quality criteria

which, in the case of mixed methods research, must consider abduction - the blending of deduction and induction.

Given this, managing people and process becomes crucial. As we demonstrated from our fieldwork experience in Kampala the EBDT is helpful in data quality management in such situations.

The EBDT helped us to answer several questions which scholars in social research methodology have asked. First, is how to deal with issues of multiple ontologies of the truth when working with research assistants (Alcoff, 1991). During the first training and subsequent briefing and debriefing, this question was addressed by acquainting research

assistants with knowledge about pragmatism (Morgan, 2007; Schwandt, 1996; Tashakkori & Teddlie, 2010) as the guiding paradigm in our study. Second, is how to effectively select and work with research assistants given the inevitable agency and cultural brokerage during data gathering (Lather, 1986; Morrow, 2005b). Third, what was the minimum level of disciplinary knowledge required? Fourth, is how their multiple positionalities and subjectivities could affect consistency in drawing meaning from the field and how to share ideas regarding unique situations (Kwan & Ding, 2008; Lincoln, 1995; Morrow, 2005b; Rubinstein-Ávila, 2009; Scheyvens & Storey, 2003). Fifth, the potential loss of consistency and meaning in data in the translation process from the inquiry language to the source language and then to the target language (Baumgartner, 2012; Lee et al., 2014; Sanzone et al., 2013; Schwandt, 1996; Temple, 2002; Turner, 2010). Although these scholars attempted to answer these questions, our fieldwork showed that experiences are diverse and that some problems are more context-specific. As a procedural technique, EBDT can be used by other researchers in various contexts.

## **Chapter 4: Factors influencing households' flood perceptions of risk and threat appraisal in three neighbourhoods of Kampala, Uganda.**

This chapter is based on: 'Chereni, S., Sliuzas, R., Flacke, J., & van Maarseveen, M. Factors influencing households' flood risk perceptions in three neighborhoods of Kampala, Uganda' - a manuscript currently under review for publication as a journal article in 'Risk Analysis.'

## **4.1 Introduction**

Floods rank high among world disasters, killing thousands of people and affecting several million yearly (CRED - Catholic University Leuven & UNISDR, 2017). Due to climate change and growing urbanization, more people are being exposed to flood risk globally (Adelekan & Asiyebi, 2016a; Lwasa, 2010), especially in the Global South, where urban population growth outpaces planned spatial development, and millions of people end up living in flood-prone informal settlements. To reduce flood-related deaths and property losses, a comprehensive risk management policy agenda that includes management of risk perception has been set in many countries (Jasanoff, 1998).

Flood risk perception is a subjective judgement of the probability and severity of impending floods *vis-a-vis* the extent to which one's life and properties are secure and immune to the floods (Lechowska, 2018). Some broaden the meaning to include perceptions about the causes of risk, especially where anthropogenic factors can easily be associated (Vávra et al., 2017; Ziervogel et al., 2016). Flood risk management has for some time been viewed as an engineering undertaking due to an inclination to the realist approach by policymakers. Since the early 1980s, researchers have learnt that lay people's risk perceptions are often different from expert judgements, which leads to unexpected responses (Jasanoff, 1998; Rowe & Wright, 2001; Siegrist & Gutscher, 2006; Terpstra, 2011). Improved understanding of flood risk perception has helped policymakers to anticipate people's responses and preparations for floods in the absence of engineering solutions, and where they are implemented, how they might affect their perceptions and willingness to implement autonomous and private mitigation (Bempah & Oyhus, 2017; Terpstra, 2011). The value of private mitigation measures springs from a growing understanding that part of flood protection comes from the people at risk and that public mitigation efforts can fail, leading to the 'failed-levee effect' (Barendrecht et al., 2017).

Therefore, integrated risk management approaches where public and private efforts complement each other produce more resilient communities, while an undervaluing of vulnerable people's perceptions and mitigation efforts about a hazard increases the possibility of property level mitigation failure or maladaptation (Ardaya, Evers, & Ribbe, 2017; Slovic, 1987). Therefore, management of perceptions to better reflect the actual risk situation is paramount. However, to do so, the factors influencing risk perception must be understood.

While much research on flood risk perception has been conducted in the Global North, it has not been done much in the Global South yet. Studies using the Protection Motivation Theory (PMT) have revealed mixed directions of relationships between environmental, psychological, and socio-economic variables on the one hand, and flood risk perception on the other (Andráško et al., 2020; Philip Bubeck, Botzen, et al., 2018; Grothmann & Patt, 2005; Kellens, Zaalberg, Neutens, et al., 2011; Morss et al., 2016; Patel & Fatti, 2013; Raška, 2015a; Wachinger & Renn, 2010). PMT originated from the Health Sciences and was later applied in disaster risk management research. This research has been driven by two objectives: first, to use field evidence to inform risk management policy, and second, to test its wider applicability in different contexts. Recent efforts have been directed at specific subcomponents of the PMT to draw detailed insights and improve the theoretical formulation itself (Babcicky & Seebauer, 2019b; Philip Bubeck, Wouter Botzen, et al., 2018a; Cannon et al., 2020; Seebauer & Babcicky, 2020)

Studies applying PMT in African cities are scarce. In this chapter, we compare the determinants of risk perceptions in two informal settlements and one affluent neighbourhood in Kampala, Uganda. We document factors of risk perceptions among selected households, community leaders, and government officials, guided by the following questions:

- How do households perceive the causes of flood risk in Kampala?
- How do households perceive the likelihood of future flood property damage?
- What are the key determinants of households' flood risk perceptions?

## **4.2 Literature review**

### **4.2.1 Theoretical underpinning**

Factors of risk perception have been understood from three different angles – the realist, relativist (psychometric), and constructivist paradigms (Armas et al., 2015). The realist paradigm was explained in the previous section and is outside the scope of this chapter. The

relativist paradigm views risk perception as contextual (determined by characteristics such as gender, experience, social status, etc.), while the constructivist paradigm views it as a product of communication. Different categorizations of the contextual factors are also evident in

the literature. They have been categorized as primary, secondary, and intervening factors (Lechowska, 2018); risk, informational, personal, and contextual factors (Wachinger et al., 2013); and cognitive/behavioural, socio-economic, and geographical factors (O'Neill et al., 2016).

To the latter categorization, we add one variable related to the socio-cultural and political context – the role of government authorities. In conceptualization, we employ the Protection Motivation Theory PMT), and focus on concepts related to threat appraisal.

#### **4.2.2 Past studies on risk perception**

Previous research on determinants of flood risk perception shows mixed results (see Table 6), but the general proposition is that there is a relationship between cognitive, socio-economic, socio-cultural, and political factors and flood risk perception (Lechowska, 2018). However, in many cases, the relationships between predictor (explanatory) and outcome (dependent) variables are weak (Bubeck et al., 2013; Kellens, Zaalberg, Neutens, et al., 2011; Thieken et al., 2010; Zaalberg et al., 2009). A comprehensive literature review by Lechowska (2018) identified three elements characterizing flood risk perception – awareness, worry, and preparedness, borrowing from the relativist paradigm (Slovic, 1987). Although the PMT formulation does not directly include these three components, they are comparable with other variables in PMT. For example, awareness i.e., knowledge of a hazard event and/or its trends, can be compared to having received information/knowledge about flooding. Both are influenced by direct experience, age, gender, education, income, and knowledge and information dissemination (Botzen et al., 2015; Lechowska, 2018). Worry i.e., negative feelings about uncertain and undesirable events and situations (Sjoberg, 1998), is comparable to a high perceived likelihood of flood/flood damage that is usually measured under threat appraisal in the PMT. Both are affected by direct experience, gender, and education. Preparedness refers to the readiness of governments, organizations, groups, and individuals to effectually anticipate, respond to, and recover from a disaster. It is normally related to the levels of damage prevention mechanisms, damage mitigation, and coping capacity already in place (European Commission, 2013) and is influenced by location, hazard proximity, living on the ground floor, length of residence, direct experience, age, gender, education, incomes, household size (children), homeownership, cellar ownership, knowledge, indirect experience, cultural-historical context, religious context, and political context (Lechowska, 2018).



Table 6: Summary of literature on risk perception factors

Factor	Relationship with risk perception	Sources
<b>Cognitive/behavioural</b>		
Flood experience	Positive	(Ardaya et al., 2017; Wachinger et al. 2013; Messner and Meyer 2006; Botzen, Aerts, and Bergh 2009; Raaijmakers, Krywkow, and van der Veen 2008; Siegrist and Gutscher 2006; Grothmann and Reusswig 2006; Kreibich et al. 2007; Kellens, Zaalberg, et al. 2011; Bradford et al. 2012; Terpstra 2011; Diakakis, Priskos & Skordoulis, 2018)(Heidi Kreibich et al., 2007; Miceli et al., 2008)
Flood information	Positive	
	Negative	(Thieken et al. 2007; (Miceli et al., 2008)
Property damage	Positive	(Cannon et al., 2020)
Willingness to mitigate	Positive	(Biernacki et al., 2008)
Knowledge	Mediating factor	(Thieken et al. 2007; Miceli et al., 2008; Bienacki et al., 2009; Colten & Sumpter, 2009; Comănescu & Nedelea, 2016; Raaijmakers et al., 2008b; Berman & Tyyskä, 2011; Boholm, 2011; Wachinger et al., 2013)
<b>Geographical factors</b>		
Proximity to hazard	Positive	(Å et al., 2008; Lindell & Hwang, 2008; O'Neill et al., 2016; Zhang, Hwang, & Lindell, 2010; Liu et al., 2018)
	Negative	(Colten & Sumpter, 2009)
	None	(Kellens, Zaalberg, Neutens, et al., 2011)
<b>Socio-economic, cultural, and political context</b>		
Culture and religion	A mediating variable relationship exists	(Armas et al., 2015; Boholm, 1998; Działek et al., 2013; Kleinhesselink & Rosa, 1991; Rohrmann, 1994; Bempah & Oyhus, 2017; Schmuck, 2000)
Income	None/negative	(Armaş & Avram, 2012; Lechowska, 2018)
Age	Positive	(Cannon et al., 2020)
Gender	Lower odds of being in a higher risk perception category for males	(Cannon et al., 2020)
Education	Positive	(Qasim et al., 2015b)
Role of Government Authorities	- (the role of the embankment effect)	(Ardaya et al., 2017); Birkholz, Muro, Jeffrey, & Smith, 2014; Bubeck et al., 2013; Cutter, Boruff, & Shirley, 2003; Grothmann & Reusswig, 2006; Kellens, Vanneuville, Neutens, & De Maeyer, 2011; Kousky & Kunreuther, 2009; Ludy & Kondolf, 2012; Raška, 2015; Terpstra, 2011; Wachinger et al., 2013)
Media	Relationship complex	(Sjoberg 1998; Englander et al. 1986)

\*Influence of experience changes with time, especially that of low magnitude events

---

### ***Perception about causes of, and responsibilities for flood risk management***

Most literature on perceptions surrounding the causes of flood risk is based on qualitative research. It documents the contention between residents and government entities concerning the causes of flood risk in urban settings. Government authorities, especially in the Sub-Saharan African context view the settlement of poor communities in unplanned, environmentally sensitive areas, as the main cause of flood risk (Abeka et al., 2020). On the other hand, communities at risk may view government actions such as the implementation of big projects without proper Environmental Impact Assessments (EIA), as the main cause. Additionally, residents often attribute flood risk to poor management of stormwater drains (Patel & Fatti, 2013; Ziervogel et al., 2014).

### **Final reflections on current knowledge**

Eleven factors (table 6) have been identified as key determinants of risk perception, some of which show low or even mixed results (e.g., income and proximity to the hazard). Many of the studies investigated how risk perception itself influences flood risk mitigation and adaptation that are beyond the scope of this chapter. Another observation is that most studies about the Global North used the PMT as an analytical framework while the few available studies about the Global South have framed risk through its causes and mitigation responsibility. This opens a niche for mixed-methods studies in the Global South that improve our understanding of contextual factors explaining differences in risk perceptions.

## ***4.3 Conceptual scope and research methods***

### ***4.3.1 Conceptual scope***

Figure 1 below shows the concepts we examine in this research and the linkages between them. We discuss the factors that explain flood risk perception frames within the flood threat appraisal component of the PMT, in relation to the perception of the likelihood of flood-induced property damage (hereafter LFPD) as its proxy.

To begin with, high-income earners feel more secure, more so when they anticipate even higher future incomes. Income, and other factors, like household size, age, and gender, affect coping capacity and consequently influence risk perception (Lechowska, 2018). Social networks are relational and, in some instances, may provide

associational ties that provide readily available helplines that indirectly 'underwrite' an individual's decision to live closer to a hazard (Mabuku et al., 2018). Implemented hazard mitigation measures have also been found to create a sense of safety, thereby causing individuals to underestimate risk. Large private investments in property may also reduce an individual's willingness to move to a less-risky place, for fear of loss of capital.

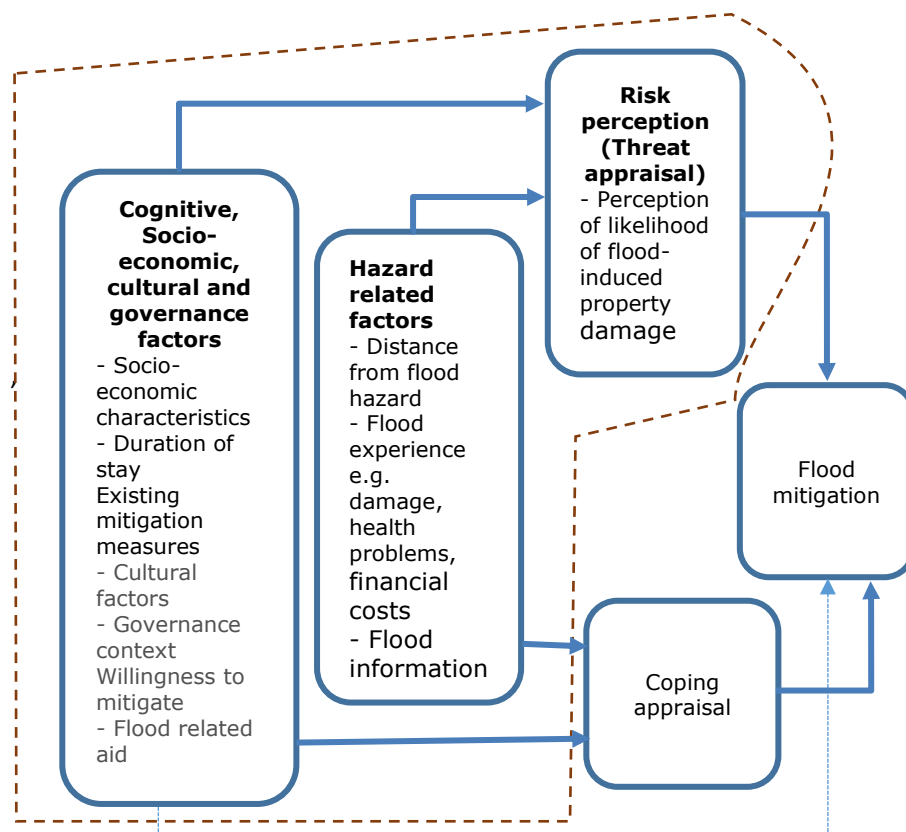


Figure 10: Extended Protection Motivation Theory: the polygon with brown dashed borders indicates the conceptual boundaries of this work, adapted from Rogers (1975)

Length of residency has also been found to affect the perception of risk through the habituation of disaster experience; an individual's perception of risk drops with time, for those living for extended periods in a hazardous environment. Distance from a hazard is associated with risk perception in that, often proximity to a hazard increases the likelihood of severe damage or loss. In turn, flood experience, flood-induced losses, past flood damage, and flood-related financial costs have been found to increase the perception of high risk through

memories of past undesirable experiences related to a disaster, which is linked to fear.

### **4.3.2 Data and analysis methods**

With the help of nine multi-lingual research assistants, we administered 612 *semi-structured questionnaires* in August 2017 – appendix 1 (154 in Bwaise, 248 in Natete, and 210 in Ntinda) which generated data about socio-economic status, flood experience, and flood perception. Most questions were either binary or ordinal [four levels were used to avoid the temptation of choosing the average (Moors, 2008)]. The questions were also consistently bipolar to balance the impact of the negative/positive inclination in responses to related questions (Kamoen et al., 2013). Assistants would be assigned to a route every morning.

Via a *WhatsApp* group, the Principal Investigator could reassign assistants to specific households depending on their preferred language. During daily briefing and debriefing sessions, refinements to the data collection were made if required (Chereni, Sliuzas, & Flacke, 2020). In so doing, we reduced social desirability bias and loss of meaning which could arise where non-ethnic interviewers are used (Adida et al., 2016). Via transect walks and observations, flood-water marks on walls, and the presence of flood mitigation measures were also noted.

The interview responses were reviewed to identify key themes deemed to explain flood risk perception. For example, the interviewees' understanding of the causes of flooding in the three areas and responsibility for mitigation. Observations made during transect walks and comments from the expert interviews were subsequently used in interpreting the questionnaire data.

For the analysis of the questionnaire data, we first generated frequency tables and graphs and used cross-tabulations to examine the general distribution of the data in the respondent variable and the explanatory variables (see appendix 1 for details). Second, we performed correlation analysis (*Spearman's Rho*) among all the variables, to identify potential multi-collinearity among explanatory variables and to highlight predictor variables with significant correlation with the response variable for the subsequent analysis. To establish key factors of perceived likelihood of property damage, we used Ordinal Logistic Regression (OLR) modelling.

The formula for the Ordinal Logistic Regression is expressed:

$$\text{Logit}(p(\gamma \leq j)) = \beta_{j0} - \alpha_1 x_1 - \dots - \alpha_p x_p$$

Where  $\beta_{j0}$  is the interception at the  $\gamma$  axis,  $\alpha_1$  is the regression coefficient of  $x_n$ ; and  $x_n$  are the explanatory variables.

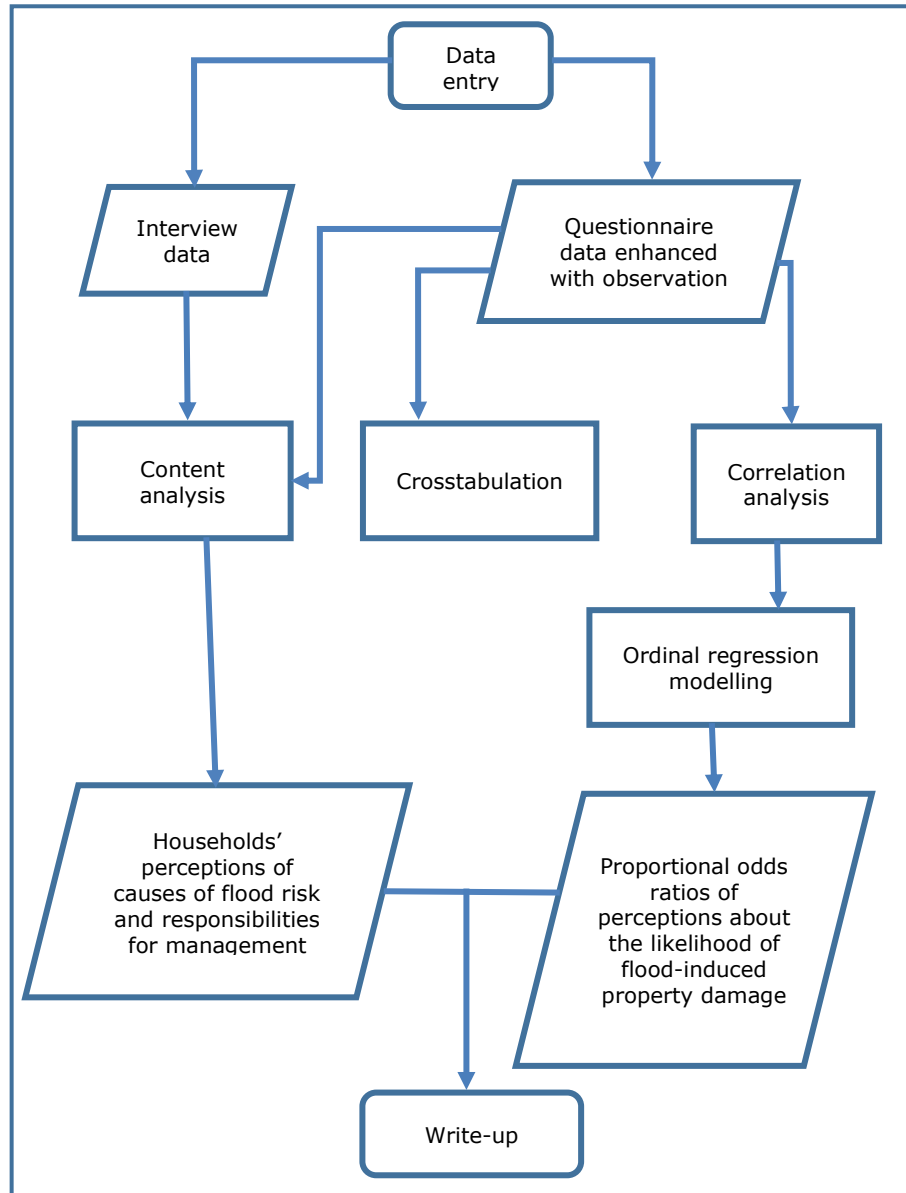


Figure 11: Data analysis steps

Throughout the analysis, missing responses were treated as system missing data, and cases with no valid answers per variable were removed from the analysis. As the socioeconomic status of the population in each case study area is relatively homogenous and has wide experience with floods, the removal of cases without valid entries

per respective variable was appropriate. This was confirmed by comparing means of socio-economic variables with estimates from settlement profiles done by ACTogether and the Uganda Bureau of Statistics using one-sample t-tests (ACTogether, 2014; ACTogether Uganda, n.d.; Uganda Bureau of Statistics, 2017) as shown in table 1. Figure 11 above summarizes the data analysis steps we took within the mixed method design

## **4.4 Findings**

In the following subsections, we present the main results of our interviews and the statistical analysis.

### **4.4.1 Households' perceptions of the causes of flood risk**

Residents and municipal leaders have differing explanations for the main causes of flooding. For example, in Bwaise III most interviewees (7 out of 9) indicated that there were no floods in the area when they settled there. Rather, they attributed the floods to the construction of the Northern By-pass – a ring road that relieves traffic congestion in the city, because it is in or nearby wetland areas and crosses several primary and secondary drains. Residents also blamed the local authority for failing to do a proper environmental impact assessment before constructing the road. On the other hand, all (8) government officers blamed the community for settling in environmentally sensitive land without proper planning and permission and for illegal garbage dumping, which causes blocked drainage channels. Nevertheless, four of them accepted that the construction of the Northern Bypass could have had some impact on the flooding in the area. For example, a Water and Sanitation Supervisor at KCCA said:

*"of course, we have constructed there a road which is the Northern By-pass. If you see the plan of the road, about 80% of it passes through the swamp..... I do not deny that, but that is not the sole reason why we are having floods there.... If these people are well behaved, those channels will be clean, but they are not clean, which affects water flow"*

These differences of opinions regarding the causes of flooding in Bwaise III are deep-seated and rooted in the complexities of Uganda's land tenure system. The land concerned is owned by the Buganda Kingdom which leases plots to citizens to build structures. Until recently the actions of the Buganda Kingdom and the city authorities were uncoordinated so that tenants would be unable to obtain permission from KCCA to build, yet construction continued illegally. These results are likely to influence the direction of the relationship between land

tenure and flood risk perception from the PMT perspective in that both owners and tenants are in some form of precariousness.

Regarding waste dumping, two issues that emerged from the interviews with residents and community leaders are worth noting. Garbage is both waste and a resource since some residents use it as fill material before developing, while others use it to create mounds for flood protection (interview with a community leader and a CBO leader).

In Natete, the parish chairperson of *Central B* pointed to the increase in the built-up area and failure to expand the primary drainage channel as the main reasons for flooding. In Ntinda, the parish chairperson stated that the flooding that started in 2015 was due to the construction of a wetland in Nsimbiziwoome (see figure 8 below, which shows stages of groundworks on satellite images 2015-2020).

These results demonstrate conflicting rationalities in the contestation for space between residents, government authorities, and the Buganda Kingdom. The Kingdom seeks to extract rents from its lands, low-income households seek to satisfy their shelter needs and the planning authority justifies development in sensitive areas on the account of providing for the public good.

Related to the question of the legitimate use of these lands is the transient nature of informal settlements. According to one community leader and one local government official, some people in the informal settlements view their residency as temporary. This temporality may affect their perception of the LFPD and may even allow them to rent houses without toilets and rely on so-called flying toilets (plastic bags for faeces disposal). Such a situation can contribute to cascading effects such as flood-related health problems (e.g., typhoid or cholera). Some residents may not attribute such diseases to flooding but rather the transient nature of life in informal settlements with poor infrastructures.

#### **4.4.2 Perception of the LFPD**

Residents of Natete expect much higher flood-induced property damage than those of Bwaise III and Ntinda (figure 4). Overall, 85% of residents in Natete perceived some likelihood of damage compared to 64% in Bwaise and 40% in Ntinda. Moreover, about half of the respondents have a high expectation of flood damage compared with 20% in Bwaise, and 13% in Ntinda. That residents of Natete express a higher likelihood of flood damage than those of Bwaise III is surprising given that Bwaise is often referred to as one of Kampala's flooding hotspots, but perhaps the recent drainage improvements in Bwaise have influenced resident perceptions.

*Factors of households' risk perceptions and threat appraisal*



Figure 12a: January 2015 image –  
Clearing of wetland for construction



Figure 12b: November 2016 image showing  
the landfill extent

Landfill  
area



Figure 12c: June 2017 image indicating the  
area in the photo below



Figure 12d: December 2019 image showing  
some erected structures

Area in  
photograph  
(fig. 3e)



Figure 12e: Ground photograph 2 - part of the construction site on a wetland in Nsimbiziwoome –  
August 2017



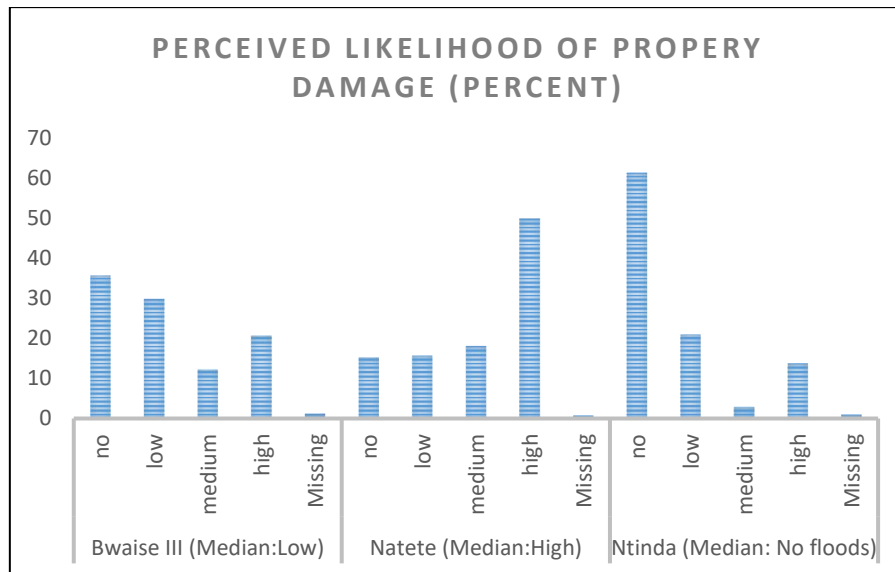


Figure 13: Perception of the likelihood of property damage

#### 4.4.3 Relationship of explanatory variables and perceived likelihood of property damage

Correlation analysis was performed among all the variables derived from the literature. First, for multicollinearity diagnostics, and second, to identify explanatory variables with a significant relationship with the response variable. No signs of potential multi-collinearity were identified (*i.e.*, no set of predictor variables had a correlation factor of 0.8 and above). Third, predictor variables with a significant correlation with the perceived probability of flood damage were further tested for multi-collinearity. None had a Variance Inflation Factor (VIF) of at least 10, and the Dublin Watson Statistic for all the models was between 1.7 and 2.1, which pointed to acceptable auto-correlation among the predictor variables.

Weak associations between predictor variables and flood perceived likelihood of property damage were found (Table 4). Key observations are that Bwaise III had the lowest number of important explanatory variables (4) followed by Natete (8) and Ntinda (10). Willingness to spend on mitigation is important for residents of Bwaise and Ntinda while years at the location, the highest level of education, and severity of flooding are important for both Natete and Ntinda. Income and receiving flood-related information are important to Natete only while monthly rent, distance from the channel, and existing mitigation measures are important for Ntinda only. The highest level of education, the severity of flooding, flood-induced property damage, flood-induced

*Factors of households' risk perceptions and threat appraisal*

health problems, and flood-induced financial costs have a stronger association with the dependent variable.

Table 7: Association between explanatory variables and perceived likelihood of property damage - Spearman's Rho.

Predictive variables	Bwaise III			Natete			Ntinda		
	Co-efficients	Sig.	n	Co-efficients	Sig.	n	Co-efficients	Sig.	n
Years at location	-.051	.536	150	.163*	.012	240	-.191*	.003	205
Household size	-.114	.166	150	.089	.170	238	-.0104	.111	198
Age of respondent	.026	.763	140	.079	.242	223	-.047	.490	221
Highest level of education	-.005	.953	145	-.263**	.000	236	.147*	.024	235
Number of households networked to	-.066	.421	152	-.023	.723	246	.065	.348	208
Tenure of property	-.001	.994	151	-.014	.825	237	.041	.532	225
Income	-.050	.558	138	-.215**	.001	229	-.092	.168	236
Monthly rent	-.110	.372	68	-.135	.188	97	-.288*	.017	68
Severity of flooding	.046	.658	94	.505**	.000	205	-.5**	.000	204
Distance from channel	-.006	.943	149	-.009	.883	246	-.332*	.000	208
Existing mitigation measures	-.014	.867	142	-.071	.293	222	.219*	.005	162
Willingness to spend on mitigation	.249*	.003	144	.007	.914	237	.257*	.000	198
Looked for flood risk information	-.022	.792	146	-.063	.330	238	-.040	.567	206
Received information	.104	.212	146	-.169*	.011	224	-.030	.673	198
Flood property damage	-.348**	.000	148	-.509**	.000	243	-.367*	.000	203
Flood health problems	-.280**	.001	147	-.387**	.000	243	-.448*	.000	204
Flood financial costs	-.375**	.000	146	-.534**	.000	242	-.540*	.000	203

NB: \* means  $p < 0.05$  and \*\* means  $P < 0.001$

Surprisingly, in all three cases, flood-induced property damage, flood-induced health problems, and flood-induced financial costs show significant negative relationships with the perceived likelihood of property damage when one would normally expect positive relationships. These unexpected results can be explained by the fact that households that had suffered such losses had often mitigated against future losses. In each settlement, we found some correlation between mitigation actions and the perceived likelihood of flooding. In Bwaise, households that had experienced health problems had constructed flood barriers with sandbags ( $p < 0.05$ ) while those who suffered financial losses had rebuilt their houses or raised the floor ( $p < 0.05$ ). Households in Natete had put up flood barriers with sandbags ( $p < 0.01$ ) while those in Ntinda that suffered health-related losses had constructed small dykes for protection ( $p < 0.05$ ). Perhaps one of the most striking features of the other variables with significant correlations is their cross-case variability, with several variables (years at the location, level of education, and severity of flooding) showing opposite correlations comparing Natete and Ntinda.

#### **4.4.4 Factors of Perception of the LFPD**

The results of the ordinal regression models indicate a very low explanation of the variation in the perceived likelihood of property damage. Table 8 below, shows the model fitting outputs between explanatory variables and the perceived likelihood of property damage in the three case study areas. The models fit the data ( $p < 0.001$ ) in all the three models from the three cases (table 8 below) – the ‘intercept only model’ (without predictors) is not equal to the final model (with predictors). With Chi-Square deviance and Pearson goodness of fit tests producing non-significance values ( $p > 0.05$ ), we fail to reject the null hypothesis (that there is no significant difference between the sample parameter and the expected value) and conclude that our models best fit the data. In the test of parallel lines,  $p$  values are greater than 0.05 for the three cases, suggesting that the ordered logit coefficients are unequal across the levels of the response categories. The Nagelkerke R Squared values suggest that the models explain, 26%, 62%, and 63% of the variation in perceived likelihood of property damage in Bwaise, Natete, and Ntinda respectively.

Table 8: Perceived likelihood of property damage model fitness Information

Important variables	Bwaise model		Natete model		Ntinda model	
	Variation	Significance	Variation	Significance	Variation	Significance
Model-fitting: Intercept only(final)	124.7 (86.5)	0.000	299.2 (184.8)	0.000	124.9 (78.6)	0.001
The goodness of fit: Pearson (Deviance)	41.8 (39.9)	0.130	248.3 (176.95)	1.000	132.7 (77.2)	0.700
Nagelkerke R Square	0.260		0.619		0.629	
Test of Parallel lines: Null hypothesis (General model)	86.5 (78.5)	0.624	184.8 (125.2)	0.122	78.58 (70.19)	1.000

The negative relation between flood severity and the perceived likelihood of property damage in Bwaise III and its positive relationship in Natete may be due to the widening of the primary drainage channel in the former and its apparent effectiveness in reducing flooding. Closely related to this is the lack of significance for the severity of flooding in Ntinda which can be understood by looking at the levels of flooding. Ntinda experiences relatively low flooding and qualitative sections of the questionnaire results show that many households just experience intense runoff, not flooding.

#### 4.4.5 Relationship of explanatory variables and perceived likelihood of property damage

Tables 9, 10, and 11 below show the parameter estimates from the ordinal regression models for the three cases, including the proportional odds for changes in the response variable given the variation in the predictor variables. The proportional odds were calculated for orders which showed significant contribution in explaining the variation in the perception of the likelihood of property damage by exponentiating the estimate [ordered log-odds (logit) regression coefficients] in the first third column. The model considers the last order to be the base category from which it begins to calculate whether the effect of changes in the order is statistically significant from zero in estimating levels of perception of LFPD. The general observation from the results is that home ownership, gender, age, household size, and flood-related information showed no significant influence on the perception of flood-induced property damage. Additionally, flood-related financial costs are important in the two low-income areas and not in the affluent area. In the latter, flood-induced property damage, willingness to mitigate, and income, are more important.

*Bwaise estimates*

Table 9 below shows the ordinal regression model estimates and proportional odds of changes in the perception of LFPD in response to changes in the levels of predictor variables for Bwaise III. Residents who experienced flood-induced financial costs were 3 times (proportional odds column) more likely to perceive a high likelihood of future flood-induced property damage than those that did not

( $p < 0.05$ ).

Table 9: Bwaise III: Parameter Estimates – perception of the likelihood of property damage

		Estimate	Std. Error	Wald	df	Sig.	Proportional odds	95% Confidence Interval	
								Lower Bound	Upper Bound
Threshold (Response)	<b>Likelihood of property damage: No</b>	-.949	.297	10.212	1	.001		-1.531	-.367
	Low	.545	.288	3.575	1	.059		-.020	1.109
	Medium]	1.228	.310	15.663	1	.000		.620	1.836
Location (Predictors)	<b>Flood-induced property damage:</b>								
	Yes	1.403	.567	6.121	1	.013	4.06	.292	2.514
	No	0 <sup>a</sup>	.	.	0	.		.	.
	<b>Flood-induced financial costs:</b>								
	Yes	1.071	.494	4.696	1	.030	2.91	.102	2.039
	No	0 <sup>a</sup>	.	.	0	.		.	.
	<b>Willingness to spend on mitigation:</b>								
	Not willing	-1.167	.363	10.353	1	.001	0.31	-1.878	-.456
	Somewhat willing	-1.601	.674	5.637	1	.018	0.2	-2.922	-.279
	Willing	-.339	.647	.274	1	.600		-1.606	.929
	Highly willing	0 <sup>a</sup>	.	.	0	.		.	.
Link function: Logit.									
a. This parameter is set to zero because it is redundant.									

Similarly, households which experienced flood-induced property damage were 4 times more likely to have a higher perceived LFPD than those that did not ( $p < 0.05$ ). Willingness to spend on mitigation explains the variation in perceived LFPD in the lower levels of the variable scale. Households which were somewhat willing to mitigate were 0.2 times more likely to have a higher perceived likelihood of property damage than those which were willing ( $p < 0.05$ ).

Table 10: Natete Parameter Estimates – Perception of the likelihood of property damage

		Estimate	Std. Error	Wald	df	Sig.	Odds	95% Confidence Interval	
								Lower	Upper
Threshold	[LikelihoodPropertyDamage2017 = 1]	-20.870	2.001	108.744	1	.000		-24.792	-16.947
	[LikelihoodPropertyDamage2017 = 2]	-18.511	1.976	87.766	1	.000		-22.384	-14.638
	[LikelihoodPropertyDamage2017 = 3]	-17.040	1.982	73.886	1	.000		-20.925	-13.155
Location	<b>Length of residency</b>								
	Up to 1 year	-19.951	.952	438.841	1	.000	0.001	-21.818	-18.085
	2 -5 years	-18.771	.833	507.574	1	.000	2	-20.404	-17.138
	6 -10 years	-18.194	.855	453.323	1	.000	6.7	-19.869	-16.519
	11-15years	-18.619	.966	371.678	1	.000	3	-20.512	-16.726
	16 -20 years	-18.663	.000	.	1	.		-18.663	-18.663
	20+ years	0 <sup>a</sup>	.	.	0	.		.	.
	<b>Income UGX</b>								
	0-40 000	.875	.622	1.979	1	.159		-.344	2.095
	40001-80000	2.456	.834	8.675	1	.003	11.7	.822	4.091
	80001-12000	2.399	.962	6.225	1	.013	11	.515	4.284
	120001-160000	4.650	1.328	12.260	1	.000	105	2.047	7.252
	160001-200000	16.403	9875.479	.000	1	.999		-19339.179	19371.985
	200001-240000	17.092	7816.287	.000	1	.998		-15302.550	15336.733
	240001-280000	3.790	1.464	6.702	1	.010	44	.921	6.659
	280001-320000	1.169	1.585	.544	1	.461		-1.937	4.275
	320001-360000	.925	.827	1.251	1	.263		-.696	2.546
	360001 and above	0 <sup>a</sup>	.	.	0	.		.	.
	<b>Highest education</b>								
	None	1.994	2.038	.958	1	.328		-2.000	5.988
	Primary	1.985	.947	4.397	1	.036	7	.130	3.841
	High school	1.406	.527	7.118	1	.008	4	.373	2.439
	Tertiary	0 <sup>a</sup>	.	.	0	.		.	.
	<b>Flood Severity</b>								
	Low	-3.687	1.835	4.035	1	.045	0.03	-7.285	-.090
	Medium	-2.254	1.830	1.516	1	.218		-5.841	1.333
	High	-.602	1.953	.095	1	.758		-4.430	3.226
	Extremely high	0 <sup>a</sup>	.	.	0	.		.	.
	<b>Flood property damage</b>								
	Yes	.404	.600	.452	1	.501		-.773	1.580
	No	0 <sup>a</sup>	.	.	0	.		.	.

Table 10 continued

<b>Food-induced health problems</b>									
Yes	.584	.589	.983	1	.321		-.571	1.739	
No	0 <sup>a</sup>	.	.	0	.		.	.	.
<b>Flood financial costs</b>									
Yes	2.170	.682	10.131	1	.001	8.8	.834	3.506	
No	0 <sup>a</sup>	.	.	0	.		.	.	.
[Incentive2016=yes]	-4.243	2.603	2.657	1	.103		-9.345	.859	
[Incentive2016=No]	0 <sup>a</sup>	.	.	0	.		.	.	.
Link function: Logit.									
a. This parameter is set to zero because it is redundant.									

Those who were not willing to mitigate were 0.3 times more likely to have a higher perceived likelihood of property damage than those who were somewhat willing ( $p < 0.05$ ).

#### *Natete estimates*

Although having suffered from flood-related health problems was significantly correlated with perception of LFPD, it was excluded from the model to reduce noise. Table 10 above, illustrates that length of residency, household income, highest education level, the extent of flooding, and flood induced financial costs are important predictors of perceived likelihood of property damage.

Regarding the length of residency in Natete, households which had been in the area for up to a year were 0.001 times less likely to increase their perception of LFPD compared to those which had been in the area for 2 to 5 years ( $p < 0.05$ ). Those who had lived in the area for 2 years to 5 years were 2 times less likely to have a higher perception of LFPD than those who were in the area for 6 to 10 years ( $p < 0.05$ ). Respondents who had lived in the area for 6 years to 10 years were 6.7 less likely to perceive more LFPD than those who were in the area for 11 – 15 years ( $p < 0.05$ ), and those who had lived in the area for 11 – 15 years were 3 less likely to have a higher perception of LFPD than those who lived in the area for 16-20 years and above ( $p < 0.005$ ).

**Income** is negatively related to the perception of LFPD. Respondents who fell in the income bracket 40 001 UGX to 80 000 UGX were 11.7 times more likely to perceive a higher LFPD than those who earned 80 001-120 000 UGX ( $p < 0.05$ ). Respondents from households earning between 80001 UGX and 120000 UGX were 11 times more likely to perceive a higher LFPD than those who earned 120 001-160 000 UGX ( $p < 0.05$ ). Respondents from households with salaries that fell in the

120 001 – 160000 UGX bracket were 105 times more likely to perceive a higher LFPD than those from the 160 001 – 200 000 UGX ( $p < 0.05$ ); and those from the 240001 UGX to 280000 UGX were 44 times more likely to perceive a higher LFPD than those who earned 280001-320000 UGX ( $p < 0.05$ ).

**Level of education** is negatively related to perceived LFPD – respondents from households where the primary level was the highest achieved by among all household members were 7 times more likely to perceive more flood-induced property damage than those from households where high school education was the highest level achieved among all household members ( $p < 0.05$ ), and those with high school as the highest level achieved among all household members 4 times more likely to perceive higher LFPD than those with tertiary education as the highest level achieved by a member ( $p < 0.05$ ).

**The severity of flooding** is positively related to perceived likelihood of property damage – respondents from households that experienced flooding to a low extent were 0.03 times less likely to perceive higher LFPD than those who experienced flooding to an extremely high extent ( $p < 0.05$ ). Experiencing **flood-induced financial loss** was positively related to the perception of the likelihood of property damage. Those who experienced it were 8.8 more likely to perceive a high likelihood of property damage than those who did not ( $p < 0.05$ ).

#### *Ntinda estimates*

In Ntinda, Income, flood-induced property damage, and willingness to spend on flood mitigation were the important factors of the perceived likelihood of property damage (Table 11 below). However, **income** showed some significant contribution in the lowest bracket (0UGX to 40000 UGX). Respondents from households whose salaries fell in this bracket were 19 times more likely to perceive higher LFPD than those who earned 40001 – 80000UGX ( $p < 0.05$ ). With regards **to having suffered flood-induced property damage**, those who suffered it were 27 times more likely to have a higher perceived LFPD than those who did not suffer it ( $p < 0.05$ ). **Willingness to mitigate** showed significant estimates in the willing and not willing levels. Those who were not willing were 0.054 times less likely to perceive more LFPD than those who were somewhat willing, and those who were willing were 0.024 less likely to perceive high a likelihood of property damage, than those who were highly willing ( $p < 0.05$ ).



Table 11: Ntinda Parameter Estimates									
		Estimate	Std. Error	Wald	Df	Sig.	95% Confidence Interval		
							Proportional odds	Lower Bound	Upper Bound
Threshold	Likelihood of property damage:								
	No	3.176	3.272	.943	1	.332		-3.236	9.588
	Low	5.379	3.336	2.599	1	.107		-1.160	11.919
Location	Medium	5.564	3.344	2.768	1	.096		-.990	12.119
	Monthly rent								
	Monthly rent	-4.065E-8	5.843E-7	.005	1	.945		-1.186E-6	1.105E-6
	Highest education level								
	None	19.872	6082.622	.000	1	.997		-11901.847	11941.592
	Primary	.207	.923	.050	1	.823		-1.603	2.016
	High school	0 <sup>a</sup>	.	.	0	.		.	.
	Status of house								
	Rented	2.086	2.766	.569	1	.451		-3.334	7.507
	Usufruct	0 <sup>a</sup>	.	.	0	.		.	.
	Household income								
	0-40 000 UGX	2.939	1.371	4.594	1	.032	19	.251	5.626
	40001-80000 UGX	1.513	1.244	1.480	1	.224		-.925	3.951
	80001-120000 UGX	-18.663	6008.593	.000	1	.998		-11795.289	11757.963
	120001-160000 UGX	1.798	1.305	1.898	1	.168		-.760	4.356
	160001-200000 UGX	-19.519	6082.622	.000	1	.997		-11941.239	11902.201
	200001-240000UGX	-17.618	8881.627	.000	1	.998		-17425.287	17390.051
	240001-280000UGX	-1.073	1.689	.403	1	.525		-4.383	2.238
	280001-320000 UGX	-.417	1.704	.060	1	.807		-3.758	2.923
	320001-360000 UGX	-19.673	.000	.	1	.		-19.673	-19.673
	360001 UGX and above	0 <sup>a</sup>	.	.	0	.		.	.
	Flood-induced property damage								
	Yes	3.313	1.377	5.792	1	.016	27	.615	6.011
	No	0 <sup>a</sup>	.	.	0	.		.	.
	Number of households networked to								
	No households	1.842	1.241	2.203	1	.138		-.590	4.274
	2-3 households	1.395	1.910	.533	1	.465		-2.350	5.139
	4-5 households	2.105	2.480	.720	1	.396		-2.755	6.964
	6+ households	0 <sup>a</sup>	.	.	0	.		.	.
	Willingness to spend on mitigation								
	Not willing	-2.915	.950	9.409	1	.002	0.054	-4.777	-1.052
	Somewhat willing	-1.527	1.213	1.583	1	.208		-3.905	.852
	Willing	-3.717	1.966	3.574	1	.059	0.024	-7.571	.136
	Highly willing	0 <sup>a</sup>	.	.	0	.		.	.
Link function: Logit.									
a. This parameter is set to zero because it is redundant.									

## 4.5 Discussion

That we found generally weak associations between individual predictors and perceptions of LFPD comes as no surprise given the trend in the PMT literature on flooding. In our case, combining these associations in an ordinal regression model improved the predictive power of the variables. Nagelkerke  $R^2$  values as high as 0.26, 0.62, and 0.63 for Bwaise III, Natete, and Ntinda respectively, are generally high relative to what other scholars found elsewhere (Botzen et al., 2009; Rana et al., 2020).

Table 12 shows a synoptic view of the relationships between flood risk perception and its explanatory variables from the literature vis-à-vis our findings. We established that flood-induced financial costs are an important factor in Bwaise III and Natete, income is important for Natete and Ntinda, and extent of flooding, education level, and length of stay are also important in Natete. For Ntinda, flood-induced property damage and willingness to mitigate are additional important factors. Through qualitative analysis of flood risk perceptions, we established that religion is not an important factor of risk perception, like in the findings of Adelekan & Asiyanbi (2016b) in Lagos – a comparable setting to ours. The positive relationship we found between risk perception and flood experience (extent of flooding) is in line with studies in Belgium, Germany, the Netherlands, Greece, Brazil, and Switzerland (Ardaya et al., 2017; W. J. Botzen et al., 2015; Diakakis et al., 2018; Messner & Meyer, 2006; Raaijmakers et al., 2008a; Wachinger et al., 2013).

The additional factor in the case of Bwaise III – flood-induced financial costs is not common in the literature and is worthy of further investigation in other contexts. **The extent of flooding** was found to be an important predictor for the perceived likelihood of property damage only in Natete. This difference may be explained by the greater intensity of flooding in Natete and its terrain physiography. Natete has a more uneven terrain than Bwaise III and, since its primary drain had not yet been improved, its flooding experiences are more variable than those in Bwaise. However, although the improved primary drainage channel in Bwaise has reduced flooding in some parts, floods also occur due to overflowing secondary and tertiary drains and from rainwater accumulation on land parcels (Chereni, 2016). In Ntinda, which has similar physiography to Natete, flooding began only recently and is concentrated in the area closer to the main drainage channel (Interview with key informant from Nsimbiziwoome).

We established that a respondent's age, gender, homeownership, and distance from a major drainage channel, are not important predictors of flood risk perception in our study areas. These findings concur with much of the existing literature while flood information, culture, and media were deemed to be non-applicable to our cases because of the very low response rate on these aspects in the questionnaire.

Table 12: Relationship between our findings on risk perception and evidence from the literature

Factor	Relationship with risk perception	
	<i>In the literature</i>	<i>Our findings</i>
<b>Cognitive/behavioural</b> Severity of flooding Flood-induced financial costs Flood-induced property damage Flood information Knowledge Willingness to mitigate <i>*Influence of experience changes with time, especially of low magnitude events</i> Media	Positive n.a. Positive Positive/negative Mediating factor Positive Relationship complex	Positive/None Positive in <i>Bwaise III</i> and <i>Natete</i> , None in <i>Ntinda</i> Positive in <i>Ntinda</i> None n.a. Positive in <i>Ntinda</i> n.a.
<b>Socio-economic</b> Income Household size Age Gender Education Homeownership Length of stay	None Positive/negative Positive Positive Positive/None None Positive	Negative in <i>Natete</i> and <i>Ntinda</i> None None None Negative in <i>Natete</i> None Positive in <i>Bwaise III</i>
Geographical Proximity to hazard	Positive/negative/none	None
<b>Socio-cultural and Political context</b> Culture Role of government Authorities Religion	A mediating variable relationship exists Negative: (the role of the embankment effect) Mediating factor	N/A Negative – in <i>Bwaise III</i> , residents showed some trust in the widening of the primary channel but at the same time worried about the local government's failure to effectively dredge it N/A

However, our finding of a non-significant relationship between flood risk information and flood risk perception is different from the consulted literature which established a positive relationship. In our study areas, there was no systematic provision of flood forecast information directly to the households. At the settlement level, community organizations were trying to cover this gap but their activities were still incidental (Chereni et al. 2020). Our findings show that the majority of people in Bwaise III and Natete rely on neighbours and community leaders for flood-related information. One can hypothesize that these sources do not command enough authority to influence households' perception of flood likelihood.

Our findings that **income** is an important factor of the perceived likelihood of property damage in Natete and Ntinda confirm the study by Armaş & Avram (2012) in Romania. That it is not an important factor in Bwaise is in line with what Oasim et al. (2015); Botzen, Aerts, and Bergh (2009) established in Pakistan and the Netherlands, respectively. Relating to **household size**, the literature consulted contains diverging accounts. For example, Kreibich et al. (2005); and Zaalberg et al. (2009) established a positive effect of household size on flood likelihood perception in Pakistan and Belgium respectively, while Oasim et al. (2015); Armas, Ionescu, and Posner (2015); and Liu et al., (2018) document a negative relationship in Pakistan and Romania, respectively. Our findings add another dimension with the variable being proved unimportant. There are also mixed results on the relationship **between education level** and flood risk perception in the literature. Some sources documented a lack of relationship in line with our findings from Bwaise III and Ntinda, while others established a positive relationship based on the idea that the higher the literacy, the more rational one is in interpreting flood risk (Burningham et al., 2008; Grothmann & Reusswig, 2006a; Qasim et al., 2015a). In contrast to the latter, our findings in Natete documented a negative relationship between education level perceived likelihood of property damage in Natete, suggesting that the lower the literacy, the higher the perception of the likelihood of property damage. **Homeownership** does not have a significant relationship with flood risk perception in the accounts of Kellens, Zaalberg, et al. (2011) and Knocke and Kolivras (2007) which our findings confirm.

While the consulted literature established a positive contribution of **age** (Botzen et al., 2009; Cannon et al., 2020; Qasim et al., 2015a), length of residency (Ardaya et al., 2017; Thistlethwaite et al., 2018); and some relationship of gender (Armas et al., 2015; Kellens, Zaalberg, Neutens, et al., 2011); to flood likelihood perception, our findings show no significant relationship for age but a positive relationship for the length of residency. One explanation for such a difference is the

characteristics of the cases we studied, especially Bwaise and Natete. Age and gender are non – significant factors, most likely because of the household structure in the African context, where the elderly live with other family members who take care of them such that they have little fear or worry associated with flooding compared to other age groups and genders. This can also be explained by the absence of the very aged. The difference between genders is also not significant, for example, in Bwaise III, because economic survival appears more crucial than the threat of flooding. This can also be explained by the reduced threat of flooding because of the widening of the Nsooba-Lubigi primary drainage channel which passes through the area. It matters for all genders only when they have experienced flood-induced financial loss.

The lack of a significant relationship between flood risk perception and ***distance from a hazard*** in our findings is in line with Kellens, Zaalberg, Neutens, et al.'s (2011) findings in Belgium. However, they differ from Sotgiu, and Settanni (2008); Zhang, Hwang, and Lindell (2010); and O'Neill et al. (2016), who established a positive relationship between these two variables in Italy, Texas, and Europe, respectively. On the other hand, Oasim et al. (2015); and Colten and Sumpter (2009) established a negative effect of the independent variable on flood risk perception in Pakistan and New Orleans, respectively.

*Regarding the role of government authorities*, we established a higher perception of flood likelihood in Natete where there has been little government flood prevention and mitigation activity compared to Bwaise, where much has been done. The finding suggests a growing trust in the government intervention in Bwaise, which confirms findings in the literature (Birkholz et al., 2014; P Bubeck et al., 2013; Cutter et al., 2003; Grothmann & Reusswig, 2006a; Kellens, Zaalberg, Vanneuville, et al., 2011; Kousky & Kunreuther, 2009; Ludy & Kondolf, 2012; Raška, 2015b; Terpstra, 2011a; Wachinger et al., 2013).

## 4.6 Conclusions

We conclude that although the extent of flooding is not an important predictor of perceived the likelihood of property damage, considering related factors such as flood-induced damage and flood-induced financial costs, one can conclude that residents in the three areas have some feeling of vulnerability to flooding impacts. However, where the government has taken significant flood mitigation actions, the perception of flood risk drops. This in turn may reduce households' willingness to invest directly in private flood mitigation measures.

In terms of policy, and in light of the results of this study, the City Authority should try to make the experiences and costs already suffered

by the residents more salient among these residents to encourage them to take private preparedness action.

In light of the mixed results with low levels of variance explained in the models, in the literature, and in our study, further research must explore different research designs that include grounding of research on flood risk perception in different contexts to unravel some context-specific trends that can enrich the existing theoretical framework.

## **Chapter 5: Factors influencing flood coping appraisal among homeowners and residents in Kampala, Uganda**

This chapter is based on: 'Chereni, S., Sliuzas, R., Flacke, J., & van Maarseveen, M., Factors influencing flood coping appraisal among homeowners and residents in Kampala, Uganda - a manuscript accepted for publication as Book Chapter in 'Homeowners and The Resilient City'

## **5.1 Introduction**

Households in many Global South Cities endure the loss of lives, illness, and property damage due to floods. Floods are the most frequent and damage inflicting disasters worldwide (Chai et al., 2020; de Koning et al., 2019). Of all disasters, they represent 69% in Africa, 46% in Europe, and 47% in Asia (CRED, 2021). Although in Africa the proportion of flood damage is still relatively low at 17% compared to 46% and 49% for Europe, and Asia respectively, their impact on both private homeowners and residents' livelihoods, and local economies is high considering the generally high levels of vulnerability in the continent (Fraser, 2017). In many African cities, for example, 62-70% of the population live in informal settlements (Simiyu et al., 2019), which in many cases are low-lying and flood-prone. The combination of the flood hazards in these areas and the socio-economic status of the informal settlement dwellers is translating into increased flood risk. The frequency of floods is also increasing due to climate change.

The flood risk management burden on governments has therefore become increasingly heavy (Jha et al., 2012a). For this reason, government policies in many countries have adopted an integrated approach to flood risk management, which acknowledges that both homeowners and residents can meaningfully contribute to the risk management process. Homeowners' and residents' mitigation efforts have therefore become integral in increasing resilience to floods and thereby augmenting government efforts (Everett & Lamond, 2014; Grothmann & Reusswig, 2006b; Howe, 2011; Oakley et al., 2020). This is also true for Kampala, Uganda's capital city.

Kampala Capital City Authority (KCCA) seeks ways in which homeowners and residents can contribute to resilience-building efforts after the Integrated Flood Management in Kampala Project (IFMK - a UN-Habitat funded project) produced models of future urban growth and flooding for the city and recommended a series of measures to reduce flooding (UN-Habitat, 2013a). Some measures included regular engineering and community-based drainage cleaning, sensitization of communities for proper sewage management and flood management, increasing infiltration by planting vegetation and using permeable technologies, and widening of drainage channels (UN-Habitat, 2013b), and water harvesting (Nadraiqere, 2014). From the foregoing, one can observe that like many city-wide flood management projects, the IFMK could not explore in-depth, the current state and potential of property-level mitigation, except for those directly related to hydrological modelling. Besides the fact that much of what households can contribute to resilience-building was beyond this project, many of the



recommendations required household and community participation in the resilience-building process. Such participation depends on the intrinsic perceptions and motivation of households and communities that we focus on in this study by assessing households' coping appraisals.

This chapter provides insights into the motivations of homeowners and residents, from three case study areas with varying risk levels, to implement specific measures, some of which have been popularized in recent years that help to build resilience to floods. For example, the chapter documents the perceptions of both homeowners and tenants regarding, among others, Sustainable Urban Drainage Systems (SuDs), that fall under nature-based solutions to flooding (Everett & Lamond, 2014; IUCN, 2016; Nadraiqere, 2014). According to the available climate change adaptation literature, implementation of these approaches has taken a slow pace due to path dependence on other engineering approaches (Davies & Laforтеzza, 2019), and Kampala is no exception. We also assess homeowners' and residents' potential responses to the government's implementation of engineering solutions in Kampala, which is important because excessive trust in government efforts may culminate in the reduction of private mitigation measures (Terpstra, 2011b).

## **5.2 Theoretical framework and literature review**

### **5.2.1 Theoretical framework**

Adoption of flood mitigation measures by households has been associated with behavioural processes linked to their perceptions of risk *vis-à-vis* their perceived capacity to protect themselves. (Everett & Lamond, 2014). The Protection Motivation Theory (PMT) (Rogers, 1975), which is among the key theories explaining individual risk behaviour in chapter 3 of this volume, is arguably the most applied in autonomous and private risk mitigation research. PMT relates the implementation of disaster mitigation measures to the mental processes of at-risk individuals when gauging the severity of risk, their ability to cope, the effectiveness of potential measures, and the costs of the measures. Figure 1 illustrates these conceptual links and demarcates the conceptual boundaries of this study. In the conceptualization, experiencing a disaster (in this case flooding severity), or learning about it, triggers a response process with a binary outcome variable (whether to protect oneself or not). The process is

based on cognitive assessment of the risk at hand (threat appraisal) (Ardaya et al., 2017; Babcicky & Seebauer, 2019b; P. Bubeck et al., 2013), the perception of one's ability to protect oneself and the perception of the effectiveness and costs of mitigation measures at hand (coping appraisal). An extension of this formulation brings in additional socio-economic variables as shown in figure 14 below.

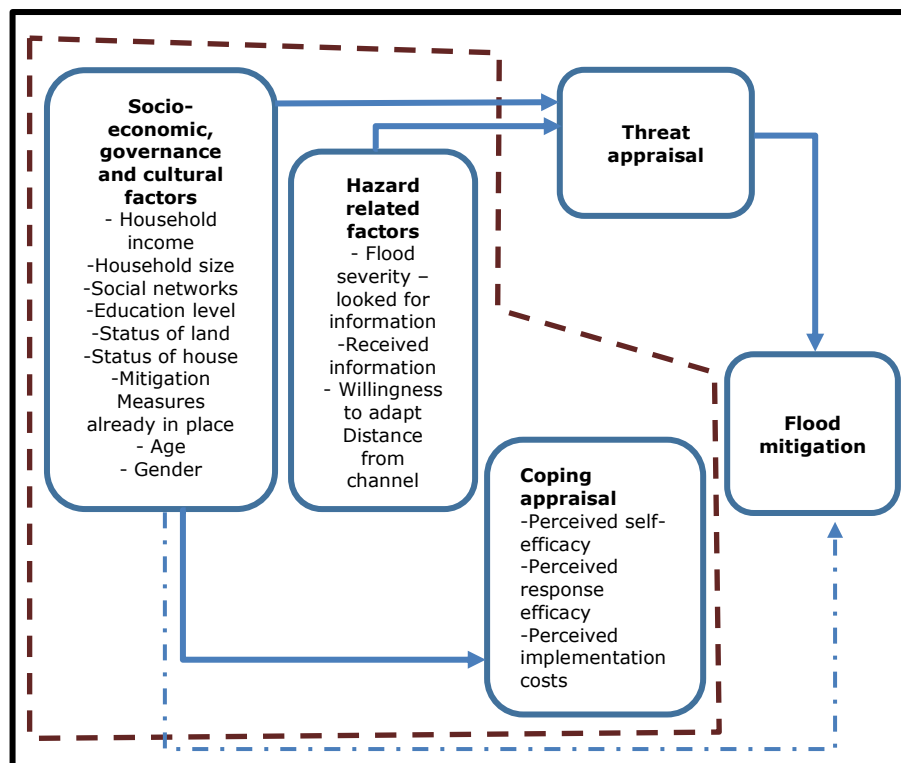


Figure 14: Extended Protection Motivation Theory Adapted from Bubeck et al., (2018) – the current work focuses on concepts within the brown polygon.

In this formulation, household income, household size, social networks [within the collective efficacy thinking (Babcicky & Seebauer, 2019a)], education level and tenure status, are believed to have an indirect impact on the flood damage mitigation level or choice of a flood damage mitigation measure as indicated by the blue dashed arrow, and direct influence on threat and coping appraisal.

### ***5.2.2 Past studies on homeowners and residents' coping appraisals***

Studies which document factors affecting measure-specific flood coping appraisals by homeowners and residents are scarce. Much of the available literature documents factors that influence their mitigation behaviour or intentions to mitigate against flooding or climate change impacts (W. J. W. Botzen, Kunreuther, Czajkowski, & Moel, 2019; Brody et al., 2010; Grothmann & Reusswig, 2006a; Koerth et al., 2013; H. Kreibich et al., 2011; Osberghaus, 2015; Poussin et al., 2014a; Terpstra, 2011a; Vávra et al., 2017). Given that measure-specific appraisals are the pathway to eventual adoption of the flood coping measures, it is important to discuss the factors that influence such decisions by homeowners and residents to lay some sort of foundation for this study. One key finding in these studies is that both homeowners and tenants think that it is the role of the government authorities to put up mitigation measures, thereby limiting their motivation to self-protect, for example in Bichard, (2012) and Terpstra, (2011a). Related to trust in government measures, Osberghaus, (2015) identifies interaction effects and concludes that risk seeking and lower educated homeowners are likely to mitigate even if they expect government aid, while risk averse and highly educated households do not. More generally, this study established that homeowners were more likely to mitigate against flood risk than tenants. Relating to self-protection with insurance, Antwi-Boasiako, (2016), found that homeowners are discouraged from putting up flood mitigation measures because insurers tend to interpret them as evidence of more flood risk and therefore demand higher premiums compared to properties without measures, yet in fact, private measures reduce the flood damage risk.

There is, however, a growing subset of risk perception and mitigation studies zooming into subcomponents of the PMT to reveal detailed insights and provide component specific policy recommendations. Such studies have concentrated on establishing the determinants of threat and coping appraisal and they have revealed mixed results (Babcicky & Seebauer, 2015; Philip Bubeck, Wouter Botzen, et al., 2018b; Fox-Rogers et al., 2016; Schlef et al., 2018; Seebauer & Babcicky, 2020) to proffer detailed policy recommendations on appraisal elements of the PMT. In this work we concentrate only on the factors influencing coping appraisal.

Most PMT studies proffer insights which are largely related to Global North case studies. Moreover, they focus on compounded assessments

of coping appraisal and do not assess it per mitigation measure. While Bubeck et al. (2018) acknowledged the need for assessing antecedents of coping appraisal of households per mitigation measure, their reporting touches on mitigation types, *i.e.* structural and nonstructural grouping of measures not necessarily mitigation measure by mitigation measure. Only the purchase of insurance is studied as an individual measure. Information on coping appraisal in relation to individual measures is important in situations where local authorities would like to know which measures would likely enjoy the support of community members and how they could complement private mitigation investments.

Our objective was to identify influencing factors of coping appraisal in a sub-Saharan African city, thereby testing the applicability of PMT in a less developed context. We also establish measure-specific appraisals that can help to improve the PMT framework while at the same time providing insights to the Kampala city and other developing world cities on how best to harness the potential of homeowners and residents to contribute to resilience building processes. These are: perceived self-efficacy (SE); Response Efficacy (RE); and Implementation Costs (IC) for: raising the floor or rebuilding the house; putting up a small dyke; Putting up a pile of sandbags; raising sockets; capturing rainwater; planting grass; clearing the drainage; and temporarily moving away to a safe place. We used the parts of PMT with applicable variables bordered by the brown dashed border polygon in figure 1 above, having modelled its other parts elsewhere. Below we list five research hypotheses that guided this study.

### **Research hypotheses**

We tested the following hypotheses which have guided similar studies elsewhere, for example, the first 4 have guided the work of in Bubeck, Botzen, Laudan, Aerts, & Thieken, (2018), and the 5<sup>th</sup> is our addition:

**H1:** Where the degree of social vulnerability (in terms of income, education level, social networks, household size, tenure status, gender, and age) is high, household's perceptions of self-efficacy are low and perceptions of implementation costs are high.

**H2:** "flood severity is positively correlated with response and self-efficacy, *i.e.*, where levels of flood severity are high, also the self-perception of the households' response efficacy is high."

**H3:** Receiving flood-related information is positively correlated with perceptions of response and self-efficacy and negatively related to perceptions of implementation costs.

**H4:** Risk-averse households have lower perceptions of response and self-efficacy and higher perceptions of implementation costs.

**H5:** Level of mitigation already in place is positively correlated with perceptions of self-efficacy and response efficacy, but negatively correlated with perceptions of response costs, i.e., households with high levels of mitigation already in place have perceptions of high self-efficacy and response efficacy, and perceptions of low implementation costs at the same time.

### **5.3 Data and analysis methods**

The data were analyzed using the Statistical Package for Social Science (SPSS). The descriptive statistics for the selected explanatory variables are shown in table 13 below. In the first step, we correlated all variables (using Spearman's Rho) to identify multicollinearity, at the same time identifying important variables influencing coping appraisal elements.

Subsequently, important factors were included in sets of ordinal regression models estimating coping appraisals per each measure to quantify the amount of variation in the coping appraisal elements they explain and the proportional odds of changes in the ranks of explanatory variables relative to the ranks in the dependent variables.

### **5.4 Findings**

#### **5.4.1 Association between explanatory variables and coping appraisal elements in the five hypotheses**

In this section, we correlate the explanatory variables and measure-specific appraisal elements, (i.e., perceptions of self-efficacy; response efficacy; and implementation costs). The measures common in Kampala as presented in section 2 above are: raising the floor or rebuilding the house, putting up a small dyke; piling up sandbags; raising electric sockets; capturing rainwater; planting grass; clearing the drains; and temporarily moving away to a safe place.

*Factors influencing flood coping appraisal*

Table 13: Descriptive statistics for selected explanatory variables of coping appraisal

	Bwaise III			Natete				Ntinda	
	Frequency	Percent	Valid Percent	Frequency	Percent	Valid Percent	Frequency	Percent	Valid Percent
<b>Status of house</b>									
Valid	79	51,3	51,6	127	51,2	53,1	120	59,7	59,7
Owner	72	46,8	47,1	111	44,8	46,4	78	38,8	38,8
Tenant	2	1,3	1,3	1	,4	,4	3	1,5	1,5
Usufruct	153	99,4	100	239	96,4	100,0	201	100	100
Total									
Missing	1	,6		9			9		
<b>Total</b>	<b>154</b>	<b>100</b>		<b>248</b>	<b>100</b>	<b>100</b>	<b>210</b>	<b>100</b>	
<b>Gender</b>									
Valid	38	24,7	24,8	88	35,5	36,5	76	36,2	36,4
Female									
Male	115	74,7	75,2	153	61,7	63,5	133	63,3	63,6
<b>Total</b>	<b>153</b>	<b>99,4</b>	<b>100</b>	<b>241</b>	<b>97,2</b>	<b>100</b>	<b>209</b>	<b>99,5</b>	<b>100</b>
Missing	1	,6		7	2,8		1	,5	
<b>Household income</b>									
Valid	15	9,7	10,8	73	29,4	31,7	39	18,6	19,5
0-40 000 UGX									
40001-80000 UGX	36	23,4	25,9	25	10,1	10,9	21	10,0	10,5
80001-120000 UGX	39	25,3	28,1	13	5,2	5,7	16	7,6	8,0
120001-160000 UGX	23	14,9	16,5	16	6,5	7,0	13	6,2	6,5
160001-200000 UGX	16	10,4	11,5	15	6,0	6,5	11	5,2	5,5
				8	3,2	3,5	10	4,8	5,0
240001-280000UGX	1	,6	,7	16	6,5	7,0	13	6,2	6,5
				11	4,4	4,8	8	3,8	4,0
320001-360000 UGX	4	2,6	2,9	14	5,6	6,1	14	6,7	7,0
360001 UGX and above	5	3,2	3,6	39	15,7	17,0	55	26,2	27,5
Total	139	90,3	100,0	230	92,7	100,0	200	95,2	100,0
Missing	15	9,7		18	7,3		10	4,8	
<b>Total</b>	<b>154</b>	<b>100</b>		<b>248</b>	<b>100</b>		<b>210</b>	<b>100,0</b>	
<b>Highest education</b>									
Valid	2	1,3	1,4	6	2,4	2,5	1	,5	,5
None									
Primary	30	19,5	20,4	32	12,9	13,5	12	5,7	6,1
High school	74	48,1	50,3	106	42,7	44,7	54	25,7	27,6
Tertiary	41	26,6	27,9	93	37,5	39,2	129	61,4	65,8
Total	147	95,5	100,0	237	95,6	100,0	196	93,3	100,0
Missing	7	4,5		11	4,4		14	6,7	
<b>Total</b>	<b>154</b>	<b>100</b>		<b>248</b>	<b>100,0</b>		<b>210</b>	<b>100</b>	

Table 13 continued

<b>Flood Severity</b>									
Low	22	14,3	52,4	58	23,4	28,3	17	8,1	42,5
Medium	14	9,1	33,3	78	31,5	38,0	17	8,1	42,5
High	5	3,2	11,9	60	24,2	29,3	6	2,9	15,0
Extremely high	1	,6	2,4	9	3,6	4,4	40	19,0	100,0
Total	42	27,3	100,0	205	82,7	100,0	170	81,0	
Missing	112	72,7		43	17,3		210	100,0	
<b>Total</b>	<b>154</b>	<b>100</b>		<b>248</b>	<b>100,0</b>		<b>17</b>	<b>8,1</b>	<b>42,5</b>

NB: 1 USD = 3500 UGX

In table 13 above, we provide a snippet of descriptive statistics of some explanatory variables to enable a quick understanding of the socio-economic statuses and total number of households that we interviewed. The results show small ratios of homeowners to tenants in all three areas and more male respondents. The mode income bracket for Natete is the lowest on the income brackets scale while in Ntinda it is the highest income bracket. In Bwaise III it is the third-lowest bracket. Regarding the highest education attained by a household member, high school level is the mode for Bwaise III and Natete while for Ntinda it is tertiary level. Flooding is more severe in Natete, followed by Bwaise III, and lastly Ntinda. Table 13 above provides the correlation coefficients of these and other variables with the measure-specific coping appraisal elements explained above.

Factors influencing flood coping appraisal

Table 14: Correlations of predictor variables with elements of coping appraisal in Bwaise III

	SE rebuilding	SE small dyke	SE Sandbags	SE capturing rainwater	SE raising sockets	SE planting grass	SE clearing drainage	SE goods high	RE Dykes	RE capturing rainwater	RE putting goods high	IC Clearing drainage	IC raising sockets	IC planting grass	IC small dyke	IC sandbags	IC capturing rainwater	IC goods high
Gender					-0.19* 0.015 N = 153													
Age	,165* ,043 N=152						,183* ,025 N=150											
Distance from Channel												0.173* 0.034 N = 150					-0.211* * 0.009 N = 152	
Household income	0.232* * 0.006 N = 137				0.362 0.000 N = 139								0.224* * 0.009 N = 137	0.206* * 0.016 N = 136				
Status of house			-0.238* * 0.003 N = 149															
Status of Land					0.292* * 0.06 N = 88		0.480* * 0.00 N = 88				0.295* * 0.005 N = 88				-0.399* * 0.000 N = 88	-0.570* * 0.000 N = 88	-0.223* * 0.036 N = 87	0.228* * 0.035 N = 86



Table 14 continued: Correlations of predictor variables with elements of coping appraisal in Bwaise III

	SE rebuilding	SE small dyke	SE Sandbags	SE capturing rainwater	SE raising sockets	SE planting grass	SE clearing drainage	SE goods high	RE Dykes	RE capturing rainwater	RE putting goods high	IC Clearing drainage	IC raising sockets	IC planting grass	IC small dyke	IC sandbags	IC capturing rainwater	IC goods high
Highest education					0.186* 0.024 N = 147													
Flood severity			0.379* 0.015 N = 41							0.460* 0.002 N = 42							0.346* 0.027 N = 41	
Flood-induced property damage			- 0.177* 0.033 N = 146							0.194* 0.018 N = 148								
Flood-induced health problems			- 0.279* 0.001 N = 145	0.233* 0.004 N = 147		-0.195 0.018 N = 146				-0.195* 0.018 N = 148	999 9						9999	
Flood-induced financial costs	- 0.209* 0.011 N = 146		0.270* 0.001 N = 144	- 0.255* 0.002 N = 146		0.165* 0.048 N = 144	- 0.168 0.044 N = 144			-0.169 0.041 N = 147		- 0.173 0.038 N = 144				- 0.200 0.015 N = 148		

Table 14 continued

	SE rebuilding	SE small dyke	SE Sandbags	SE capturing rainwater	SE raising sockets	SE planting grass	SE clearing drainage	SE goods high	RE Dykes	RE capturing rainwater	RE putting goods high	IC Clearing drainage	IC raising sockets	IC planting grass	IC small dyke	IC sandbags	IC capturing rainwater	IC goods high
Mitigation efforts before 2017	0.234** 0.005 N = 142	0.217** 0.01 N = 142			0.173* 0.038 N = 144			0.360* 0.000 N = 150								-0.253* 0.002 N = 144		0.239* 0.004 N = 141
Looked for Information									-0.283** 0.001 N=146				-0.165 0.048 N = 145					
Received flood-related information				-0.188* 0.023 N = 146					-0.283* 0.000 N = 146						0.227* 0.006 N = 146			
Willingness to spend on mitigation	0.214* 0.010 N = 144	0.167* 0.046 N = 144	0.245** 0.003 N = 143	0.188* 0.002 N = 144			0.255* 0.002 N = 142			0.237* 0.004 N = 145		0.175* 0.036 N = 142	0.200* 0.017 N = 142	0.202 0.016 N = 142		0.175* 0.035 N = 146		

Table 15: Correlations of predictor variables with elements of coping appraisal in Natete

	SE rebuildin g	SE small dyke	SE Sandbag s	SE capturin g rainwater	SE raising sockets	SE planting	SE clearing drainage	SE goods high	RE Rebuildi ng	RE Dykes	RE Sockets	RE capturin g	RE moving	RE Planting grass
Age														153* ,018 N=240
Household income	,188** ,005 N = 222	-,169* ,011 N = 226	-,134* ,045 N = 225					,262** ,000 N = 229		,171* ,010 N=225	,363** ,000 N =226	,134* ,045 N=223		
Status of house	- ,294** 0,000 N = 230	-,173** ,008 N = 233		-,140* ,031 237	-,135* ,039 N = 234									
Status of Land	- ,374** 0.000 N = 95	-,338** ,001 N = 93	-,336** ,001 N = 92	-,335** ,001 94	-,310** ,002 N = 93		-,489** ,000 N = 95	-,371** ,000 N = 95		-,249 ,015 94				
Highest education	,213** 0.001 N = 228				,223** ,001 N = 233									,162* ,014 N=229
Flood severity				-,142* ,044 N = 203				,235** ,001 N = 204						
Flood- induced property damage	-,253 ,000 236		-,196** ,002 N = 238	-,164* ,011 N = 241	-,176** ,006 N = 239		-,253** ,000 N = 238	-,392** ,000 N = 242						,194** ,003 N=235
Flood- induced health problems	-,260 ,000 235	-,206** ,001 N = 238	-,302** ,000 N = 238	-,239** ,000 N = 241			-,386** ,000 N = 238	-,240** ,000 N = 242	-,139* ,031 N = 240					,136* ,037 N=235

Table 15: More variable correlations

	RE putting goods high	RE Clearing drainage	IC Rebuildin g and Raising the floor	IC small dyke	IC sandbags	IC raising sockets	IC planting grass	IC Clearing drainage	IC capturing rainwater	IC moving away from	IC goods high
Age											
Household income	,219** ,001 N=221				-,207** ,002 N=227						
Status of house											-,158* ,016 N=232
Status of Land	-,420** ,000 N=92			-,524** ,000 N=94	-,314** ,002 N=94	-,380** ,000 N=93	-,279** ,006 9N=4	-,420** ,000 N=94		-,287** ,005 N=93	-,261* ,011 N=93
Highest education	,176** ,008 N=228									,156* ,019 N=225	,236** ,000 N=230
Flood severity											
Flood- induced property damage			-,127* ,050 N=238	-,258** ,000 N=240		-,188** ,004 N=239					
				-,308** ,000 N=240	-,155* ,016 N=240	-,219** ,001 N=239		-,164* ,011 N=240			

Table: 15 continued: Correlations of predictor variables with elements of coping appraisal in Natete

	SE rebuilding	SE small dyke	SE Sandbags	SE capturing rainwater	SE raising sockets	SE planting grass	SE clearing drainage	SE goods high	RE Rebuilding	RE Dykes	RE Sockets	RE capturing rainwater	RE moving away	RE Planting grass
Flood-induced financial costs	-,318 ,000 234	-,135* ,038 237	-,307** ,000 N = 237	-,169** ,009 N = 240	-,208** ,001 N = 238		-,351** ,000 N = 237	-,308** ,000 N = 241	-,131* ,043 N = 239					,175** ,007 N=234
Mitigation efforts before 2017	,518 ,000 214	,262** ,000 N = 217		,223** ,001 N = 221	,284** ,000 N = 218		,148* ,029 N = 218	,313** ,000 N = 222	,168* ,013 N = 219		,210** ,002 N = 220			
Looked for flood information			,204** ,002 N = 234						-,193** ,003 N = 235		-,141* ,031 N = 236			
Received flood-related information								,133* ,047 N = 224					,145* ,033 N=218	
Willingness to spend on mitigation					,230** ,000 N = 234		,192** ,003 N = 234		,297** ,000 N = 234		,166* ,011 N = 235	,141* ,031 N=233		,189** ,004 N=232
Household size	,129 ,046 238	,137* ,034 N = 241		,142* ,027 N = 244										
Distance from Channel														,152* ,019 N=240
Years at location	189 ,003 238				,205** ,001 N = 242	,142* ,028 N = 242		,205** ,001 N = 245						

*Factors influencing flood coping appraisal*

Table: 15 continued: Correlations of predictor variables with elements of coping appraisal in Natete

	RE putting goods high	RE Clearin g drainag	IC Rebuild ing and	IC small dyke	IC sandba gs	IC raising sockets	IC plantin g grass	IC Clearin g drainag e	IC capturi ng rainwat er	IC moving away from	IC goods high
Size of social network	,205 ,001 N = 238		,268** ,000 N = 241	,126* ,050 N = 244	,146* ,023 N = 242		,177** ,006 N = 241	,138* ,031 N = n = 245			
Flood- induced financial costs				-,320** ,000 N=239		-,304** ,000 N=239		-,144* ,026 N=239			
Mitigation efforts before 2017	,182** ,007 N=215					,164* ,015 N=218					,144* ,034 N=217
Looked for flood information		,143* ,029 N = 232		-,206** ,001 N=237		-,202** ,002 N=236	-,211** ,001 N=234			-,136* ,041 N=228	-,145* ,026 N=235
Received flood- related information	,262** ,000 N=218	,139* ,040 N = 218			,228** ,001 N=223		,132* ,049 N=221				,177** ,008 N=221
Willingness to spend on mitigation	,188** ,004 N=231			,302** ,000 N=236		,333** ,000 N=235	,160* ,014 N=234		,187** ,004 N=237	,191** ,004 N=230	,197** ,003 N=233
Years at location	,170** ,009 N=238								-,135* ,035 N=243		
Size of social network				,128* ,046 N=243							

Table 16: Correlations of predictor variables with elements of coping appraisal in Ntinda

	SE rebuilding	SE small dyke	SE Sandbags	SE capturing rainwater	SE raising sockets	SE planting grass	SE clearing drainage	SE Moving away	SE goods high	RE Rebuilding	RE Dykes	RE Sandbags	RE Raising sockets	RE Planting grass	RE capturing rainwater
Gender		-,177* ,011 N=204			-,146* ,037 N=205										
Age															,138* ,046 N=208
Household income	,164* ,023 N=194			-,161 ,024 198	,148* ,039 N=196			-,149* ,039 N=193			,196** ,006 N=199		,195** ,006 N=196	,173* ,014 N=199	
Status of house						-,199** ,005 N=198									
Status of Land		-,472** ,001 N=44		-,359* ,015 N=45		-,366* ,015 N=44	-,320* ,032 N=45								
Highest education			-,306** ,000 N=192	-,183* ,011 N=194			-,210** ,003 N=193	-,250** ,001 190N=	-,240** ,001 N=191		,198** ,005 N=195			,341** ,000 N=195	,283** ,000 N=192
Flood-induced property damage	-,306** ,000 N=200	-,291** ,000 N=201	-,340** ,000 N=201				-,223** ,001 N=202	-,172* ,015 N=199	-,220** ,002 N=200						
Flood-induced health problems	-,201** ,004 N=201		-,232** ,001 N=202	,165* ,036 N=162			-,273** ,000 N=203							,226** ,001 N=205	,171* ,015 N=202

*Factors influencing flood coping appraisal*

Table 16: More variable correlations

	<i>RE clearing drainage</i>	<i>RE moving away</i>	<i>RE putting goods high</i>	<i>IC Clearing drainage</i>	<i>IC raising sockets</i>	<i>IC planting grass</i>	<i>IC rebuilding</i>	<i>IC small dyke</i>	<i>IC sandbags</i>	<i>IC capturing rainwater</i>	<i>IC moving away</i>	<i>IC goods high</i>
<i>Gender</i>												-,183** ,009 N=203
<i>Age</i>	,151* ,030 N=208											
<i>Household income</i>			,145* ,041 N=199							-,195** ,006 N=196		
<i>Status of house</i>								-,369* ,013 N=45			,181* ,015 N=181	
<i>Status of Land</i>					-,356* ,017 N=45					-,476** ,001 N=45	-,413** ,005 N=45	
<i>Highest education</i>		,177** ,014 N=192	,272** ,000 N=196							-,241** ,001 N=192		,147* ,042 N=192
<i>Flood-induced property damage</i>										-,216** ,002 N=201		
<i>Flood-induced health problems</i>		,156* ,026 N=202	,202** ,004 N=206							-,331** ,000 N=202		



Table 16 continued: Correlations of predictor variables with elements of coping appraisal in Ntinda

	<i>SE rebuilding</i>	<i>SE small dyke</i>	<i>SE Sandbags</i>	<i>SE capturing rainwater</i>	<i>SE raising sockets</i>	<i>SE planting grass</i>	<i>SE clearing drainage</i>	<i>SE Moving away</i>	<i>SE goods high</i>	<i>RE Rebuilding</i>	<i>RE Dykes</i>	<i>RE Sandbags</i>	<i>RE Raising sockets</i>	<i>RE Planting grass</i>	<i>RE capturing rainwater</i>
<i>Flood-induced financial costs</i>	-,310** ,000 N=200	-,210** ,003 N=201	-,373** ,000 N=201				-,312** ,000 N=202	-,176* ,013 N=199						-,245** ,000 N=204	
<i>Flood severity</i>													99999		
<i>Mitigation efforts before 2017</i>	,367 ,000 158	,269** ,001 N=159	,348** ,000 N=160	,165 ,036 N=162	,244** ,002 N=160	,269** ,001 N=161	,391** ,000 N=163		,351** ,000 N=159		,227** ,004 N=162	,160* ,044 N=160			,215** ,006 N=159
<i>Looked for information</i>	-,214** ,002 N=202									-,158* ,022 N=208	-,241** ,000 N=207	-,301** ,000 N=205			
<i>Received flood-related information</i>				-,165* ,020 N=198	,162* ,023 N=196		-,159* ,026 N=197								-,240** ,001 N=204
<i>Willingness to spend on mitigation</i>	,440** ,000 N=195	,203** ,004 N=197	,315** ,000 N=198		,188** ,008 N=198	,153* ,031 N=199	,377** ,000 N=198		,263** ,000 N=197	-,187** ,008 N=200	-,152* ,032 N=199			-,146* ,040 N=199	-,293** ,000 N=196
<i>Distance from channel</i>			-,210** ,002 N=206					-,206** ,003 N=203	-,244** ,000 N=205						

*Factors influencing flood coping appraisal*

---

Table 16 continued: Correlations of predictor variables with elements of coping appraisal in Ntinda

<i>Size of social network</i>	,174* ,013 N=204													,185** ,007 N=209	
<i>Age</i>							,196** ,005 N=207								
<i>Household size</i>				,150* ,031 N=208		,164 ,018 207	,180** ,009 N=207	-,164* ,019 N=203							-,186 ,007 206
<i>Years at location</i>					,145* ,038 N=206	,165* ,017 N=207									-,149 ,033 206

Table 16 continued: More variable correlations

	RE clearing drainage	RE moving away	RE putting goods high	IC Clearing drainage	IC raising sockets	IC planting grass	IC rebuilding	IC small dyke	IC sandbags	IC capturing rainwater	IC moving away	IC goods high
Flood severity	99999	,352* ,028 N=39		999999	99999							
Flood-induced property damage										-,216** ,002 N=201		
Flood-induced health problems		,156* ,026 N=202	,202** ,004 N=206							-,331** ,000 N=202		
Flood-induced financial costs									-,144* ,040 N=204	-,241** ,001 N=201		
Mitigation efforts before 2017			,161* ,040 N=163				,207** ,009 N=160			,160* ,044 N=159		
Looked for information			-,156* ,025 N=207						-,151* ,030 N=207			
Received flood-related information			,159 ,025 199			,186** ,008 N=199	,167* ,020 N=196	,341** ,000 N=198	,147* ,038 N=199		,180* ,016 N=181	,152* ,034 N=195

Table 16 continued: More variable correlations

	<i>RE clearing drainage</i>	<i>RE moving away</i>	<i>RE putting goods high</i>	<i>IC Clearing drainage</i>	<i>IC raising sockets</i>	<i>IC planting grass</i>	<i>IC rebuilding</i>	<i>IC small dyke</i>	<i>IC sandbags</i>	<i>IC capturing rainwater</i>	<i>IC moving away</i>	<i>IC goods high</i>
<i>Willingness to spend on mitigation</i>	-,227** ,001 N=198	-,243** ,001 N=196	-,300** ,000 N=199		,161* ,023 N=198	,156* ,028 N=199			,305** ,000 N=199	,317** ,000 N=194		
<i>Distance from channel</i>							-,188** ,007 N=206			-,184** ,008 N=204		
<i>Size of social network</i>		,187** ,007 N=205			,279** ,000 N=208				,266** ,000 N=209		,153* ,036 N=189	,237** ,001 N=204
<i>Age</i>												
<i>Household size</i>		-,169* ,015 N=205	-,205** ,003 N=209									
<i>Years at location</i>							-,199** ,004 N=206				-,233** ,001 N=189	

### ***Association between social vulnerability and flood coping appraisal***

Gender, age, household income, household size, size of the social network, the status of the house, the status of the land, and the highest level achieved by a family member constituted the social vulnerability component in this hypothesis (Philip Bubeck, Wouter Botzen, et al., 2018b). Tables 1 (Bwaise III), 2 (Natete), and 3 (Ntinda) above show that these and other explanatory variables covered in the subsequent sections have significant relationships with some coping appraisals of different mitigation measures. We found that gender associated with self-efficacy of certain measures, though not in all cases. Females had lower perceived self-efficacy for raising power sockets (hereafter SE sockets in Bwaise III and Ntinda but not in Natete. In Ntinda, females also had lower perceived self-efficacy for raising the floor and rebuilding the house (hereafter SE Rfloor or rebuilding) levels than men.

Older people perceive that they are more able to raise the floor/rebuild the house and/or clean the drainage in Bwaise III while in Ntinda people perceive the measure to be too costly compared to the younger age groups. In Natete, older people perceive capturing rainwater and clearing the drainage to be effective ways to mitigate against flooding compared to the younger age groups. It is however important to note that the age groups that include the aged (65+years) had very few respondents and therefore, this conclusion should be adopted with caution.

Households that earn more perceive that they can raise the floor or rebuild the house, and raise power sockets in Bwaise III. They however perceive raising sockets and planting grass to be costly. In Natete, households which earn more perceive that they can raise the floor or rebuild and put goods in higher places, but are not able to put up small dykes and piles of sandbags. In line with their perceptions of ability, they perceive putting goods in higher places and raising sockets to be effective measures against flood damage while to them sandbags are costly to implement. They further perceive capturing rainwater as an effective measure. Surprisingly, they perceive small dykes to be effective as well.

Homeowners were found to perceive themselves as more able to put up piles of sandbags in Bwaise III. In Natete, they have high perceived ability to raise the floor or rebuild the house, put up a small dyke, capture rainwater, and plant grass.

The highest education level attained by a household member is positively associated with perceived self-efficacy for raising sockets in Bwaise III and Natete. Over and above, in Natete, the highest

education positively associated with perceived self-efficacy for: raising the floor or rebuilding and raising sockets; perceived response efficacy for planting grass and clearing drainage; and perceived implementation costs for moving away and putting goods high. In Ntinda, highest education positively associated with perceptions of response efficacy for putting up small dykes, planting grass, capturing rainwater, moving away, putting goods high and perceived implementation costs for putting goods in high places. It negatively associated with perceived self-efficacy for: putting up piles of sandbags; capturing rainwater; clearing drainage and temporarily moving away. It also negatively associated with perceived implementation costs for capturing rainwater.

Other variables related to social vulnerability (i.e., household size and size of social network) have significant relationships with coping appraisals in Natete and Ntinda. In Natete, the bigger the household size, the higher the perceptions of perceived self-efficacy for raising the floor or rebuilding the house, putting up a small dyke, and capturing rainwater. The bigger the social network, the higher the self-efficacy for raising the floor or rebuilding the house, putting up sandbags, capturing rainwater, planting grass, and clearing the drainage. Bigger social networks are also positively correlated with perceived implementation costs for putting up a small dyke. In Ntinda, the bigger the household size the higher the perceived self-efficacy for capturing rainwater, planting grass, and clearing drainage; and the lower the perceived self-efficacy for moving away. Bigger households are also negatively correlated to perceived response efficacy for capturing rainwater, moving away to safe places, and raising goods high. The bigger the social network the higher the: perceived self-efficacy for raising the floor or rebuilding the house; perceived response efficacy for planting grass, response efficacy for moving away. Perceived implementation costs for raising sockets, putting up sandbags, moving away and raising goods high, are also positively correlated with bigger social networks.

***Influence of Flood severity and loss on perceptions self-efficacy, response efficacy and implementation costs.***

Flood severity associates with coping appraisal elements for very few measures. In Bwaise III it positively associates with SE sandbags, RE capturing rainwater, and IC capturing rainwater. In Natete the higher the flood severity, the lower the perception of self-efficacy for capturing rainwater, and in contrast, the same is associated with the higher perception of self-efficacy for elevating goods. In Ntinda residents who suffered high flood severity perceived moving away as an effective way of mitigating the impacts of floods.

Homeowners and residents who experienced flood-related property damage perceived themselves as unable to pile up sandbags but, at the same time, perceived capturing rainwater to be an effective flood mitigation measure. In Natete, having suffered flood-related property damage is associated with perceptions of low self-efficacy for R floor or rebuilding, piling up sandbags, capturing rainwater, raising sockets, clearing drainage, and putting goods high. At the same time, people who suffered flood-related property damage perceive planting grass to be an effective mitigation measure. They also perceive the costs of putting up small dykes, raising sockets, and clearing drainage to be lower. In Ntinda, having suffered flood-related property damage is associated with perceptions of lower self-efficacy for R floor or rebuilding, small dyke, sandbags, clearing the drainage, moving away, and putting goods high. Households that suffered such damage also perceive the costs of capturing rainwater to be lower.

Having suffered from flood-related health problems largely associated negatively with all coping appraisal elements with which it manifests significant relationships in Bwaise III and Natete. In the former, households that suffered it have lower SE for putting up sandbags and planting grass and higher SE for capturing rainwater. It also leads to perceptions of lower RE for capturing rainwater. In Natete, having suffered flood-related health problems is associated with lower SE for R floor or rebuilding, small dyke, sandbags, capturing rainwater, clearing drainage, and putting goods high. It is associated with lower RE for R floor or rebuilding but higher RE for planting grass. Lastly, it is associated with lower IC for small dykes, raising sockets and clearing drainage. In Ntinda it negatively associates with R floor or rebuilding, sandbags, and clearing drainage, but positively relates with SE capturing rainwater. It also positively relates to RE planting grass, capturing rainwater, moving away, and putting goods high. In terms of implementation costs, it negatively associates with capturing rainwater.

Homeowners and residents who incurred flood-related financial costs have perceptions of lower SE for R floor, capturing rainwater, clearing drainage, and higher SE for sandbags and planting grass in Bwaise III. They also have lower RE for capturing rainwater, clearing drainage, and IC for sandbags. In Natete and Ntinda, suffering flood-related financial costs have a negative association (significant relationships considered) with coping appraisals of all but one measure (RE planting grass). In the former, it negatively associates with R floor or rebuilding, small dykes, sandbags, capturing rainwater, clearing drainage, raising goods high; RE R floor or rebuilding; and IC small dykes, raising sockets and clearing drainage. In the latter, it negatively associates with R floor or rebuilding, small dykes, sandbags, clearing drainage, moving away; and IC sandbags capturing rainwater.

Distance from the drainage channel has significant relationships with very few appraisals, especially in Bwaise 3 and Natete. In Bwaise III the longer the distance from the drainage channel the higher the perceptions of implementation costs for clearing the drainage and the lower the perceptions of implementation costs for capturing rainwater. In Natete the longer the distance from the channel the higher the perception of response efficacy for planting grass. In contrast the variable is negatively correlated with all the appraisals (where the relationship is significant) in Ntinda. These are SE sandbags, SE moving away, SE raising goods high, Rfloor or rebuilding, and IC capturing rainwater.

The longer households have lived at their current location, the higher SE R floor or rebuilding, sandbags, raising sockets, planting grass, raising goods high; and RE raising goods high in Natete. The variable however relates negatively with perceptions of implementations costs of capturing rainwater. In Ntinda living in a place longer positively correlates with perceptions of SE raising sockets and for panting grass, but negatively correlates to perceptions of RE for capturing rainwater, IC R floor or rebuilding and IC moving away.

***Influence of receiving/looking for flood-related information on perceptions of self-efficacy, response efficacy, and implementation costs***

In Natete, flood-related information seeking is positively correlated with perceptions of SE for putting up sandbags and RE for raising goods high; negatively correlated to perceptions of RE for R floor or raising the house and for raising sockets, IC for small dykes, raising sockets planting grass, moving away, and raising goods high. In Ntinda, it negatively correlates with perceptions of SE for Rfloor or rebuilding, of RE for floor or rebuilding, RE for small dykes, planting grass, raising goods high and for sandbags; and IC sandbags.

Having received flood-related information in Natete is positively related to SE raising goods high, RE moving away, RE raising goods high, RE clearing drainage, IC sandbags, IC planting grass, and IC raising goods high. In Ntinda it is positively related to SE raising sockets high and negatively correlated to SE for capturing rainwater and for clearing drainage and RE capturing rainwater. It is also positively correlated to RE raising goods high, IC for planting grass, R floor or rebuilding, small dyke, sandbags, moving away, and raising goods high.

***Influence of risk aversion (Willingness to spend on mitigation) on perceptions of self-efficacy, response efficacy, and implementation costs.***



Risk aversion is generally positively correlated with appraisals for more measures compared to any other explanatory variable (i.e., when one combines responses from the three case study areas). In Bwaise III, it is positively related to perceptions of SE for Rfloor, small dykes, sandbags, capturing rainwater, and clearing drainage; RE for capturing rainwater; and IC clearing the drainage, raising sockets, planting grass, and putting up sandbags. In Natete it positively correlates with perceptions of SE for raising sockets and clearing drainage; RE of R floor or rebuilding, raising sockets, capturing rainwater, and planting grass; and IC small dykes, raising sockets, planting grass, capturing rainwater, moving away, and raising goods high. In Ntinda it positively correlates with perceptions of SE for floor or rebuilding, small dykes, sandbags, planting grass, raising sockets, clearing drainage, and raising goods high; and IC raising sockets, planting grass, sandbags, and capturing rainwater. It is, however, negatively related to the RE of R floor or rebuilding, small dykes, planting grass, capturing rainwater, clearing drainage, moving away and raising goods high.

***Influence of existing mitigation measures on perceptions of self-efficacy, response efficacy, and implementation costs.***

Having existing mitigation measures is by and large related to positive appraisals in all the three case study areas. It is positively related to perceptions of Self-efficacy for Rfloor, small dykes, raising sockets, and raising goods high; and IC raising goods high in Bwaise III. It has a negative association with perceptions of IC sandbags only. In Natete it shows a positive association with all appraisals with which the relationship is significant. These are self-efficacy for: Rfloor or rebuilding, small dykes, capturing rainwater, raising sockets, clearing drainage, and raising goods high; RE of R floor or rebuilding, raising sockets, capturing rainwater, and clearing drainage; IC raising sockets and putting goods high. In Ntinda it positively correlates with SE for floor or rebuilding, small dykes, sandbags, capturing rainwater, clearing drainage, raising sockets, planting grass, clearing drainage, and raising goods high; RE dykes, sandbags, capturing rainwater and raising goods high; and IC R floor or rebuilding and capturing rainwater.

### ***5.4.2 Regression analyses of flood coping appraisals***

We ran 72 models for all coping appraisal elements per measure and only 18 (4 for Bwaise III, 8 for Natete, and 6 for Ntinda) satisfied all fitness criteria. That is having: a difference between the final model and the 'intercept only' model with a p-value lower than 0.05; passed the goodness of fit test ( $p > 0.05$ ); and the test of parallel lines ( $p > 0.05$ ). For more on this please refer to supplementary material. In the next

section, we present results from the 18 models, the amount of variation in the coping appraisal element explained in them, the explanatory variables with significant p values, and their levels' proportional odds ratios of influence on the levels of the dependent variables.

In Bwaise III, models for SE clearing drainage (Nagelkerke  $R^2$ : 0.337), SE raising goods high (N. R Square: 0.187), SE capturing rainwater (N.RSquare: 0.220), and RE small dykes (N.R Square: 0.136) fulfilled the above-mentioned criteria.

Table 17: Significant proportional odds ratios of influence in the coping appraisal models in Bwaise III

Model	Influencing factors and direction of influence	Proportional odds	Wald statistic	P-Value
<b>SE clearing drainage</b>	<b>Willingness to spend</b> Not willing (-)	0.30	10.800	0.001
	Somewhat willing			
<b>SE raising goods high</b>	<b>Implemented measures before 2017</b> Nothing (-)	0.06	13.282	0.000
	Communitarian			
<b>SE capturing rainwater</b>	<b>Received flood-related information</b> Yes (+)	3.60	8.758	0.005
	No			
	<b>Willingness to spend on mitigation</b> Somewhat willing (-)	0.12	3.879	0.049
	Willing			
<b>RE small dykes</b>	<b>Looked for flood-related information</b> Yes (+)	6.00	11.757	0.010
	No			
	<b>Received flood-related information</b> Yes (-)	0.40	6.268	0.012
	No			

From table 17 above, one can observe that generally very few explanatory variables had a significant influence in very few levels likewise. For SE clearing drainage, willingness to spend on mitigation showed significant negative influence in the lower levels - those who were not willing were 0.3 times less likely to have a higher perception of ability compared to those who were somewhat willing. For SE raising goods high, measures implemented before 2017 a had significant negative influence on the lower levels as well. Households which had done nothing were 0.06 times less likely to have a higher perception compared to those who had been involved in communitarian mitigation. Regarding perceptions of SE capturing rainwater, receiving flood-related information and willingness to spend had positive and negative significant influences respectively. Households which had received information about flooding were 3.6 more times likely to perceive

themselves as able compared to those , had not; and those who were somewhat willing were 0.12 times less likely to perceive themselves as able. Regarding perceptions of RE for small dykes, households which had flood-related information were 6 times more likely to perceive the measure as effective compared to those who had had not. Those which had received flood-related information were 0.4 times less likely to perceive small dykes as effective compared to those who had not.

Table 18 below, shows the regression outputs for Natete - one can observe that the SE R floor or rebuilding, SE small dykes, SE sandbags, SE capturing rainwater, SE raising goods high, RE Rfloor and rebuilding, RE moving away, IC Capturing rainwater models fulfilled fitness criteria. The first column provides the N. R Square values of these models which indicate the amount of variation in the dependent variables attributable to change in the scale levels of the explanatory variables. The second column provides the explanatory variables, their levels and the direction of influence of these levels (from the bottom upwards) on the dependent variables (coping appraisal elements). In the third column, the proportional odds of these influences are provided with their significance values provided in column 5.

In the first model, the N. R square is the highest. To begin with, household income has a small significant negative influence across 8 of the 10 levels. The highest influence is in the 240001-280000UGX income bracket. Households in this bracket were 0.014 times less likely to perceive themselves as able compared to those who earned between 280001-320000 UGX. The magnitude of influences of the other levels can be deduced by observing the proportional odds column likewise.

Mitigation measures implemented before 2017 also had a negative influence on the perceptions of self-efficacy for R floor/rebuilding the house. Households who had at most put up a dyke/heap of sandbags were 0.07 times less likely to perceive themselves as able to raise the floor or rebuild the house compared to those who had not implemented the measure. Households which had at most raised sockets were 0.06 times less likely to perceive themselves as able compared to those who had put up at most a small dyke/hip of sandbags. In turn, households which had at the most implemented non-structural measures like moving away or putting goods in higher places were 0.08 times less likely to perceive themselves as able to raise the floor or rebuild the house compared to those who had at most managed to raise their sockets. One can therefore conclude that perception of ability to the implement the most effective mitigation measure is strongly influenced by perceptions of self-efficacy.

Table 18: Significant proportional odds ratios of influence in the coping appraisal models in Natete

Model	Influencing factors and direction of influence	Proportional odds	Wald statistic	P-Value 95% confidence
<b>SE R floor/rebuilding</b> N.R Square – 0.59	<b>Income</b> 0-40 000 UGX (-)	0.009	7.256	0.007
	40 001-80 000 UGX			
	80 001-120000 UGX (-)	0.004	6.696	0.010
	120 001-160 000UGX (-)	0.011	5.684	0.017
	160 001-200 000UGX (-)	0.003	8.418	0.004
	200 001-240 000UGX			
	240 001-280 000UGX (-)	0.014	5.083	0.024
	280 001 – 320 000UGX (-)	0.006	6.287	0.012
	320 001UGX-360 000UGX (-)	0.009	5.546	0.019
	360 001 and above			
	<b>Implemented measures before 2017</b>			
	Moving away/putting goods high (-)	0.008		
	Raised sockets (-)	0.06	6.227	0.0013
	Small dyke/sandbag (-)	0.07	19.127	0.00
<b>SE small dykes</b> (N. R. Square: 0.322)	<b>Implemented measures before 2017</b>			
	Done nothing (-)	0.5	6.525	0.011
	Communitarian	0.008		
	Raised sockets (-)	0.08	8.667	0.003
	Small dyke/sandbag (-)	0.07	19.127	0.000
	Rfloor/rebuilding the house			
	<b>Homeownership</b>			
	Homeowners (-)	6	2316	0.000
	Tenants			
	<b>Income</b>			
	40 001UGX - 80 000UGX (-)	5	5.302	0.021
<b>SE Sandbags</b> (N. R Square: 0,307)	<b>Looked for flood-related information</b> Yes (+)	3.2	13.402	0.000
	No			
	<b>Experienced flood-related costs</b> Yes (-)	3	6.464	0.011

Table 18: Continued

Model	Influencing factors and direction of influence	Proportional odds	Wald statistic	P-Value 95% confidence
	<b>Experienced flood-related health problems</b> Yes (-)	2	4.484	0.034
	No			
<b>SE Capturing rainwater</b> (N. R Square: 0.212)	<b>Experienced flood-related property damage</b> Yes (-)	3	6.607	0.010
	No			
	<b>Flood severity</b> Experienced flooding to feet level for less than 3 days (-)	18	5.558	0.018
	Experienced flooding up to Knee height			
<b>SE raising goods high</b> (N. R Square of 0.426)	<b>Experienced flood-related property damage</b> Yes (+)	6	9.977	0.002
	No			
	<b>Size of social network</b>			
	One household (+)	4	4.352	0.037
	2-3 households			
	5-6 households (+)	7	6.155	0.013
	<b>Mitigation measures before 2017</b>			
	Done nothing (-)	0.04	6.82	0.009
	Communitarian			
	Small dyke (-)	3.7	5.412	0.020
	Rfloor/rebuilding the house			
	<b>Homeownership</b>			
	Homeowners (+)	33 000 000	1759	0.000
	Tenants			
<b>RE Rfloor/rebuilding the house</b> (N. R Square: 0.330)	<b>Homeownership</b>			
	Homeowners (+)	5	1.022	0.000
	Tenants			
<b>RE Moving away</b> (N. R Square: 0.022)	<b>Received information about flooding</b> Yes (+)	0.6	4.360	0.03
	No			
<b>IC Capturing rainwater</b> (N. R Square: 0.070)	Willingness to spend on mitigation Not willing (-)	4	8.976	0.003
	Somewhat willing			

With regards to the SE small dykes model, past mitigation efforts, the status of house and income had significant contributions in the explanation of the variation. The table above illustrates that households that had at most raised the sockets were 0.8 times less likely to perceive themselves as able compared to those that had put up a pile of sandbags or built a dyke. Those who had done nothing at all were 0.5 times less likely to perceive themselves as able compared to those who had implemented communitarian measures. Homeowners were 6 times more likely to perceive themselves as able compared to tenants and households which earned 40001 to 80000. In turn, the latter were 5 times more likely to perceive themselves as able compared to those who earned 80001 – 120000 UGX. In summary, households which had not put up a small dyke or a pile of sandbags were unlikely to perceive themselves as able to implement it, and having a secure property tenure, and a higher income is likely to influence a positive perception of the ability to put up the measure.

Having looked for flood-related information, having suffered flood-related health problems, and having incurred flood-related financial costs significantly explain variation in the SE sandbags model. Households that had looked for information were 0.2 times more likely to perceive themselves as able compared to those who had not. Those who had incurred flood-related financial costs were 3 times less likely to perceive themselves as able compared to those who had not, and those who had suffered flood-related health problems were 2 times less likely to perceive themselves as able. Therefore, information-seeking behaviour positively influences how one judges his ability to put up sandbags while flood-related loss and health problems negatively influence judgement. In the SE capturing rainwater model, flood severity and flood-related property damage significantly explain variation in the coping appraisal element. Households which had experienced flood depth up to feet level for less than 3 days were 18 times less likely to perceive themselves as able compared to those who had experienced flooding up to knee height. In other words, households which suffered more severe floods were likely to perceive themselves as able to capture rainwater. Having incurred flood-related property damage caused households to view themselves as unable to capture rainwater. Households that suffered damage were 3 times less likely to perceive themselves as able compared to those which had not.

The SE raising goods high model had the second-highest Nagelkerke R Square suggesting a significant amount of variation explained by the independent variables. This is also evident in the high proportional odds of changes in the dependent variable levels relative to the changes in the explanatory variable levels. The explanatory variables which significantly influenced the coping appraisal elements include flood-

related property damage, size of the social network, past mitigation, having received information, and the status of the Household. Households that had experienced flood-related property damage were 6 times more likely to perceive themselves as able compared to those that those did not. Surprisingly, households that had a network of between 5-6 households were 7 times more likely to perceive themselves as able compared to those that had six-plus. Households which were networked to only one household were 4 times more likely to perceive themselves as able compared to those who were networked to 2-3 households.

Households that had at most put up a dyke or heap of sandbags were 3.7 times less likely to perceive themselves as able compared to those who had raised the floor or rebuilt the house. Households which had done nothing were 0.04 times less likely to perceive themselves as able compared to those who had participated in communitarian measures. The status of house had a very high influence on the perception of ability to raise goods high. Homeowners were 32736460 times more likely to perceive themselves as able compared to tenants.

For the RE Rfloor and rebuilding model, the status of the house is the only explanatory variable that shows significant contribution. Homeowners were 5 times more likely to perceive the measure as effective compared to tenants. The model for RE moving away also has only one explanatory variable – received flood-related information. The results show that households which had received information about floods were 0.6 times more likely to perceive moving away to a safe place as an effective measure compared to those which had not.

In the IC Capturing rainwater model, only willing to spend on mitigation showed a significant contribution in explaining the variation. Households which were not willing to spend were 4 times less likely to perceive it as a costly measure compared to those which were somewhat willing.

The appraisal models that fulfilled fitness criteria were fewer – than 6 in Ntinda. Table 19 below presents the proportional odds of changes in the coping appraisal elements relative to changes in the levels of explanatory variables.

In the SE capturing rainwater model, past mitigation measures showed significant influence in the changes across the levels of the coping appraisal element. Households that had at most put up a dyke or a pile of sandbags were 3 times more likely to perceive themselves as able compared to those who had raised the floor or rebuilt the house.

Table 19: Significant proportional odds ratios of influence in the coping appraisal models in Ntinda

Model	Influencing factors and levels	Proportional odds	Wald statistic	P-Value
<b>SE capturing rainwater</b> (N. R Square: 0.39)	<b>Mitigation measures before 2017</b>			
	Done nothing (-)	0.027	9.505	0.002
	Communitarian			
	Raised sockets	4	6.111	0.013
	Small dyke (-)	3	3.901	0.048
	Rfloor/rebuilding the house			
<b>RE Rfloor/rebuilding</b> (N. R Square: 0.105)	Looked for information			
	Yes (-)	4.5	6.480	0.011
	No			
	<b>Willingness to spend on mitigation</b>			
	Not willing (+)	4	9.579	0.002
	Somewhat willing			
<b>RE moving away</b> (N. R Square: 0.597)	<b>Size of social network</b>			
	0 households (-)	0.06	3.934	0.047
	1-2			
<b>IC small dyke</b> (N. R Square: 0.112)	<b>Received flood-related information</b>			
	Yes (+)	0.3	19.568	0.000
	No			
<b>IC Sandbags</b> (N. R Square: 0.218)	<b>Looked for information</b>			
	Yes (-)	3	6.651	0.010
	No			
	<b>Size of social network</b>			
	0 households (+)	0.3	6.392	0.011
	1-2			
	<b>Willingness to spend on mitigation</b>			
	Not willing (+)	0.3	9.856	0.002
	Somewhat willing			
<b>IC raising goods high</b> (N. R Square: 0.144).	<b>Size of social network</b>			
	0 households (+)	0.27	71677	0.006
	1-2			
	Gender			
	Male (-)	1,8	4.022	0.045
	Female			

Those who had at most raised their sockets were 4 times more likely to perceive themselves as able compared to those who had put up a small



dyke or pile of sandbags homeowners and residents who had done nothing were 0.027 less likely to perceive themselves as capable compared to those that had participated in communitarian measures. One can observe that it is only those who had done nothing at all who were less likely to perceive themselves as able to capture rainwater.

In the RE R floor or rebuilding model, households which had looked for flood-related information were 4.5 times less likely to perceive the measure as effective compared to those that did not. Risk aversion, measured by the level of willingness to spend on mitigation had a positive influence on perceptions of response efficacy for this measure. Those who were not willing were 4 times more likely to perceive the measure as effective compared to those who were somewhat willing. The RE moving away from the current premises model had the size of social network as the only explanatory variable showing significant influence. Households which had no social network were 0,06 times less likely to perceive the measure as effective compared to those who were connected to between 1 and 2 members. This confirms the importance of having friends and relatives who can accommodate one's family during floods.

In the IC small dyke model, receiving flood information positively influences perceptions of implementation costs of small dykes. Households which received flood-related information were 0.3 times more likely to perceive the measure as costly compared to those which had not received. The IC sandbags model has four variables with significant contribution - the size of social network, willingness to mitigate, having looked for flood-related information and having received flood-related information. Households with no social network were 0.3 times more likely to perceive the measure as costly compared with those networked to between 1 and 2 households.

Willingness to implement also positively influences perceptions of implementation costs of small dykes. Households which were not willing to spend on mitigation were 0.3 times more likely to perceive the measure as costly compared to those which were somewhat willing. Those who looked for flood-related information were 3 times less likely to perceive the measure as costly compared to those who did not. Households which received flood-related information were 0.46 times more likely to perceive the measure as costly to implement compared to those that did not.

Regarding IC raising goods high, males were 1.8 times less likely to perceive the measure as costly than females, and households which had no social network were 0,27 times more likely to perceive the measure as costly compared to those networked to between 1 and 2 households.

## **5.5 Discussion**

The results show that the contribution of most appraisal factors in the models is in line with the assumptions in the conceptual framework and other findings in the literature. In this section, we discuss these relationships taking note of the differential contribution in the rank levels in the data to provide policy-specific recommendations for different groups of respondents.

The finding that females perceive lower self-efficacy for structural measures than males in all the three case study areas is in line with other findings from the African context in the literature (Adzawla et al., 2019). Given that implementation of many structural measures is labour-intensive, less muscular genders would naturally perceive lower self-efficacy regardless of case-specific attributes as in Sultana (2010).

The contribution of age is in contrast with Bubeck et al.'s (2013) and Fox-Rogers et al.'s (2016) observation that it negatively relates to SE structural measures in Europe. Older people in Bwaise III perceive themselves as able to raise the floor or rebuild the house. About implementation costs, our study concurs with part of these authors' findings that it positively contributes to high-cost perceptions.

By and large, our findings confirm the findings in the literature about income that positively contributes to perceptions of SE and RE for structural measures and non-structural measures, but negatively to perceptions of IC for non-structural measures. The cumulative odds in the SE Rfloor or rebuilding the house were very small though. Our study further established that the same relationship exists with structural measures, especially putting a barricade of sandbags. However, income negatively correlates with perceptions of SE for lower-cost structural measures, i.e. small dykes and sandbags in Natete. This can be explained by the context of informality – where the less the income one has, the less likely he/she can hire specialized help, and the more he/she believes that he/she can do it herself and vice versa. Like what obtains in the literature, tenure security in terms of the status of house occupation positively relates with perceptions of SE sandbags in Bwaise and for Rfloor, small dyke in Natete. Additionally, in our case, it also positively contributes to SE capturing rainwater and planting grass. By extension, this shows that tenants are not much prepared to make any investments, even small ones. This observation is strengthened by the comments which were given in which some tenants indicated that any improvement was the responsibility of the landlord/lady.

In the literature, education is documented as contributing to lower perceptions of SE and RE for structural measures which our results

contrast, especially those from the 2 slum areas. However, our results from Ntinda – the affluent neighbourhood partly concur with this association. This can be explained by the fact that the characteristics of respondents in that area are almost similar to those studied in the cited literature in terms of social status. About size of the social network, our findings confirm Bubeck et al.'s (2013) findings of a positive contribution to perceptions of SE and RE for both structural and non-structural measures are not in agreement with its negative contribution to perceptions of implementation costs for non-structural measures documented in the literature.

The positive contribution of the size of the networks to the perceptions of IC for non-structural measures can signal the fact that when the emergency hits, altruism will not exist. A study by Babcicky & Seebauer (2017) in Austria explained this farther using hypothesis of the 'two faces of social capital.' This refers to a situation where recipients of help continue to expect help without putting measures to protect themselves and worse still, do not help others (breaking a reciprocity that should sustain a network), leading to broken social networks.

Results on the influence of past flood damage experience from all the three cases which we studied are in stark contrast with Bubeck et al.'s (2013) and Seebauer & Babcicky's (2020) findings of a positive relationship with SE structural measures. Those who suffered damage perceived lower SE for structural measures. In these communities, it shows that instead of suffering flood-related damage motivating households to protect themselves from similar events in the future, it incapacitates them. Additionally, they feel that low-cost measures such as piling sandbags and planting grass are ineffective. In other words, such measures do not offer protection as they would require, especially where flood severity is high. Regarding willingness to mitigate/risk avoidance, our results from the other two cases confirm previous findings in the literature that it positively correlates with perceptions of SE and RE for both structural and non-structural measures, but those from Ntinda contradict it. Looking for flood-related information negatively associates with the same, and having implemented costly flood mitigation measures positively relates with SE and RE for both structural and non-structural measures, but negatively correlates with IC sandbags in Natete.

## **5.6 Conclusions and recommendations**

Our study sought to establish motivating factors for measuring specific coping appraisal in a Sub-Saharan African context by comparing slum and non-slum contexts. By and large, the factors influencing flood coping appraisals as postulated in the PMT, do apply in all the three

case study areas. However, we established context-specific differences from what has been observed in the developed world contexts as reported by the very little existing literature on this topic and level of detail.

First, income negatively influences perceptions of SE for lower-cost structural measures because, in informal economies, those with lower incomes tend to do manual jobs themselves. Second, our findings from the affluent neighbourhood confirms what past studies report – that higher education is associated with lower perceptions of SE for structural measures by contrast with what was found in the slum areas. Here too, we expect that income is playing a role since it is correlated with education level. Third, social capital does not necessarily lead to perceptions of a lower cost of implementing non-structural measures, which may signal weak social networks (Babcicky & Seebauer, 2015). Fourth, instead of past flood damage motivating households to do more to protect themselves in the future, we see evidence that such events incapacitate them and undermine their sense of resilience. This suggests that low-severity but high-frequency floods, such as those in Kampala, can have significant impacts on the resilience of affected communities which should not be underestimated in flood risk reduction strategies and programs.

## **Chapter 6: Flood damage mitigation behaviour of micro, small and medium enterprises in Kampala**

This chapter is based on: 'Veeravalli S. G., Chereni S., Sliuzas R., Flacke J., & van Maarseveen M., Flood damage mitigation behaviour of micro and small and medium enterprises in Kampala, paper under review for publication in the 'International Journal of Disaster Risk Reduction'

## **6.1 Introduction**

Floods are the most frequent and widespread natural hazard; they account for about one-third of all disasters and sometimes have devastating effects on economies, businesses, and livelihoods (Wannous & Velasquez, 2017). Due to urbanization and changing weather patterns, the number of people exposed to flooding is increasing, especially in Africa and Asia (Adelekan, 2010; Jha et al., 2012; Lavell et al., 2012). Managing flood risks effectively is becoming more critical in the light of climate change (IPCC, 2015; Trenberth, 2008). Climate change associated uncertainty in rainfall patterns and intensity, coupled with insufficient drainage systems, unregulated urban development and poor city planning have increased the risk of flooding in many African cities (Adelekan, 2015; Adelekan, 2010; Satterthwaite, 2011).

Effective flood risk management strategies and measures partly rely on a clear understanding and consideration of public flood risk perception and knowledge (Grothmann & Reusswig, 2006). Some recent literature on flood damage mitigation has focused on understanding how risk perceptions determine private/autonomous damage mitigation, which researchers from the Protection Motivation Theory (PMT) perspective now believe is key in complementing mitigation efforts by governments (Grothmann & Reusswig, 2006; Nascimento et al., 2008; Poussin et al., 2014; Reynaud et al., 2013; Wachinger et al., 2010).

While influencing factors of an individual's risk perceptions are known to be different cognitive factors, social and cultural backgrounds (Elliott, 1983), those of businesses are not well documented, especially in the African context. Some studies have indicated that small businesses attribute their lack of risk management to factors such as lack of resources and lack of information about their vulnerability and mitigation measures available (Dahlhamer & D'souza, 1995). Others identified operational health and safety obligations; business norms (Gissing et al., 2005); trust in state emergency services (Crichton, 2006); business size and previous flood experience (Kreibich et al., 2007); implementation costs; awareness of options available (Dahlhamer & D'souza, 1995); and insurance (Crichton, 2005) as the drivers or barriers to business investment in flood mitigation. However, there is no proper understanding of different factors that influence flood mitigation behaviour in different geographical, social, and cultural contexts.

Even though small-scale businesses in Africa are crucial to their countries' development by creating local employment opportunities and

contributing to GDP, little research has been done to understand the businesses' flood mitigation behaviour. Existing literature on businesses' flood mitigation behaviour is focused on studies that were conducted in European, American, Australian and Asian cities. So, it is crucial to research on African cities as they differ primarily from the rest of the world in terms of their economic, social and cultural, contexts.

This study addressed this shortfall by building a profile of business type for an African case study. In Kampala, Uganda's capital city and one of Africa's fast-growing cities. Rapid population growth is increasing the demand for services and products, thereby stimulating business investment of various types. For example, micro, small and medium medium-sized enterprises (MSMEs) contribute about 90% of production in Uganda's private sector and provide about 2.5 million jobs (Lutwama, 2008). MSMEs are also prevalent in Greater Kampala where regular flash flood events have led to losses in assets and direct or indirect disruption of businesses, thereby affecting the wider urban economy (Lwasa, 2016). To curb or reduce flood impacts, government authorities need to implement flood mitigation measures while supporting businesses' mitigation efforts to increase their flood resilience. We aimed to identify the most important factors which determine the flood mitigation behaviour of MSMEs in Kampala. First, we established the relationship between business characteristics and flood mitigation behaviour. Second, we established the relationship between flood experience, flood impacts, risk attitudes of businesses and their flood mitigation behaviour. Third, we established the relationship between businesses' perceptions about flood risk and their flood mitigation behaviour. Last, we established the relationship between government efforts and flood mitigation behaviour. We also explore opportunities to strengthen the PMT framework from an African perspective.

## **6.2 The Protection Motivation Theory**

Current literature on understanding flood mitigation behaviour using protection motivation theory (PMT) is primarily focused on households (Grothmann & Reusswig, 2006; Nascimento et al., 2008; Poussin et al., 2014; Reynaud et al., 2013; Wachinger et al., 2010). Existing research on flood damage mitigation by small businesses use sense approaching to suggest that it takes an ontological shock for small businesses to embark on flood damage mitigation (Harries et al., 2018). Translating the PMT framework from households to businesses has been done by very few scholars with varied contextual elements unique to each case study (Alesch et al., 2001; Bubeck et al., 2012; Dahlhamer & D'souza, 1995).

To guide this study, an extended version of the PMT framework (Figure 11), including concepts and variables deemed relevant to businesses is proposed. The concepts are categorized into three sets: i. perception elements adopted from the PMT framework (shown as dashed boxes); ii. business elements that include business-specific variables such as their profile, experiences, and the owner's risk attitudes; iii. and the government's efforts in flood risk communication and implementing public mitigation measures.

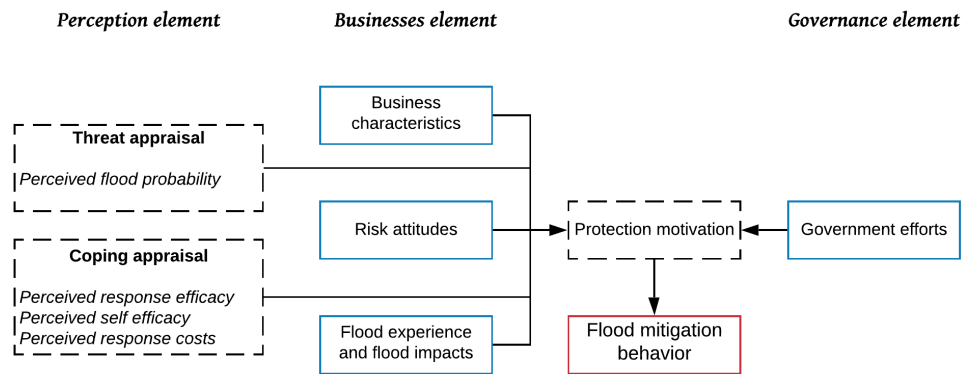


Figure 15. Modified PMT framework for businesses. Adapted from Grothmann & Reusswig, (2006)

### **6.2.1 Threat appraisal**

In the flood damage mitigation literature, it is shown that emotion-related feelings towards risk, previous flood experience, and risk attitudes can have an important influence on decision making under risk (Loewenstein et al., 2001).

### **6.2.2 Coping appraisal**

The cumulative influence of coping appraisal and threat appraisal affects the motivation of a business to implement protective measures. PMT assumes that a business will protect itself against a specific hazard if it believes that the risk is high (high threat appraisal) and if they consider the protective measures to be effective, within their capacity to implement, and not too costly to enforce (high 'coping appraisal') (Grothmann & Reusswig, 2006).

### **6.2.3 Business characteristics**

Though research on business' flood mitigation behaviour is sparse, a positive correlation between the size of the company and the flood mitigation behaviour is suggested (Crichton, 2006). The influence of business type, number of employees, and age of business as a



determinant of flood mitigation behaviour are also potentially key factors (Dahlhamer & D'souza, 1995).

#### **6.2.4 Risk attitudes**

Risk attitudes were assessed using a question that elicited the individual's willingness to spend resources on mitigation measures.

#### **6.2.5 Flood experience and its impact**

Personal experience of flooding is believed to strongly influence business owners to undertake mitigation measures. Concerning household mitigation behaviour, past studies showed mixed results – some studies found a positive correlation between flood experience and non-structural mitigation but not with structural mitigation (Bubeck et al., 2012; Grothmann & Reusswig, 2006; Poussin et al., 2014), and others found a positive correlation between flood experience and structural mitigation measures (Kellens et al., 2011). Concerning business mitigation behaviour, a positive correlation between flood experience and mitigation behaviour was found (Bubeck et al., 2012; Dahlhamer & D'souza, 1995). Alesch et al., (2001) mentioned that flood flood-induced costs are positively correlated to mitigation behaviour.

#### **6.2.6 Government efforts**

The local government's direct help or mitigation activities can influence a business' efforts to reduce flood damage. In the Netherlands, for instance, it was shown that government mitigation measures have created a level of societal trust, which in turn has reduced private mitigation (Terpstra, 2011). Kampala offers an opportunity to test this claim, since the local authority has implemented several measures, including the expansion of some major drainage channels and the cleaning of secondary channels in certain high-risk areas. As communication is important during a crisis, we also examine whether and how businesses received flood-related information from the government.

#### **6.2.7 Flood mitigation behaviour**

In this study, flood mitigation behaviour includes structural mitigation, non-structural mitigation, emergency measures, and intentions to mitigate (Poussin et al., 2014). Here, we distinguish between non-structural and structural mitigation measures. Flood mitigation behaviour was used as the dependent variable.

## **6.3 Methodology**

### **6.3.1 Research design and setting**

The study focuses on Kampala City in Uganda. Kampala is in the central region of Uganda and covers approximately 195 sq. km. Administratively, the city is governed by Kampala Capital City Authority (KCCA) which is represented at the ministerial level in the National Cabinet. Kampala is divided into five divisions (Central, Kawempe, Makindye, Nakawa, and Rubaga), 99 parishes, and 811 sub-parishes (KCCA, 2012). The city has an average altitude of 1120m above sea level, with daily temperatures ranging between 17 degrees Celsius and an average rainfall of 1200mm (Ajambo, 2013). The pattern of rainfall is changing and is projected to increase in intensity and frequency due to climate change.

We purposively selected three parishes (Bwaise III, Natete, and Ntinda) as case study sites based on their flood occurrences, socio-economic status, and location. Natete and Bwaise III are informal settlements that are acknowledged as flash flooding hotspots, though flooding in Bwaise III has been reduced by the upgrading of an adjacent primary drainage channel in 2013. Ntinda, on the other hand, is an affluent neighbourhood, parts of which experience flash floods. The three areas all have mixed land uses with businesses coexisting with housing. The location of the study areas in Kampala can be observed in Figure 3, Chapter 1, and more characteristics of the cases are described in the same chapter.

### **6.3.2 Sampling**

Within the case study areas, we used systematic random sampling to select businesses for investigation because the businesses were fairly evenly distributed in their different sizes both in the mixed-use areas and in the few businesses-only areas. Sampling involved picking every 3rd business premises along a road or a footpath.

### **6.3.3 Data collection**

We conducted 311 semi-structured questionnaires (appendix 1) from businesses in the three parishes (161 in Natete, 88 in Bwaise III, 62 in Ntinda) and participant observation in August 2017. The respondents were a company or enterprise representatives with knowledge of the business's experience with flooding and the efforts that they have made to mitigate flooding threats. The questionnaires were completed with the help of 9 bi/multilingual research assistants who moved door to door, tracking systematically chosen businesses (Chereni et al., 2020). Questions were designed to generate data on business characteristics, perceptions, experience, risk attitude, government efforts, and

mitigation behaviour. For some issues, the respondents were also asked to provide answers for 2015 and 2016 and thereby provide some insight into changes in their situations and perceptions over time. Through participant observation research assistants could use some evidence of flood experience such as flood markings and implemented measures to probe for more information and help the respondents to recall their experiences vividly.

Table 20: Variables relevant to businesses, measured in the data

<b>Concept</b>	<b>Variables and responses</b>
<i>Threat appraisal</i>	Perceived future flood likelihood (fewer, about the same, and much worse).
<i>Coping appraisal</i>	<ul style="list-style-type: none"> <li>Perceived effectiveness of flood mitigation measures (ineffective, somewhat effective, effective, and very effective).</li> </ul>
	<ul style="list-style-type: none"> <li>Perceived ability of the businesses to implement flood mitigation measures (not able, a bit able, able, and highly able).</li> </ul>
	<ul style="list-style-type: none"> <li>Perceived costs of implementing flood mitigation measures (very low, low, high, and very high)</li> </ul>
<i>Flood experience and its impacts</i>	<ul style="list-style-type: none"> <li>Experienced flooding in a particular year (Yes or No).               <ul style="list-style-type: none"> <li>Flood induced property damage (Yes or No).</li> <li>Flood induced health problems (Yes or No).</li> </ul> </li> </ul>
<i>Risk attitudes</i>	<ul style="list-style-type: none"> <li>Willingness to spend on mitigation measures (not willing, somewhat willing, willing, and highly willing).</li> </ul>
<i>Risk communication and local assistance</i>	<ul style="list-style-type: none"> <li>Whether a business looked for flood risk information (Yes or No).</li> </ul>
	<ul style="list-style-type: none"> <li>Whether a business received flood risk information (Yes or No).</li> </ul>
	<ul style="list-style-type: none"> <li>Whether a business received flood assistance (Yes or No).</li> </ul>
<i>Business characteristics (profile)</i>	<ul style="list-style-type: none"> <li>Number of employees</li> </ul>
	<ul style="list-style-type: none"> <li>Business type</li> </ul>
	<ul style="list-style-type: none"> <li>Age of business</li> </ul>
	<ul style="list-style-type: none"> <li>Status of premises (Owned or Rented)</li> </ul>
<i>Flood damage mitigation (dependent variable)</i>	Respondents were asked to list the mitigation measures they had implemented in an open question (later coded into structural and non-structural measures).

The variables for each of the concepts used are mentioned in Table 20 along with the type of responses that were either binary or using a Likert scale.

### 6.3.4 Data analysis

The responses were compiled in SPSS and then cleaned and checked for errors. There were nominal, ordinal, scale, and text data with few open-ended answers in the questionnaire responses. Micro, small and medium enterprises (MSMEs) that make up over 70% of the Ugandan economy and contribute more than 20% to GDP, can be categorized based on the number of employees or using capital investments or capital turnover (Uganda MSME Policy, 2015). We used the number of employees to classify each business (Table 21) as there was no reliable data available on capital investment or turnover.

Table 21: Classification of MSMEs. Source: Modified from Uganda MSME Policy, 2015

	MSMEs definition is based on the following criteria	
	No. of employees	Capital investments / Capital Turnover (UGX x 10 <sup>6</sup> )
<b>Micro</b>	0-4	0-10
<b>Small</b>	5-49	10-100
<b>Medium</b>	> 50	> 100

UGX refers to Ugandan Shillings

The various business types mentioned by the respondents were categorized into 16 sectors following the International Standard Industrial Classification of All Economic Activities (ISIC) (UNIDO, 2008).

- Agriculture, forestry, and fishing (Category A)
- Manufacturing (Category C)
- Electricity, gas, steam, and air conditioning supply (Category D)
- Construction (Category F)
- Wholesale and retail trade of consumption goods (Category G1)
- Wholesale and retail trade of non-consumption goods (Category G2)
- Transportation and storage (Category H)
- Accommodation and food service activities (Category I)
- Financial and insurance activities (Category K)
- Real estate activities (Category L)
- Professional, scientific, and technical activities (Category M)
- Public administration and defence, compulsory social security (Category O)
- Education (Category P)

- Human health and social work activities (Category Q)
- Arts, entertainment, and recreation (Category R)
- Other service activities (Category S)

For the variables, flood experience and impacts responses were converted from nominal data to scale data by calculating the number of times businesses experienced floods (and the impacts) in the years 2015, 2016 & 2017 (maximum of 3 and minimum of 0). Among the 311 businesses surveyed, 225 of them were established before or in 2015, 44 in 2016 and 30 in 2017, while 12 of them had missing data for year of establishment. Therefore, in this research for the analysis, including flood experience and its impact variables, only businesses that existed from or before 2015 were considered.

The coping appraisal elements are analysed for nine different coping measures out of which five are structural and four are non-structural. The five structural measures are rebuilding/raising the floor, building small dykes, putting sandbags, planting grass, and clearing the drainage while the four non-structural measures are raising electric sockets, capturing rainwater, relocation and raising goods. In the literature, all the responses for coping appraisal elements are aggregated to form an index, but in this research the three elements of coping appraisal are analysed individually for all the nine coping measures.

From the open-ended question where we asked the respondents to list the mitigation measures which they implemented for each year, we created two variables 'whether or not businesses implemented mitigation measures' and 'what type of measures the businesses implemented.' If they mentioned any measures implemented for a particular year, we coded it as 'yes' for that particular year and type of measures were coded into relevant themes based on the literature. Measures that involve some construction or installation on the perimeters (clearing/construction of drainage, building dykes, pouring sand/maram/sandbags, construction/digging trenches, rebuilding/raising premises, and rainwater harvesting) were classified as structural measures; other measures (raising goods/electric sockets, capturing rainwater, relocating, clearing the water with containers, and closing business) were classified as non-structural measures.

A variety of statistical techniques were used in the analysis, including descriptive statistics, various measures of association and binary logistic regression to identify key parameters influencing business perceptions and flood mitigation behaviour.

## **6.4 Findings**

In this section, we present the descriptive statistics and relationships between different key variables. As some variables contain missing data, a difference in N is observed throughout the analysis.

### **6.4.1 Business characteristics as factors for flood mitigation behaviour**

#### *Business characteristics*

The majority (71.2%) of the surveyed businesses were micro-enterprises, particularly in the informal settlements of Bwaise III and Natete. By contrast, small businesses predominate in the more affluent neighbourhood of Ntinda. Overall, most businesses (81%) belonged to one of five sectors, trade of non-consumption goods (25.7%), trade of consumption goods (14%), manufacturing (13%), other service activities (10%) and accommodation & food service activities (8.3%). Among the micro-businesses, a major proportion of businesses belong to the trade of consumption & non-consumption goods, accommodation & food service activities, and other service activities while in small businesses most of them belong to the trade of non-consumption goods and manufacturing.

Although in general, most of the businesses do not own their premises, this was not true for the small businesses in Ntinda. Around 50% of businesses are relatively new (age less than five years) and micro-enterprises are relatively young compared to small businesses.

Most of the businesses in the three locations implemented some sort of flood mitigation measures in 2017 (Bwaise III: 56%; Natete: 60.5%; Ntinda: 51%). Structural measures were most common, irrespective of the business size, location, type, tenure status, age, and flood experience. Table-22 shows that the micro enterprises were more likely to implement mitigation measures compared to small businesses ( $\chi^2 = 4.959$ ,  $N = 224$ ,  $p = .026$ ,  $\Phi = -.159$ ). Relocation as flood mitigation measure was only found amongst micro-enterprises and for tenants, which reflects the relative ease with which they can move to a new and hopefully safer location.

Table 22: Relationship of business size and status of premises with mitigation behaviour

		Business size		Total	Status of premises		Total
		Micro	Small		Owner	Tenant	
<b>Mitigation behaviour in 2017</b>	Yes (count)	99	30	129	36	92	128
	% within column variable	62.7%	45.5%	57.6%	43.9%	64.8%	57.1%
	% of Total	44.2%	13.4%	57.6%	16.1%	41.1%	57.1%
	No (count)	59	36	95	46	50	96
	% within column variable	37.3%	54.5%	42.4%	56.1%	35.2%	42.9%
	% of Total	26.3%	16.1%	42.4%	20.5%	22.3%	42.9%
<b>Total</b>		158	66	224	82	142	224
	% within column variable	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	70.5%	29.5%	100.0%	36.6%	63.4%	100.0%

Tenants were found to be more likely to implement mitigation measures than owners ( $\chi^2 = 8.426$ ,  $N = 224$ ,  $p = .004$ ,  $\Phi = .203$ ). This difference may be attributable to the youthful age of most business tenants and their small size (micro-enterprises) whereas most business owners have small enterprises that may have already put mitigation measures in place. Two mitigation measures were dominant amongst owners and tenants: clearing/construction of drainage was the major structural measure, and raising goods/electric sockets was the major non-structural measure. Clearing/construction of drainage was also the major structural measure among four of top five business sectors. In the accommodation & food service sector rebuilding/raising the floor and placing sandbags/soil/maram were the two major structural measures to ensure the safety of their customers and to safeguard the goods and materials from flood waters. This is also the only business type which frequently closes down during floods.

Generally, those businesses that implemented mitigation measures were relatively young, micro-enterprises. These typically favour rebuilding/raising premises for mitigation, whereas new small businesses favour clearing/construction of drainage. The non-structural measure 'closing business,' was only observed in relatively new micro-enterprises as these are more vulnerable to the flood impacts due to their lack of resources and finances in comparison to small businesses.

#### **6.4.2 Influence of flood experience on flood mitigation behaviour**

Among the 225 businesses that existed from 2015, 45.7% experienced floods in all three years (2015-2017) while 24.7% businesses did not

experience any floods. Most of the businesses that did not face floods in 2015-2017 were from Ntinda while most of the businesses that faced floods in all three years were from the informal settlement Natete. Using binary logistic regression, we investigated whether the experienced impacts of flooding (property damage, health and financial) affected the implementation of mitigation measures. Financial impacts were found to be most prevalent and also the most important determinant of mitigation behaviour ( $\chi^2 (3, N = 144) = 12.172, p = .007$ ) (Table 23).

Table 23: Impacts of property damage, health problems, and flood-related financial problems on mitigation behaviour

	<i>B</i>	<i>S.E.</i>	<i>Wald</i>	<i>df</i>	<i>Sig.</i>	<i>Exp(B)</i>	<i>95% C.I. for EXP(B)</i>	
							<i>Lower</i>	<i>Upper</i>
<i>Property damage experience</i>	-0.43	0.22	3.73	1	0.05	0.65	0.43	1.01
<i>Health problems experience</i>	-0.10	0.17	0.38	1	0.54	0.90	0.65	1.25
<i>Financial problems experience</i>	0.75	0.24	9.83	1	0.00	2.11	1.32	3.36
<i>Constant</i>	-0.55	0.32	2.91	1	0.09	0.58		

### **6.4.3 Risk attitude and flood risk perception as factors of flood mitigation behaviour**

#### *Risk attitudes*

Table 24 below shows cross-tabulation of the relationship between willingness to mitigate and flood mitigation behaviour. Among the 299 businesses that responded to the question on willingness to spend on mitigation measures, over (28.6%) expressed that they are highly willing to do so, while 10.9% indicated their unwillingness. The reasons behind their decision not to spend on mitigation measures were the existence of previous mitigation measures, trust in terrain, lack of funds, their belief that it is the landlord's responsibility, and their perception that mitigation measures are ineffective. While most of the micro-enterprises were unwilling to spend on mitigation measures, most small businesses were willing to make such investments.

The proportion of businesses that were unwilling to spend on mitigation was highest in the informal settlement Bwaise III, while the proportion of those which were highly willing was highest in the affluent neighbourhood - Ntinda. The businesses that were more willing to spend on mitigation measures were also more likely to implement on mitigation measures ( $\chi^2 = 15.365, N = 220, p = .002$ , Cramer's V =



.264) (Table 24). The preference to relocate was only observed in businesses with low willingness to spend on mitigation measures, suggesting that they would rather move than invest their scarce resources in on-ground mitigation measures, especially when they were not the property owners. Not surprisingly, only 8.2% of businesses, most of which were small businesses located in Ntinda, had insurance for flood damage.

Table 24: Cross-tabulation of mitigation behaviour vs willingness to spend on mitigation measures

		Willingness to spend on mitigation measures in 2017				Total
		Not willing	Somewhat willing	Willing	Highly willing	
<b>Mitigation behaviour in 2017</b>	Yes (Count)	24	9	30	63	126
	% within column variable	41.4%	69.2%	81.1%	56.3%	57.3%
	% of Total	10.9%	4.1%	13.6%	28.6%	57.3%
	No Count	34	4	7	49	94
	% within column variable	58.6%	30.8%	18.9%	43.8%	42.7%
	% of Total	15.5%	1.8%	3.2%	22.3%	42.7%
<b>Total</b>	(Count)	58	13	37	112	220
	% within column variable	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	26.4%	5.9%	16.8%	50.9%	100.0%

#### **6.4.4 Influence of threat appraisal on flood mitigation behaviour**

Regarding the likelihood of future floods, though more than half of all businesses expressed that there would be fewer floods in the future (Figure 12) expectations varied across the three study areas. In Bwaise III, a large majority (79.3%) of businesses expected fewer floods in the future while few (3.4%) expressed worse floods. By contrast, in Natete more than one quarter (28.3%) expected less floods and those expecting worse floods was much higher than Bwaise III (29%). In general, the businesses in both areas that expected worse floods in the future were located close to the major drainage channels, pointing to their importance as a source of flood waters as well as to their potential

importance in hazard mitigation. Further, our analysis shows that businesses which expect more future floods were more likely to implement mitigation measures ( $\chi^2 (2, N = 190) = 14.74, p = .001$ ) (Table-6).

Figure 16. Perceptions of businesses about future flood probability (n = 248)

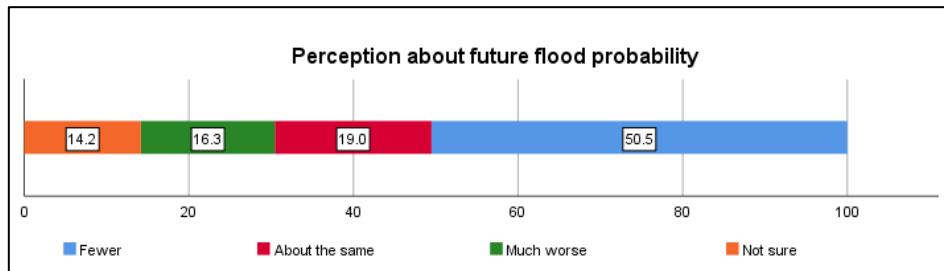


Table 25: Influence of future flood probability on mitigation behaviour

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
<i>Fewer (reference)</i>			13.84	2	0.00			
<i>About the same</i>	0.98	0.39	6.26	1	0.01	2.65	1.24	5.69
<i>Much worse</i>	1.31	0.40	10.75	1	0.00	3.71	1.70	8.14
<i>Constant</i>	-0.24	0.20	1.57	1	0.21	0.78		

The category 'Not sure' is not included in the regression model

#### 6.4.5 Influence of coping appraisal on flood mitigation behaviour

We hypothesize that a decision to invest in a particular mitigation measure will be influenced by the perception of its effectiveness. Most businesses viewed rebuilding/raising the floor and clearing drainage as very effective, easily self-implementable but high-cost measures, while only one-third of businesses expressed non-structural measures as very effective. Consequently, we observed a preference for structural measures irrespective of business size, location, tenure status, flood experience and willingness to spend. Despite its low cost and its popularity amongst proponents of Sustainable Drainage Systems (Ellis, 2013), planting of grass was clearly identified as the most ineffective structural measure. Among the four non-structural measures relocation was viewed by most businesses as an inefficient and costly measure that is, however, easily self-

implementable. The businesses in Bwaise III were most positive about 'clearing drainage' as a flood mitigation measure, perhaps an indication of their experienced benefits from the primary drainage channel improvements that were completed there in 2013.

Using binary logistic regression, we explored how perceived response efficacy, perceived self-efficacy and perceived response cost for the nine coping measures predict mitigation behaviour. Not all measures had significant contributions to the models. The hypotheses that businesses will implement coping strategies that are effective is true for the measure 'placing sandbags' but not for the measure 'raising sockets' ( $\chi^2 (27, N = 134) = 59.09, p < .001$ ) (Table-1 of Appendix 4). In case of self-efficacy, the measure 'placing sandbags' supported the hypotheses that businesses implement coping measures that are easily self-implementable while the measures 'planting grass' and 'clearing drainage' rejected ( $\chi^2 (26, N = 212) = 68.33, p < .001$ ) (Table-2 of Appendix 4). In terms of cost, the hypotheses of businesses implementing relatively low-cost measures holds true for the measures 'clearing drainage', 'raising sockets,' and 'relocation' but not for the 'rebuilding/raising the floor' and 'placing sandbags' ( $\chi^2 (27, N = 211) = 76.45, p < .001$ ) (Table-3 of appendix 4). Several measures (building small dykes, raising goods and rebuilding/raising the floor level) were clearly preferred by businesses that were located close to drainage channel.

#### *Government efforts as factor for flood mitigation behaviour*

While very few businesses (63 out of 311) actively sought flood-related information, most of them did receive it through multiple sources such as radio, television, community leaders, newspapers and internet. While no relation was observed between their mitigation behaviour and risk communication variables, there was, however, a significant relationship between the type of mitigation measures used and risk communication.

Interestingly, we observed that businesses that looked for and received flood information were more likely to implement non-structural measures whereas others were more likely to implement structural measures (Table 26 below). Therefore, we can say that businesses with proactive information seeking behaviour were better prepared for flooding by being able to explore different mitigation options, including non-structural measures, in addition to the common structural measures.

The systems for flood assistance in Kampala appeared to be underdeveloped, with very few (25 out of 311) received any form of local flood assistance. Most (13) were small businesses of which more

than half were in the informal settlement Natete. The local assistance mentioned most was cleaning the drainage system by KCCA.

Table 26 Relationship between having looked for and/or received flood information, and implementation of mitigation measures, among businesses

		Looked for flood info		Total	Received flood info		Total
		Yes	No		Yes	No	
<b>Type of mitigation measures 2017</b>	Structural (Count)	21	74	95	49	47	96
	% within column variable	61.8%	83.1%	77.2%	70.0%	90.4%	78.7%
	% of Total	17.1%	60.2%	77.2%	40.2%	38.5%	78.7%
	Non-structural (Count)	13	15	28	21	5	26
	% within column variable	38.2%	16.9%	22.8%	30.0%	9.6%	21.3%
	% of Total	10.6%	12.2%	22.8%	17.2%	4.1%	21.3%
<b>Total</b>	Count	34	89	123	70	52	122
	% within column variable	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	27.6%	72.4%	100.0%	57.4%	42.6%	100.0%

## 6.5 Discussion

Our results indicate that the findings from literature based on formal businesses in a developed world context cannot be completely transferred to a developing world context with high levels of informality, such as Kampala. Among the variables analysed, the results of threat appraisal, flood induced financial impact, and willingness to spend on mitigation measures support the findings from the literature while the results of tenure status, business age, and flood experience are contradictory. The results of the variable business size are inconclusive.

In our study, micro-enterprises were found to be more likely to implement mitigation measures compared to small enterprises contradicting the studies of Crichton, (2006) in the United Kingdom and Dahlhamer & D'Souza, (1995) in two states of USA. However, our results support those of Kreibich et al., (2007) in Germany. A possible reason identified behind such relations is that more than half of the small businesses had mitigation measures already in place at the time

of the study. This highlights the importance of time in such studies and perhaps indicates why there are mixed results in the literature. The businesses that rent their premises were more likely to implement mitigation measures compared to those that own contradicting the studies of Dahlhamer & D'Souza, (1995) in two states of the USA. In Kampala, business tenants may be more self-reliant in this respect; they may have little confidence that the property owner will invest in such measures given their low incomes and the lack of legal instruments that require owners to invest in order to protect their tenants.

Our finding that flood experience was not significantly correlated to mitigation behaviour contradicts the studies of Bubeck et al., (2012) and Dahlhamer & D'Souza, (1995). Among the three variables analysed to study the influence of flood impacts on mitigation behaviour, only flood induced financial impact results support the hypotheses and studies of Alesch et al., (2001) in the United States. The financial impacts were significant enough to show a change in mitigation behaviour unlike property damage and health issues, but it is important to note that most of the financial impacts include costs incurred due to hospital bills and property/goods damages. Also, while floods may be frequent in our three study areas they are, mostly not extreme so that major property damage and health impacts may be quite rare.

The businesses that are more willing to spend on mitigation measures are more likely to implement such measures, supporting the hypotheses and the studies in the UK (Crichton, 2006). Business with high threat appraisal (future flood likelihood) are more likely to implement mitigation measures supporting the studies of Bubeck et al., (2012) and Dahlhamer & D'Souza, (1995). The results of coping appraisal both support and contradict the hypotheses and studies of Bubeck et al., (2012) and Bubeck et al., (2013). The influence of coping appraisal elements was not consistent across the nine mitigation measures analysed in this research, and not all were significant contributors to the models predicting the mitigation behaviour. Unlike the existing literature (Babcicky & Seebauer, 2017; Bubeck et al., 2012, 2013; Poussin et al., 2014) where all three components of coping appraisal are aggregated to form an index, analysing them separately for all nine coping strategies showed that the influence of each measure was different by allowing much deeper analysis.

Government actions, like expansion of the primary drainage channel in Bwaise III completed in 2013 build trust among business as those of Bwaise III are very positive about the measure 'clearing drainage' relative to Natete where such action has not yet been undertaken, despite the approval of a Drainage Master Plan in 2002. Such capital

investments in drainage infrastructure are important elements of the flood reduction strategy of Kampala, though the shortage of funding often means long lead times for implementation and the lack of attention and funds for drainage maintenance may compromise the effectiveness of the measure for long-term flood protection, even in Bwaise III.

Table 27 shows a summary of all the important findings in this research across the three study areas. The findings such as small businesses being predominant, majority of them owning their premises, 45.5% businesses not experiencing floods in 2015-2017 and 61% of insured businesses being located at this region clearly differentiates Ntinda as an affluent neighbourhood from the informal settlements of Bwaise III and Natete. The other noticeable differences observed between the affluent neighbourhood and informal settlements is that the businesses in the former are old and most of them were highly willing to spend on mitigation measures. The findings that are common across both affluent neighbourhood and informal settlements are the primary sectors being the trade of non-consumption goods, structural measures being predominant and low proactive information seeking behaviour and majority of them receiving flood-related information.

Table 27 below, shows the findings of each variable that are unique or common among the three case study areas.

Table 27: Summary of findings about businesses across the three case study areas

	<b><i>Bwaise III</i></b>	<b><i>Natete</i></b>	<b><i>Ntinda</i></b>
<i>Business size</i>	Micro enterprises are predominant	Micro enterprises are predominant	Small enterprises are predominant
<i>Business type</i>	Primary sector: Trade of non-consumption goods	Primary sector: Trade of non-consumption goods	Primary sector: Trade of non-consumption goods
<i>Tenure status</i>	Majority is tenants	Majority is tenants	Majority is owners
<i>Age of business</i>	Mean age: 6 years	Mean age: 6.1 years	Mean age: 8.5 years
<i>Mitigation behaviour</i>	56% implemented mitigation measures	60.5% implemented mitigation measures	51% implemented mitigation measures
<i>Type of mitigation measures</i>	Structural measures are predominant	Structural measures are predominant	Structural measures are predominant
<i>Flood experience</i>		73.5% of businesses experienced floods in all three years	45.5% of businesses have not experienced floods in all three years
<i>Willingness</i>	41.7% of businesses were not willing		61% of businesses were highly willing
<i>Insurance</i>	26% of insured businesses are located here	13% of insured businesses are located here	61% of insured businesses are located here
<i>Future flood likelihood</i>	79.3% expressed fewer floods in future	29% expressed much worse floods in future	
<i>Perceived effectiveness</i>	Very positive about clearing drainage; Majority of them expressed planting grass as ineffective	Very positive about rebuilding/raising the floor; Relatively positive about relocation	
<i>Perceived self-efficacy</i>		Majority of them expressed relocation as easily self-implementable measure	
<i>Perceived response costs</i>	Majority of them expressed planting grass as a very low-cost measure		
<i>Looked for flood information</i>	Majority did not look for flood information	Majority did not look for flood information	Majority did not look for flood information
<i>Receiving flood information</i>	Majority received flood related information	Majority received flood related information	Majority received flood-related information
<i>Local flood assistance</i>		Major proportion of businesses that received flood assistance are located here	

## **6.6 Conclusions**

We sought to better understand small business flood damage mitigation behaviour of business owners in Kampala with the view of contributing to the Protection Motivation Theory (PMT) through an African case study. We proposed an extension of PMT that is relevant to businesses based on piecemeal conceptualizations in the existing literature. It helped to shed light on key elements like businesses specific parameters (size, type, premises tenure status, age), experience (flood impacts) and their attitudes (willingness, information seeking behaviour) and how these influence their decision making towards implementing flood mitigation measures. These extra elements provide a better understanding of the mitigation behaviour of businesses.

The provision of information to business owners and operators is an area that requires further attention from KCCA and other authorities. It is apparent that very few businesses have regular access to useful information regarding flood mitigation measures, especially those for non-structural measures. Addressing this gap should be a component of flood mitigation measures in Kampala. Local authorities, including community leaders, NGO's and CBOs should play a more active role in raising awareness and educating businesses about the risk of future floods and the impact these could cause on their businesses. Knowledge of the low-cost non-structural measures should be enhanced among businesses, as only 21% of businesses have adopted such measures, and only one-third of businesses view them as highly effective. Given their financial constraints, it could benefit micro-enterprises more than small enterprises.

The results of this research are specific to the businesses in the selected three neighbourhoods of Kampala, Uganda, where the floods are frequent but not life threatening. Therefore, it is possible that the determinants of flood mitigation behaviour can be different in places where floods are more severe. The extended version of the PMT framework can be used as a reference framework to guide studies which analyse flood mitigation behaviour among businesses, particularly in a developing world context. However, it should be tested in a broader context, covering both informal settlements and affluent neighbourhoods as well as more global South countries to test its applicability.



## **Chapter 7: Synthesis, conclusions, and future research directions**

## **7.1 Research problem and aim**

Although the number of flood-related deaths is lower in sub-Saharan Africa than in other parts of the world, their impacts are far-reaching because of high levels of social vulnerability (Fraser, 2017). The burden of flood risk management on governments in the sub-Saharan context is also high. Property level self-protection measures and community-level measures by residents and businesses are therefore thought to be invaluable in augmenting governmental flood risk management efforts. This research has sought to shed light on the factors that influence households and businesses to self-protect and/or participate in community level flood management efforts. Their perceptions about the threats posed by flooding and their abilities to take effective protective actions are at the core of this research.

This research identified factors that motivate residents and businesses located in affluent and informal settlements in the city of Kampala to self-protect and participate in community-level flood mitigation activities. The use of the Protection Motivation Theory (PMT) framework (Poussin et al., 2014a; Rogers, 1975), together with a mixed-method approach in data collection and analysis, enabled a deeper understanding of factors influencing flood damage mitigation behaviour. Below, I summarize the findings which answer the research objectives and questions outlined earlier in this thesis.

## **7.2 Methodological synthesis and hypotheses**

I used a variety of secondary and primary data sources and methods (literature, interviews, surveys, statistical models) in parallel (Shorten & Smith, 2017), to gain a deep insight into risk perceptions and how they are shaped and formed in Kampala. This kind of information is both qualitative and quantitative and this approach was invaluable to understand the key events and experiences behind risk perceptions of multiple actors (residents, businesses, government authorities and Civil Society Organisations) and how these perceptions influence their flood damage mitigation. This was crucial since my study combined deductive elements related to PMT theory with the collection and analysis of new quantitative and qualitative empirical data for a relatively new context that generated context-specific insights on flood risk perceptions and flood mitigation decisions and actions.

A review of documentary data from KCCA and ACTogether Uganda provided a deeper understanding of the case study areas in support of comparative analysis of findings. Further, the records of settlement fora

provided qualitative data that revealed the impacts of governance rearrangements on flood resilience building. Further, a World Bank report on the implementation of the Kampala Institutional and Infrastructure Development Project helped me to assess the influence of the change of governance regimes, from Kampala City Council to The Kampala Capital City Authority, on flood risk mitigation at city level.

My consultation of pieces of legislation, for example the Town and Country Planning Act (Chapter 246) that was revised in 2000 and the Physical Planning Act (2010), helped me establish whether there had been big changes in physical planning legislation following the change of governance regimes, and how such changes could have influenced flood risk management. Interviews with government officers, CSO officials and residents helped to triangulate other findings and they also helped to understand the actor constellations, their risk perceptions and their understandings of risk mitigation responsibilities during the two governance regimes.

To assess the measure-specific influences of risk perception and mitigation, I used a questionnaire survey to elicit residents' and business owners' experiences, attitudes and mitigation efforts focusing on respective components of the Protection Motivation Theory. In the analysis, I ran multiple sets of ordinal regression models to establish key risk perception drivers among households, and binary logistic regression models to establish key determinates of flood damage mitigation among businesses. Although this approach (considering cumulative probability effects of the changes in the levels of the predictor variables on the dependent variable) helped to explain observed variations more than in many previous studies, coupling this approach with qualitative methods provided richer insights into the causes of variations in perceptions. For example, in Kampala, income does not influence perceptions of self-efficacy because both residents and to a greater extent, businesses, implement many measures on their own, without hiring labour. These insights were generated from combining observation and interview data.

Since my mixed-methods design was not a sequential qualitative-quantitative design, insights from the qualitative methods were not tested empirically. Hypothesis testing was done using ordinal regression models by testing parallel lines. The research has clearly demonstrated the value of following a mixed methods approach for risk perception research.

---

## **7.3 Answers to research objectives and questions**

The study aimed to improve the understanding of factors that influence risk governance, risk perception and coping appraisal of households and businesses, and their implications on flood mitigation in Global South cities, using Kampala as an African case. I managed to achieve this aim by answering the objectives below:

### **7.3.1 Influence of governance rearrangements on flood mitigation behaviour**

The first objective was to establish the influence of governance rearrangements on flood damage mitigation in Kampala City.

I sought to understand how best we can assess the impacts of governance rearrangements on flood mitigation where democratic space is reduced; and their impacts on flood mitigation? While the importance of governance re-arrangements has gained currency in evaluative environmental governance literature (Kaufmann & Wiering, 2017), much work has concentrated on building and applying frameworks to evaluate the impacts of decentralization, such that frameworks to evaluate the impacts of re-centralization are still lacking.

I addressed this objective in chapter two, in which I adapted a Water Governance Assessment Framework (WGAF) (Bressers et al., 2013; Vinke-de Kruijf et al., 2015), and conducted 22 in-depth interviews with stakeholders, searched documentary sources, and carried out transect walks in Bwaise III, Kampala, Uganda, to assess the impacts of local government rearrangements on flood mitigation. We generated qualitative data on stakeholder experiences and perceptions regarding governance quality and pre-reform and post-reform flood mitigation. The data were analysed using thematic content analysis to produce a scoreboard measuring changes in governance dimensions against progress in flood mitigation. In a follow-up survey, 24 structured interviews were conducted to validate the data.

Results show that the governance rearrangements that led to the creation of KCCA as a local authority with ministerial representation in the national Cabinet led to time and cost savings for the city, increased revenue and sped up the implementation of flood management strategies and measures, as a result of improved tender procedures. A case in point is the improvement of the implementation process of the Nsooba-Lubigi drainage channel widening between 2011 and 2013. The findings can be useful to policymakers at the interface of governance and flood management.

### ***7.3.2 A methodological framework for ensuring data quality***

Second, I sought to design a methodological framework for ensuring data quality in this study, given that it was a cross-language fast-paced survey. Under this objective, I sought to answer the following questions:

- (i) how to deal with multiple ontologies of risk, risk perception factors, and mitigation behaviour, studied using mixed methods studies with multi-lingual research assistants;
- (ii) How to effectively select and work with research assistants, bearing in mind their inevitable agency and cultural brokerage during data gathering;
- (iii) What potential inconsistencies in interpretation of risk and risk perception factors, and mitigation behaviour, caused by multiple positionalities and subjectivities, can be avoided;
- (iv) How to avoid potential loss of meaning due to translation.

In chapter three, I provide a comprehensive systematic method – the EBDT, to address the questions above, using the specificities of research fieldwork management concerning outsourced data collection by field assistants. As a guide to applying this approach, I conceptualize social science research into four inter-related dimensions - paradigm, people, process, and presentation.

My application of EBDT as a procedural tool helped in the recruitment of nine research assistants and to put them on the same page in terms of the meaning of concepts in the questionnaire and those that arose from the fieldwork itself. This solved quality problems by synchronising the standpoints of research assistants regarding the meaning of both the concepts in the questionnaire and the responses. This was achieved by briefing, and applying intersubjectivity when deriving meaning from the data gathered by different research assistants.

### ***7.3.3 Factors of risk understanding and threat appraisal among households***

Third, I sought to determine the influencing factors of flood risk understanding and threat appraisal) among households in selected areas of Kampala. Specifically, I sought to understand how households perceive the causes of flooding in Kampala; how do their perceptions compare to those of the local authority; how households perceive the likelihood of future flood property damage, and what the key

determinants of households' flood risk perceptions in the selected areas are?

In chapter four, I found that households' perceptions of the causes of flooding differ from those of KCCA. For example, in Bwaise III, households perceive the construction of the Northern Bypass, and failure to dredge channels as the main causes, while the local authority views illegal dumping of waste and illegal developments by residents as the main causes. My work established that residents in Natete perceived a high likelihood of future flood-related property damage compared to the other two sub-cases. This is notwithstanding that Bwaise III, the other sub-case, is considered more of a flooding hotspot than Natete. We conclude that the recent widening of the Nsooba-Lubigi primary drainage which runs through Bwaise III has had an impact on the residents' perceptions.

Regarding the key determinants of households' flood risk perception, households which experienced severe flooding, and flood-induced financial costs in the informal settlement of Bwaise III and the high density/informal settlement of Natete, perceived a higher likelihood of future flood damage. In Bwaise III, length of stay also positively affects perceptions of the likelihood of property damage and government mitigation efforts negatively influence them. In Natete, an additional factor – homeownership, has a negative influence on perceptions of future flood-induced property damage. In the affluent area - Ntinda, households who were willing to mitigate against flooding, and those who had experienced flood-induced property damage, had a high perception of the likelihood of future flood-induced property damage.

These findings strengthen the idea that flood damage, flood-induced financial loss, length of stay, homeownership, place attachment, and trust in government actions, are key determinants of flood risk perception.

#### **7.3.4 Factors of flood coping appraisal among households**

Fourth, I sought to establish factors that influence measure-specific coping appraisal among households in the three case study areas from Kampala. Below, I summarize the key findings per the sub-objectives of chapter five.

##### **Influence of social vulnerability elements on flood coping appraisal**

To begin, I sought to establish the influence of social vulnerability (in terms of low income, low education level, social networks, household

size, tenure status, gender, and age) on perceptions of self-efficacy and implementation costs.

Females had lower perceived self-efficacy for raising power sockets (hereafter SE sockets) in Bwaise III and Ntinda but not in Natete. In Ntinda, females also had lower perceived self-efficacy for raising floor (hereafter SE Rfloor or rebuilding) levels than men.

Concerning age, older people perceive that they can raise the floor/rebuild the house and/or clean the drainage in Bwaise III while in Ntinda the elderly perceive this measure to be too costly compared to the younger age groups. In Natete, older people perceive capturing rainwater and clearing the drainage to be effective ways to mitigate against flooding compared to the younger age groups. It is however important to note that the age groups that include the aged (65+years) had very few respondents, and therefore, we should be more cautious in concluding that age has a positive influence on perceptions of self-efficacy and response efficacy as explained above.

Income also affects coping appraisals for a few measures in Bwaise III and Natete. In both neighbourhoods, households which earn more perceive that they can raise the floor or rebuild the house. In addition, Bwaise III residents perceive themselves as able to raise power sockets while those in Natete can put goods in higher places, which resonates with their perception that the measure is effective. In addition, they perceive capturing rainwater and raising sockets as effective measures. In Bwaise III, they further perceive raising sockets and planting grass to be costly and in Natete they perceive the same for sandbags. Consequently, they perceive themselves as unable to implement them. Further, they perceive the inability to put up small dykes despite that they perceive them as effective.

Homeowners in Bwaise III and Natete have perceptions of self-efficacy. In the former, they perceive themselves as able to put up piles of sandbags while in the latter, they perceive the ability to raise the floor or rebuild the house, put up a small dyke, capture rainwater, and plant grass.

The highest education level reached by a household member is positively associated with perceived self-efficacy for raising sockets in Bwaise III and Natete. Over and above, in Natete, the highest education was positively associated with perceived self-efficacy for: raising the floor or rebuilding and raising sockets; perceived response efficacy for planting grass and clearing drainage; and perceived implementation costs for moving away and putting goods high. In Ntinda, the highest education was positively associated with perceptions of response efficacy for putting up small dykes, planting grass, capturing rainwater, moving away, putting goods high; and perceived implementation costs

of putting goods in higher places. It is negatively associated with perceived self-efficacy for: putting up piles of sandbags; capturing rainwater; clearing drainage and temporarily moving away. It is also negatively associated with perceived implementation costs for capturing rainwater.

Other variables related to social vulnerability (i.e., household size and size of social network) have significant positive relationships with coping appraisals in Natete and Ntinda, though not in Bwaise III.

In Natete and Ntinda, the bigger the household size or social network, the higher the perceptions of perceived self-efficacy for raising the floor or rebuilding the house. In both neighbourhoods, bigger households perceive themselves as able to capture rainwater. In the former, they also perceive themselves as able to put up a small dyke while in the latter they additionally perceive themselves as able to plant grass and clear the drainage but unable to move away to safer places. Households with bigger social networks in Natete are also able to put up sandbags, capture rainwater, plant grass, and clear the drainage. They also consider small dykes costly. In Ntinda, bigger households additionally perceive themselves as able to capture rainwater, plant grass and clear the drainage channel, but are not able to move away. Although bigger households perceive themselves to be able to capture rainwater, many do not perceive the measure to be effective. They also perceive moving away to safe places and raising goods high to be ineffective. In the same neighbourhood, households with bigger social networks also view planting grass and moving away to be ineffective, and sockets together with sandbags as being costly.

These findings imply that females, households with older heads, low-income earners, and poorly networked households, have limited abilities to self-protect and would require more support from government and non-Governmental organizations in the area and other similar areas in the Global South. This points to the importance of measuring and monitoring household vulnerability over time. The perception of self-efficacy to clear the drainage channel implies an untapped resource by the local authority especially given the silted state of the primary drainage channel in Bwaise III. The authority should therefore do more in terms of community cleaning exercises to tap on it.

### **Influence of flood severity on flood coping appraisals**

I also sought to determine the influence of flood severity on perceptions of response efficacy, self-efficacy, and implementation costs. In Chapter five I establish that flood severity is only associated with coping appraisal elements for a few measures. In Bwaise III, households which experienced severe flooding perceive themselves as able to put up



sandbags. They also consider capturing rainwater ineffective and costly. In Natete, such households are not able to capture rainwater but able to raise goods high while in Ntinda, they perceive moving away as ineffective.

### **Influence of distance from the drainage channel and length of stay on flood coping appraisals**

Distance from the channel has significant relationships with very few appraisals, especially in Bwaise 3 and Natete. In Bwaise III the longer the distance from the channel the higher the perceptions of implementation costs for clearing the drainage and the lower the perceptions of implementation costs for capturing rainwater. In Natete the longer the distance from the channel the higher the perception of response efficacy for planting grass. In contrast, the variable is negatively correlated with the ability to: put up sandbags, move away, raise goods high; and perception of Implementation costs for Rfloor or rebuilding, and capturing rainwater.

In Natete and Ntinda, households which have lived at their current location for longer, perceive themselves as able to raise sockets and plant grass. In addition, such households in Natete can plant grass, raise the floor or rebuild, put up sandbags, and raise goods high - which they also consider as effective. Moreover, they perceive capturing rainwater as less costly. In Ntinda, they also perceive capturing rainwater ineffective, and Rfloor or rebuilding as well as moving away to be less costly.

### **Influence of property damage, health problems, and financial loss, on flood coping appraisals**

I found different perceptions of self-efficacy for different measures in the three case study areas. In Bwaise III and Natete, those who experienced flood-related property damage and those who suffered health problems perceived themselves as unable to put up sandbags. Additionally, those in Natete have perceptions of low self-efficacy for Rfloor or rebuilding, putting up sandbags, capturing rainwater, raising sockets, clearing drainage, and putting goods high. Further, households in Bwaise III which suffered from flood-related health problems also perceive themselves as not able to plant grass but able to capture rainwater. In Ntinda, flood damage does not have a significant impact on any appraisal, but having suffered flood-related health problems is associated with perceptions of lower self-efficacy for Rfloor or rebuilding, small dyke, sandbags, clearing the drainage, moving away, and putting goods high. In Ntinda, they have perceptions of low SE for Rfloor or rebuilding, sandbags, and clearing drainage, but high SE capturing rainwater. In Natete and Ntinda, households which incurred flood-related financial costs perceive that they can raise the floor or

rebuild the house, put up small dykes, use sandbags, and clear drainage. Further, those in Natete perceive that they can raise goods high and capture rainwater, while in Ntinda they are able to move away to a safe place.

Property damage, health problems, and financial loss also influence perceptions of the response efficacy of some measures. People who suffered property damage in Bwaise III perceived capturing rainwater to be an effective flood mitigation measure while those who suffered financial loss perceived it to be ineffective. They also perceive Rfloor or rebuilding to be ineffective but, like those in Ntinda, they find planting grass to be an effective measure. Those who suffered health problems in the same area also perceive planting grass, capturing rainwater, moving away, and putting goods high to be effective measures,

Regarding implementation costs, both Natete and Ntinda households which suffered property damage or financial loss perceived lower costs of capturing rainwater. Further, in Bwaise III, they are not able to raise the floor or rebuild the house, or clear the drainage channel but are able to put up sandbags and plant grass. In Natete, they perceive the costs of putting up small dykes, raising sockets and clearing drainage to be lower while in Ntinda, they perceive the same for sandbags.

#### **Influence of information and information-seeking behaviour on flood coping appraisal.**

Further to the above sub-objectives, I sought to establish the influence of flood information on perceptions of response and self-efficacy, and implementation costs. My findings in Bwaise III are that residents who seek flood-related information perceive putting up small dykes to be an ineffective measure, and the costs of raising sockets to be low. On the other hand, residents who receive flood-related information perceive themselves as unable to capture rainwater. They also perceive putting up small dykes as costly yet ineffective.

In Natete, residents who seek flood-related information perceive themselves to be able to put up sandbags. At the same time, they perceive raising goods high to be an effective measure but surprisingly perceive raising the floor of the house or rebuilding the house and raising sockets to be ineffective measures. They also perceive implementation costs for small dykes, raising sockets, planting grass, moving away, and raising goods high to be lower. Having received flood-related information in Natete is positively related to SE raising goods high, RE moving away, RE raising goods high, RE clearing drainage, IC sandbags, IC planting grass, and IC raising goods high

In Ntinda, flood-related information-seeking negatively correlates with perceptions of self-efficacy for raising the floor or rebuilding. People

who seek flood-related information perceive raising the floor or rebuilding, putting up small dykes, planting grass, raising goods high and putting piles of sandbags to be ineffective. Lastly, they perceive putting up piles of sandbags to be costly.

On the other hand, having received flood-related information is positively related to SE raising sockets high and negatively correlated to SE for capturing rainwater and for clearing drainage and RE capturing rainwater. It is also positively correlated to RE raising goods high, IC for planting grass, Rfloor or rebuilding, small dyke, sandbags, moving away and raising goods high.

The fourth sub-objective was to establish the influence of risk aversion on households' perceptions of response and self-efficacy, and implementation costs.

I established that of all the variables considered, risk aversion has the strongest correlation with appraisals for more mitigation measures when one combines responses from the three case study areas. In Bwaise III It is positively related to perceptions of SE for Rfloor, small dykes, sandbags, capturing rainwater, and clearing drainage; RE for capturing rainwater; and IC clearing the drainage, raising sockets, planting grass, and putting up sandbags. In Natete it positively correlates with perceptions of SE for raising sockets and clearing drainage; RE of Rfloor or rebuilding, raising sockets, capturing rainwater, and planting grass; and IC small dykes, raising sockets, planting grass, capturing rainwater, moving away, and putting goods high. In Ntinda it positively correlates with perceptions of SE for Rfloor or rebuilding, small dykes, sandbags, planting grass, raising sockets, clearing drainage, and raising goods high; and IC raising sockets, planting grass, sandbags and capturing rainwater. It is however, negatively related with RE of Rfloor or rebuilding, small dykes, planting grass, capturing rainwater, clearing drainage, moving away, and raising goods high.

In general, the findings show that if more residents are conscientious about the importance of their actions, more can be achieved in terms of household and community level flood resilience.

### **Influence of existing mitigation measures on flood coping appraisals**

Under the fifth sub-objective, I sought to assess the influence of already implemented measures on the households' coping appraisals: In all the three case study areas, I found that households with existing mitigation measures perceive themselves as able to raise the floor, put up small dykes, raise sockets; and consider raising goods high to be costly but perceive sandbags to be less costly. In Natete and Ntinda,

they are also able to capture rainwater and clear the drainage channel. In addition, Ntinda households can put up sandbags and plant grass.

In Natete, they also consider raising the floor or rebuilding floor or rebuilding, raising sockets, capturing rainwater, and clearing drainage effective; and raising sockets as well as putting goods high costly. In Ntinda they consider raising the floor or rebuilding and capturing rainwater to be costly.

The findings show that residents who had the most protective measures had high perceptions of their ability to do it and they perceived structural measures to be more effective compared to those who had fewer measures.

### ***7.3.5 Factors influencing adoption of flood damage mitigation measures among micro to medium-sized businesses in Kampala***

In chapter 6, I sought to answer the last objective of the study - to determine the factors influencing the adoption of flood damage mitigation measures among micro to medium size businesses in Kampala. Specifically, I aimed at identifying the most key factors which determine the flood mitigation behaviour of micro and small businesses in Kampala through four steps.

I found that structural flood mitigation measures were common among all types and sizes of businesses and that micro-enterprises were more likely to implement non-structural measures compared to small businesses. Financial loss, risk aversion and perception of flood likelihood were found to positively relate to flood damage mitigation. Regarding the measure-specific coping appraisals, most businesses felt that they were able to put up sandbags, which was also viewed as an effective measure. Most businesses perceived rebuilding/raising the floor and clearing drainage to be very effective, easily self-implementable but high-cost measures, while only one-third of businesses expressed non-structural measures as very effective. Contrary to its popularity among proponents of the Sustainable Urban Drainage Systems (SUDS), planting of grass was identified as the most ineffective structural measure.

Among the four non-structural measures, relocation was viewed by most small businesses as an ineffective and costly measure that is, however, easily self-implementable. Having looked for information or received information influenced businesses to mitigate more. It is apparent that very few businesses have regular access to useful information regarding flood mitigation measures, especially relating to non-structural measures.

These findings imply that micro-enterprises are likely to suffer more from flooding since they rely more on non-structural measures, yet they lack information on such types of measures.

## **7.4 Innovative contributions**

From the foregoing discussion on how this study addressed its objectives, I would like to highlight some key contributions which can improve methodological processes and understanding of risk and risk perception factors. First, I explain a fieldwork procedural technique that I used to ensure data quality, given that I was working with multi-lingual field assistants. Second, I provide more theoretical insights related to the Protection Motivation Theory (PMT). Third, I give policy recommendations related to the implementation of city-wide flood mitigation measures, and support needed for local-level resilience building.

### **7.4.1 Methodological contributions**

My work (chapter 3) provided a procedural fieldwork management technique [Extended Briefing and Debriefing Technique (EBDT)] to manage rapid research fieldwork in cross-national/language settings. This technique is an extension of the Briefing and Debriefing Technique which was originally applied in the military and applied in other sectors, such as health and education. A key contribution is a philosophy that data quality control is a constant concern that is initiated during the design of data collection and continues through the data acquisition process into the data processing and analysis activities.

### **7.4.2 Disciplinary knowledge contributions**

This research applied the Protection Motivation Theory (PMT) to understand factors that motivate households and businesses to implement flood damage mitigation measures in Kampala. Therefore, it extends the geographical extent of previous studies that have focused more on Europe, the USA, Australia, and Asia and a few studies of rural areas in sub-Saharan Africa.

My work is the first to test the applicability of PMT in studies among households and businesses in sub-Saharan Africa using two different socio-economic contexts. The informal settlement micro-context was crucial because some rural-urban migrants view such places as ladders to employment and formality (Turok, 2015). It therefore follows that an additional frame is added in the decision matrix to either self-protect or not. Additionally, because of poverty some informal settlement dwellers may not protect themselves enough so that they can continue

receiving aid (charity hazard) (Osberghaus, 2015; Robinson et al., 2019).

In chapter 6, this thesis also contributed to the research discourse on businesses' motivations to mitigate, which is still in its infancy. My conclusion is that structural mitigation was common among businesses of all sizes and that most businesses perceived rebuilding/raising the floor and clearing drainage to be very effective, easily self-implementable but high-cost measures, while only one-third of businesses expressed non-structural measures as very effective, is a key contribution. Such knowledge is integral in crafting policies for business resilience and continuity in similar contexts and provides a reference point in ongoing international efforts to motivate flood damage mitigation by businesses.

## **7.5 Policy and societal implications**

This thesis provides the Kampala Capital City Authority (KCCA) and other Global South cities with a deeper analysis of the flood risk mitigation behaviour of households and businesses, and how these are related to city-wide actions and measures by the city authorities. A focus on measure specific appraisals can enable the authorities to prioritise measures that support local-level actions and to sensitise the communities accordingly, especially where community judgements, priorities and commitments are fatalistic or misguided.

KCCA should expand drainage widening to other flood-prone areas like Natete, through a participatory planning process which considers local views so that the mitigation action is effective. There is also a need for improved communication to avoid risk misjudgement after the widening of drainage channels and other mitigation measures. Risk communication should also provide more information regarding measures like capturing rainwater and planting grass since many households and businesses viewed these as ineffective. KCCA should also craft policy measures to support local-level mitigation efforts. For example, by encouraging households in informal settlements to join savings groups for them to put up more structural measures and to participate in the dredging of channels and general cleaning exercises, harnessing the *Bulungi Bwansi* campaign.

Households should seek more flood-related information, for example, by attending settlement fora where such issues are discussed - here they also get to know more about government actions and how their efforts can effectively augment them for more resilience building.

Businesses could also benefit from such fora through information sharing. Open-air businesses should also organise themselves to put up effective flood mitigation measures in places from which they operate, including also simple measures such as avoiding illegal dumping of waste.

## **7.6 Reflections on the key findings**

In this section, I reflect on the relationships between my key findings and those in the scientific literature, following the chapters sequentially.

Several scholars, like Kaufmann & Wiering, (2017), Matczak et al., (2016), Wiering et al., (2017), Hegger et al., (2014), and Driessen et al., (2018), have assessed the impacts of governance rearrangements on flood risk management in countries that follow democratic principles, using frameworks from international development agencies. By adapting the Water Governance Assessment Framework (Bressers et al., 2013; Vinke-de Kruijf et al., 2015) and applying it to Kampala, my research extends the knowledge of water governance and flood risk management through a case in which democratic principles and processes fail and the governance rearrangements entail the rollout of the State. This is crucial when critiquing flood risk management approaches in countries with authoritarian governments, many of which may be found in Africa.

In chapter three, my conclusion that data quality enhancement, especially in cross-national/language research, is a constant struggle resonates with Kuhn (1970) and Morgan (2007), that knowledge generation should be pragmatic. I demonstrate that rigidly adhering to blueprint survey procedures does not always produce objective results, especially when studying human behaviour or perceptions. The Extended Briefing and Debriefing Technique which is proposed can enable a pragmatistic approach to managing field research in new cultural and language territories, in a process akin to recent project management methodologies such as Agile (Goodpasture, 2016).

Many of my findings in chapter four confirm earlier work by others (Babcicky & Seebauer, 2015, 2019b; Botzen et al., 2019; Bubeck et al., 2012; Bubeck, et al., 2018a); for example, regarding the influence of flood severity, income, education, household size, distance from hazard, willingness to mitigate, and government actions, on household risk perception. However, my findings that looking for flood-related information leads to lower perceptions of risk is in contrast with findings in the literature. It also leads to lower self-efficacy for structural measures. An explanation for this difference in the role of information in risk perceptions and self-efficacy is that because government

information on flood risk and mitigation measures is lacking, citizens turn to informal and less credible sources of information that seemingly lower their perceptions of the flood risk they face and the utility for undertaking individual measures to reduce this risk.

In the same vein, contrary to previous studies (Działek et al., 2013; Grothmann & Reusswig, 2006b), I found that age has a negative relation to risk perception. One possible explanation for this difference is that the household structure in Kampala, and Africa at large, is generally such that older people often live as part of an extended family and, as a result, their potential fears about flood risk may be countered by a sense of protection from family/household members. This is likely to also influence the finding regarding self-efficacy and response efficacy which shows a positive influence.

Unlike the findings in the literature (Bubeck et al., 2013), where no relationship was established, more educated respondents in affluent neighbourhood of Ntinda have perceptions of low self-efficacy and response efficacy while the opposite is true for the two slum areas. Although our findings from the slum areas do not confirm the findings in the past studies, they confirm what we would expect. The unexpected results from Ntinda - the affluent neighbourhood in our study confirms what was established in past studies which were carried out in the developed world context. The unexpected findings can be attributed to low variability in the variable, since many people in these contexts are educated to post-secondary level.

In contrast with findings in the literature (Cannon et al., 2020; Koerth et al., 2013), given the high socio-economic vulnerability in Kampala, suffering flood damage does not positively influence self-efficacy for structural measures, most likely because, instead of damage motivating them to self-protect, the relatively high losses suffered incapacitates them.

Regarding business motivation, my findings confirm Kreibich et al.'s, (2007) findings that micro-enterprises are more likely to implement mitigation measures than small and medium enterprises. At the same time, they are contrary to those of Dahlhamer & D'Souza (1997). In the three cases, I found that half of the mitigation measures were already in place by 2017, which points to the importance of considering time in modelling the influences of flood damage mitigation. This might also explain why there are mixed results in the existing literature. For example, while Botzen et al, (2019) considered whether measures were implemented before or after the flood, Thieken et al., (2007) did not. In the next section, I also critique my research design in light of my findings and suggest possible ways to improve it in further studies.



That businesses with high threat appraisal tended to mitigate more is in line with past findings but my findings on coping appraisal are not. One potential cause of the difference is in the methodology. While studies by Bubeck, et al., (2018a) have combined perceptions of various mitigation measures through an index, my work looks at each measure independently and therefore provides more insights into the preferences and experiences of each measure. Such insights are more useful for guiding policy and for assigning priorities for information awareness campaigns directed at engaging businesses in autonomous flood mitigation actions.

That households and businesses who are willing to mitigate have high risk perceptions and tend to mitigate more confirms previous studies (Biernacki et al., 2008; Dahlhamer & D'souza, 1995; Poussin et al., 2014b) while businesses that rented premises tended to implement measures contrary to households, and again contrary to what other researchers established about businesses (Wedawatta et al., 2011).

Overall, many of my findings confirm past findings, some do not. This comes as no surprise given that the results on many variables measured in the literature are also mixed. My findings show that my extended version of the PMT which includes extra variables for households and for businesses, enabled me to be more comprehensive in capturing key factors of risk perception and flood damage mitigation behaviour. However, I did not get statistically adequate responses on other variables like flood benefits, perhaps because some respondents in Kampala might conceal such information in expectation of receiving more aid.

## **7.7 Limitations and future work**

Although in general the findings presented in this thesis provide insights that can help policy decisions in other contexts, this should be done carefully. First, I provided a case of risk perception and motivation for implementing protective measures in a city from the Global South, which improves our understanding of property/community level resilience-building processes in cities within similar cultural and socio-economic contexts and may not apply in different contexts.

Second, the specific characteristics of Kampala – that it experiences recurrent pluvial flooding - require one to apply these insights to areas with different flooding characteristics with caution.

Third, my study initially aimed to study changing flood risk perceptions and mitigation options over time – from 2015 to 2017, but such long-term panel data proved that it needs more time and resources that exceed the capacity of one PhD study. Future studies can consider

longitudinal designs to collect data on changing perceptions over time. To enable local authorities and other development stakeholders to take evidence-based policy directions, such longitudinal studies of flood resilience-building processes can apply Bayesian statistics, coupled with Agent-Based Models (ABMs), to provide planning support tools for flood risk management. These are powerful visualisation, negotiation, and awareness building tools that can be used in flood risk management multistakeholder meetings, for example, settlement fora in the case of Uganda. Using the PMT framework, recent work (Abdulkareem, 2019) has focused on this but applied it to disease spread.

More studies about flooding and risk perception in an African context are also needed, to establish how governance shifts and the socio-economic and cultural context in other nations on the continent have influenced flood risk management at the municipal level, community level, and property level. Such studies could also look at innovative methodologies to capture variables like flood-related benefits about which respondents may not be eager to give information.

## Bibliography

- Abdulkareem, S. A. (2019). *Enhancing agent-based models with artificial intelligence for complex decision making* [University of Twente].  
<https://research.utwente.nl/en/publications/enhancing-agent-based-models-with-artificial-intelligence-for-com>
- Abeka, E., Asante, F. A., Laube, W., & Codjoe, S. N. A. (2020). Contested causes of flooding in poor urban areas in Accra, Ghana: an actor-oriented perspective. *Environment, Development and Sustainability*, 22(4), 3033–3049.  
<https://doi.org/10.1007/s10668-019-00333-4>
- ACTogether. (2014). *Kampala Slum Profiles, Rubaga*.  
[http://askyourgov.ug/request/37/response/38/attach/2/Rubaga Municipality.pdf](http://askyourgov.ug/request/37/response/38/attach/2/Rubaga%20Municipality.pdf)
- ACTogether Uganda. (n.d.). *Bwaise III settlement profile* (pp. 1–7).  
[www.actogetherug.org/wp-content/plugins/.../download.php?id](http://www.actogetherug.org/wp-content/plugins/.../download.php?id)
- Adelekan, I. (2015). Integrated global change research in west Africa: Flood vulnerability studies. In *Global Sustainability: Cultural Perspectives and Challenges for Transdisciplinary Integrated Research* (pp. 163–184). Springer International Publishing. [https://doi.org/10.1007/978-3-319-16477-9\\_9](https://doi.org/10.1007/978-3-319-16477-9_9)
- Adelekan, I. O. (2010). Vulnerability of poor urban coastal communities to flooding in Lagos, Nigeria. *Environment and Urbanization*, 22(2), 433–450.  
<https://doi.org/10.1177/0956247810380141>
- Adelekan, I. O., & Asiyebi, A. P. (2016a). Flood risk perception in flood-affected communities in Lagos, Nigeria. *Natural Hazards*, 80(1), 445–469.  
<https://doi.org/10.1007/s11069-015-1977-2>
- Adelekan, I. O., & Asiyebi, A. P. (2016b). Flood risk perception in flood-affected communities in Lagos, Nigeria. *Natural Hazards*, 80(1), 445–469.  
<https://doi.org/10.1007/s11069-015-1977-2>
- Adida, C. L., Ferree, K. E., Posner, D. N., & Robinson, A. L. (2016). Who's Asking? Interviewer Coethnicity Effects in African Survey Data. *Comparative Political Studies*, 49(12), 1630–1660. <https://doi.org/10.1177/0010414016633487>
- Adzawla, W., Azumah, S. B., Anani, P. Y., & Donkoh, S. A. (2019). Gender perspectives of climate change adaptation in two selected districts of Ghana. *Heliyon*, 5(11).  
<https://doi.org/10.1016/j.heliyon.2019.e02854>
- Andráško, I., Dolák Klemešová, K., Dolák, L., Trojan, J., & Fiedor, D. (2020). Surely it will come again... Flood threat appraisal, mitigation strategies and protection motivation in Czech communities endangered by floods. *Moravian Geographical Reports*, 28(3), 170–186. <https://doi.org/10.2478/mgr-2020-0013>
- Antwi-Boasiako, B. A. (2016). Insurance and flood risk reduction in Ghana: do insurers penalise homeowners who take precautionary measures?  
<http://dx.doi.org/10.1080/17477891.2016.1209455>, 15(4), 343–355.  
<https://doi.org/10.1080/17477891.2016.1209455>
- Ardaya, A. B., Evers, M., & Ribbe, L. (2017). What influences disaster risk perception? Intervention measures, flood and landslide risk perception of the population living in flood risk areas in Rio de Janeiro state, Brazil. *International Journal of Disaster Risk*

- Reduction*, 25(May), 227–237. <https://doi.org/10.1016/j.ijdr.2017.09.006>
- Armaş, I., & Avram, E. (2012). Cognitive and emotional aspects in evaluating the flood risk. *Procedia - Social and Behavioural Sciences*, 33, 939–943. <https://doi.org/10.1016/j.sbspro.2012.01.260>
- Armas, I., Ionescu, R., & Posner, C. N. (2015). Flood risk perception along the Lower Danube river, Romania. *Natural Hazards*, 79(3), 1913–1931. <https://doi.org/10.1007/s11069-015-1939-8>
- Aryampa, S., Maheshwari, B., Sabiiti, E., Bateganya, N. L., & Bukenya, B. (2019). Status of waste management in the East African cities: Understanding the drivers of waste generation, collection and disposal and their impacts on Kampala City's sustainability. *Sustainability (Switzerland)*, 11(19), 1–16. <https://doi.org/10.3390/su11195523>
- Babcicky, P., & Seebauer, S. (2015). The Two Faces of Social Capital in Private Flood Mitigation: Opposing Effects on Risk Perception, Self-Efficacy and Coping Capacity. *Journal of Risk Research*, 9877(May), 1–21. <https://doi.org/10.1080/13669877.2016.1147489>
- 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. <https://doi.org/10.1080/13669877.2016.1147489>
- Babcicky, P., & Seebauer, S. (2019a). *Collective efficacy and natural hazards: differing roles of social cohesion and task-specific efficacy in shaping risk and coping beliefs*. <https://doi.org/10.1080/13669877.2019.1628096>
- Babcicky, P., & Seebauer, S. (2019b). Unpacking Protection Motivation Theory: evidence for a separate protective and non-protective route in private flood mitigation behaviour. *Journal of Risk Research*, 22(12), 1503–1521. <https://doi.org/10.1080/13669877.2018.1485175>
- Barendrecht, M. H., Viglione, A., & Blöschl, G. (2017). A dynamic framework for flood risk. *Water Security*, 1, 3–11. <https://doi.org/10.1016/j.wasec.2017.02.001>
- Bempah, A. S., & Oyhus, O. A. (2017). The role of social perception in disaster risk reduction: Beliefs, perception, and attitudes regarding flood disasters in communities along the Volta River, Ghana. *International Journal of Disaster Risk Reduction*, 23(April), 104–108. <https://doi.org/10.1016/j.ijdr.2017.04.009>
- Berman, R. C., & Tyyskä, V. (2011). A Critical Reflection on the Use of Translators/Interpreters in a Qualitative Cross-Language Research Project. *International Journal of Qualitative Methods*, 10(2), 178–190. <https://doi.org/10.1177/160940691101000206>
- Bichard, A. (2012). *Are homeowners willing to adapt to and mitigate the effects of climate change? Title Are homeowners willing to adapt to and mitigate the effects of climate change?* <https://doi.org/10.1007/s10584-011-0257-8>
- Bienacki, W., Bokwa, A., Dialek, J., & Padło, T. (2009). *Społeczności lokalne wobec zagrożeń przyrodniczych i klęsk żywiołowych* (H. A. Lisowski (ed.); Issue January 2009). Instytutu Geografii i Gospodarki Przestrzennej UJ i Gospodarki Przestrzennej Uniwersytetu Jagiellońskiego, Krakow.
- Biernacki, W., Dzialek, J., Janas, K., & Padło, T. (2008). *Community attitudes towards extreme phenomena relative to place of residence and previous experience* (pp.

- 
- 207–237). Łódzkie Towarzystwo Naukowe.
- Birkholz, S., Muro, M., Jeffrey, P., & Smith, H. M. (2014). Rethinking the relationship between flood risk perception and flood management. *Science of the Total Environment*, 478, 12–20. <https://doi.org/10.1016/j.scitotenv.2014.01.061>
- Boholm, A. (1998). Comparative studies of risk perception: a review of twenty years of research. *Journal of Risk Research*, 1(2), 135–163. <https://doi.org/10.1080/136698798377231>
- Boholm, A. (2011). Comparative studies of risk perception : a review of twenty years of research. *Journal of Risk Research*, 1(2), 135–163. <https://doi.org/10.1080/136698798377231>
- Botzen, W. J., Aerts, J., & Bergh, V. Den. (2009). Dependence of flood risk perceptions on socioeconomic and objective risk factors. *Water Resources Research*, 45(May), 1–15. <https://doi.org/10.1029/2009WR007743>
- Botzen, W. J., Kunreuther, H., & Michel-Kerjan, E. (2015). Divergence between individual perceptions and objective indicators of tail risks: Evidence from floodplain residents in New York City. *Judgment and Decision Making*, 10(4), 365–385. <http://journal.sjdm.org/15/15415/jdm15415.pdf>
- Botzen, W. J. W., Kunreuther, H., Czajkowski, J., & de Moel, H. (2019). Adoption of Individual Flood Damage Mitigation Measures in New York City: An Extension of Protection Motivation Theory. *Risk Analysis*, 39(10), 2143–2159. <https://doi.org/10.1111/risa.13318>
- Botzen, W. J. W., Kunreuther, H., Czajkowski, J., & Moel, H. (2019). Adoption of Individual Flood Damage Mitigation Measures in New York City: An Extension of Protection Motivation Theory. *Risk Analysis*, 39(10), 2143–2159. <https://doi.org/10.1111/risa.13318>
- Bradford, R. a., O'Sullivan, J. J., Van Der Craats, I. M., Krywkow, J., Rotko, P., Aaltonen, J., Bonaiuto, M., De Dominicis, S., Waylen, K., & Schelfaut, K. (2012). Risk perception - Issues for flood management in Europe. *Natural Hazards and Earth System Science*, 12(7), 2299–2309. <https://doi.org/10.5194/nhess-12-2299-2012>
- Bressers, H., de Boer, C., Kuks, S., Özerol, G., Vinke-De Kruijf, J., Furuso, C., Lajeunesse, I., Larue, C., Ramos, M.-H., Kampa, E., Stein, U., Troltzsch, J., Vidaurre, R., & Browne, A. (2013). *Water Governance Assessment Tool*. <https://research.utwente.nl/en/publications/water-governance-assessment-tool-with-an-elaboration-for-drought->
- Brody, S. D., Kang, J. E., & Bernhardt, S. (2010). Identifying factors influencing flood mitigation at the local level in Texas and Florida: The role of organizational capacity. *Natural Hazards*, 52(1), 167–184. <https://doi.org/10.1007/s11069-009-9364-5>
- Bubeck, P., Botzen, W. J. W., Kreibich, H., & Aerts, J. C. J. H. (2013). Detailed insights into the influence of flood-coping appraisals on mitigation behaviour. *Global Environmental Change*, 23(5), 1327–1338. <https://doi.org/10.1016/j.gloenvcha.2013.05.009>
- Bubeck, P., Botzen, W. J. W., Kreibich, H., & Aerts, J. C. J. H. (2013). Detailed insights into the influence of flood-coping appraisals on mitigation behaviour. *Global Environmental Change*, 23(5), 1327–1338. <https://doi.org/10.1016/j.gloenvcha.2013.05.009>

## Bibliography

---

- Bubeck, P., Botzen, W. J. W., Kreibich, H., & H. Aerts, J. C. J. (2012). Long-term development and effectiveness of private flood mitigation measures: An analysis for the German part of the river Rhine. *Natural Hazards and Earth System Sciences*, 12(11), 3507–3518. <https://doi.org/10.5194/nhess-12-3507-2012>
- Bubeck, Philip, Botzen, W. J., Laudan, J., Aerts, J. C. J. H., & 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. <https://doi.org/10.1111/risa.12938>
- Bubeck, Philip, Wouter Botzen, W. J., Laudan, J., Aerts, J. C. J. H., & Thieken, A. H. (2018a). Insights into Flood-Coping Appraisals of Protection Motivation Theory: Empirical Evidence from Germany and France. *Risk Analysis*, 38(6), 1239–1257. <https://doi.org/10.1111/risa.12938>
- Bubeck, Philip, Wouter Botzen, W. J., Laudan, J., Aerts, J. C. J. H., & Thieken, A. H. (2018b). Insights into Flood-Coping Appraisals of Protection Motivation Theory: Empirical Evidence from Germany and France. *Risk Analysis*, 38(6), 1239–1257. <https://doi.org/10.1111/risa.12938>
- Burningham, K., Fielding, J., & Thrush, D. (2008). 'It'll never happen to me': understanding public awareness of local flood risk. *Disasters*, 32(2), 216–238. <https://doi.org/10.1111/j.1467-7717.2007.01036.x>
- Cannon, C., Gotham, K. F., Lauve-Moon, K., & Powers, B. (2020). From the general to the specific: the influence of confidence and trust on flood risk perception. *Journal of Risk Research*, 0(0), 1–19. <https://doi.org/10.1080/13669877.2020.1806909>
- Chai, D., Wang, M., & Liu, K. (2020). Driving factors of natural disasters in belt and road countries. *International Journal of Disaster Risk Reduction*, 51(August), 101774. <https://doi.org/10.1016/j.ijdrr.2020.101774>
- Chereni, S. (2016). *Determinants of in-situ flood damage mitigation in Bwaise III, Kampala, Uganda* [University of Twente]. [https://webapps.itc.utwente.nl/librarywww/papers\\_2016/msc/upm/chereni.pdf](https://webapps.itc.utwente.nl/librarywww/papers_2016/msc/upm/chereni.pdf)
- Chereni, S., Sliuzas, R. V., Flacke, J., & van Maarseveen, M. V. (2020). The influence of governance rearrangements on flood risk management in Kampala, Uganda. *Environmental Policy and Governance*. <https://doi.org/10.1002/eet.1881>
- Chereni, S., Sliuzas, R. V., & Flacke, J. (2020). An extended briefing and debriefing technique to enhance data quality in cross-national/language mixed-method research. *International Journal of Social Research Methodology*. <https://doi.org/10.1080/13645579.2020.1731992>
- Chrysestom, K. (2012). *The changing face of Ntinda; There is no stopping*. Blogspot. <http://www.kchrys.blogspot.nl/2012/05/changing-face-of-ntinda-there-is-no.html>
- Colten, C. E., & Sumpter, A. R. (2009). Social memory and resilience in New Orleans. *Natural Hazards*, 48(3), 355–364. <https://doi.org/10.1007/s11069-008-9267-x>
- Comănescu, L., & Nedelea, A. (2016). Floods and Public Perception on their Effect . Case Study : Tecuci Plain Floods and public perception on their effect . Case Study : Tecuci Plain ( Romania ), year 2013. *Procedia Environmental Sciences*, 32, 190–199. <https://doi.org/10.1016/j.proenv.2016.03.024>
- CRED. (2021). Disaster Year in Review 2020 Global Trends and Perspectives. In *Cred Crunch: Vol. May* (Issue 62, pp. 2020–2021). <https://cred.be/sites/default/files/CredCrunch62.pdf>

- 
- CRED - Catholic University Leuven, & UNISDR. (2017). *Economic Losses, Poverty & Disasters - 1998-2017*. [https://www.unisdr.org/2016/iddr/IDDR2018\\_Economic Losses.pdf](https://www.unisdr.org/2016/iddr/IDDR2018_EconomicLosses.pdf)
- Crichton, D. (2006). Climate Change and its Effects on Small Businesses in the UK. In *AXA Insurance UK* (Issue August). <http://www.ukcip.org.uk/wordpress/wp-content/CLARA/AXAClimateChange.pdf>
- Cutter, S. L., Boruff, B. J., & Shirley, W. L. (2003). Social Vulnerability to Environmental Hazards\*. *Social Science Quarterly*, 84(2), 242–261. <https://doi.org/10.1111/1540-6237.8402002>
- Dahlhamer, J., & D'Souza, M. J. (1997). Determinants of Business Disaster preparedness in two U.S. Metropolitan areas. *International Journal of Mass Emergencies and Disasters*, 15(2), 265–281. <http://www.ijmed.org/articles/333/download/>
- Dahlhamer, J. M., & D'souza, M. J. (1995). *Determinants Of Business Disaster Preparedness In Two U.S. Metropolitan Areas*.
- Davies, C., & Laforzezza, R. (2019). Transition path to the adoption of nature-based solutions. *Land Use Policy*, 80, 406–409. <https://doi.org/https://doi.org/10.1016/j.landusepol.2018.09.020>
- de Koning, K., Filatova, T., Need, A., & Bin, O. (2019). Avoiding or mitigating flooding: Bottom-up drivers of urban resilience to climate change in the USA. *Global Environmental Change*, 59(September). <https://doi.org/10.1016/j.gloenvcha.2019.101981>
- Devex. (2020). *In cities of the global south, resilience is the only way forward*. Inside Development. <https://www.devex.com/news/sponsored/in-cities-of-the-global-south-resilience-is-the-only-way-forward-98438>
- Diakakis, M., Priskos, G., & Skordoulis, M. (2018). Public perception of flood risk in flash flood prone areas of Eastern Mediterranean : The case of Attica Region in Greece. *International Journal of Disaster Risk Reduction*, 28(December 2017), 404–413. <https://doi.org/10.1016/j.ijdr.2018.03.018>
- Driessen, P. P. J., Hegger, D. L. T., Kundzewicz, Z. W., van Rijswijk, H. F. M. W., Crabbé, A., Larrue, C., Matczak, P., Pettersson, M., Priest, S., Suykens, C., Raadgever, G. T., & Wiering, M. (2018). Governance strategies for improving flood resilience in the face of climate change. *Water*, 10(11), 1–16. <https://doi.org/10.3390/w10111595>
- Działek, J., Biernacki, W., & Bokwa, A. (2013). Challenges to social capacity building in flood-affected areas of southern Poland. *Hazards Earth Syst. Sci*, 13, 2555–2566. <https://doi.org/10.5194/nhess-13-2555-2013>
- Elliott, D. E. (1983). Risk and Culture: An Essay on the Selection of Technological and Environmental Dangers. *Yale Law Journal*, 2192, 888–899. <https://doi.org/10.2307/2067477>
- Englander, T., Farago, K., Slovic, P., & Fischhoff, B. (1986). *A Comparative Analysis of Risk Perception in Hungary and the United States*.
- European Commission. (2013). *Disaster Risk Reduction: Increasing resilience by reducing disaster risk in humanitarian action* (DG ECHO Thematic Policy Document Number 5, Issue September). [https://ec.europa.eu/echo/files/policies/prevention\\_preparedness/DRR\\_thematic\\_policy\\_doc.pdf](https://ec.europa.eu/echo/files/policies/prevention_preparedness/DRR_thematic_policy_doc.pdf)

## Bibliography

---

- Everett, G., & Lamond, J. (2014). Household behaviour in installing property-level flood adaptations: A literature review. *WIT Transactions on Ecology and the Environment*, 179, 511–522. <https://doi.org/10.2495/SC130431>
- Fox-Rogers, L., Devitt, C., O'Neill, E., Brereton, F., & Clinch, J. P. (2016). Is there really “nothing you can do”? Pathways to enhanced flood-risk preparedness. *Journal of Hydrology*, 543, 330–343. <https://doi.org/10.1016/j.jhydrol.2016.10.009>
- Fraser, A. (2017). The missing politics of urban vulnerability: The state and the co-production of climate risk. *Environment and Planning A*, 49(12), 2835–2852. <https://doi.org/10.1177/0308518X17732341>
- Goodpasture, J. C. (2016). Project Management the Agile way: Making it Work in the Enterprise. In *Management* (2nd ed.). John Ross Publishing.
- Grothmann, T., & Patt, A. (2005). Adaptive capacity and human cognition: The process of individual adaptation to climate change. *Global Environmental Change*, 15(3), 199–213. <https://doi.org/10.1016/j.gloenvcha.2005.01.002>
- Grothmann, T., & Reusswig, F. (2006a). People at risk of flooding: Why some residents take precautionary action while others do not. *Natural Hazards*, 38(1–2), 101–120. <https://doi.org/10.1007/s11069-005-8604-6>
- Grothmann, T., & Reusswig, F. (2006b). People at risk of flooding: Why some residents take precautionary action while others do not. *Natural Hazards*, 38(1–2), 101–120. <https://doi.org/10.1007/s11069-005-8604-6>
- Guy Morgan, by, McElrath, R., Allison-Hope, D., & Prattico, E. (2016). *The Future of Stakeholder Engagement: Transformative Engagement for Inclusive Business* (Issue October). [https://www.bsr.org/reports/BSR\\_Future\\_of\\_Stakeholder\\_Engagement\\_Report.pdf](https://www.bsr.org/reports/BSR_Future_of_Stakeholder_Engagement_Report.pdf)
- Haer, T., Botzen, W. J. W., de Moel, H., & Aerts, J. C. J. H. (2015). Stimulating Household Flood Risk Mitigation Investments Through Insurance and Subsidies: An Agent Based Model Approach. *European Association of Environmental and Resource Economists 21st Annual Conference 24 - 27 June 2015, Helsinki, Finland*, 1–43.
- Hegger, D. L. T., Driessen, P. P. J., Dieperink, C., Wiering, M. A., Raadgever, G. T. T., & van Rijswijk, H. F. M. . (2014). Assessing Stability and Dynamics in Flood Risk Governance An Empirically Illustrated Research Approach. *Water Resource Management*. <https://doi.org/10.1007/s11269-014-0732-x>
- Howe, P. D. (2011). Hurricane preparedness as anticipatory adaptation: A case study of community businesses. *Global Environmental Change*, 21(2), 711–720. <https://doi.org/10.1016/J.GLOENVCHA.2011.02.001>
- IPCC. (2015). PART A working group II. In *Statewide Agricultural Land Use Baseline 2015* (Vol. 1). <https://doi.org/10.1017/CBO9781107415324.004>
- IUCN. (2016). What are Nature-based Solutions? In E. Cohen-Shacham, G. Walters, C. Janzen, & S. Maginnis (Eds.), *Nature-based solutions to address global societal challenges*. IUCN. <https://portals.iucn.org/library/sites/library/files/documents/2016-036.pdf>
- Jasanoff, S. (1998). The political science of risk perception. *Reliability Engineering & System Safety*, 59(1), 91–99. [https://doi.org/10.1016/S0951-8320\(97\)00129-4](https://doi.org/10.1016/S0951-8320(97)00129-4)
- Jha, A. K., Bloch, R., & Lamond, J. (2012a). *Cities and Flooding: A Guide to Integrated*



- 
- Urban Flood Risk Management for the 21st Century*. <https://doi.org/10.1596/978-0-8213-8866-2>
- Jha, A. K., Bloch, R., & Lamond, J. (2012b). Cities and Flooding. In *Cities and Flooding*. The World Bank. <https://doi.org/10.1596/978-0-8213-8866-2>
- Kamoen, N., Holleman, B., & van den Bergh, H. (2013). Positive, negative, and bipolar questions: The effect of question polarity on ratings of text readability. *Survey Research Methods*, 7(3), 181–189. <https://doi.org/10.18148/srm/2013.v7i3.5034>
- Kaufmann, M., & Wiering, M. (2017). Discursive junctions in flood risk governance e A comparative understanding in six European countries. *Journal of Environmental Management*, 196, 376–386. <https://doi.org/10.1016/j.jenvman.2017.03.012>
- KCCA. (2011). *Kampala Physical Development Plan: Situational Report Appendices* (pp. 1–121). KCCA.
- Kellens, W., Zaalberg, R., Neutens, T., Vanneuvillie, W., & De Maeyer, P. (2011). An Analysis of the Public Perception of Flood Risk on the Belgian Coast. *Risk Analysis*, 31(7), 1055–1068. <https://doi.org/10.1111/j.1539-6924.2010.01571.x>
- Kellens, W., Zaalberg, R., Vanneuvillie, W., Neutens, T., & De Maeyer, P. (2011). An Analysis of the Public Perception of Flood Risk on the Belgian Coast. *Risk Analysis*, September 2015, 1–19. <https://doi.org/10.1111/j.1539-6924.2010.01571.x>
- Kleinhesselink, R. R., & Rosa, E. A. (1991). Cognitive Representation of Risk Perceptions. *Journal of Cross-Cultural Psychology*, 22(1), 11–28. <https://doi.org/10.1177/0022022191221004>
- Knocke, E. T., & Kolivras, K. N. (2007). Flash Flood Awareness in Southwest Virginia. *Risk Analysis*, 27(1), 155–169. <https://doi.org/10.1111/j.1539-6924.2006.00866.x>
- Koerth, J., Vafeidis, A. T., Hinkel, J., & Sterr, H. (2013). What motivates coastal households to adapt pro-actively to sea-level rise and increasing flood risk? *Regional Environmental Change*, 13(4), 897–909. <https://doi.org/10.1007/s10113-012-0399-x>
- Kousky, C., & Kunreuther, H. (2009). *Improving Flood Insurance and Flood Risk Management Insights from St. Louis, Missouri*. [www.rff.org](http://www.rff.org)
- Kreibich, H., Christenberger, S., & Schwarze, R. (2011). Economic motivation of households to undertake private precautionary measures against floods. *Natural Hazards and Earth System Science*, 11(2), 309–321. <https://doi.org/10.5194/nhess-11-309-2011>
- Kreibich, H., Thieken, A. H., Petrow, T., Müller, M., & Merz, B. (2005). Flood loss reduction of private households due to building precautionary measures – lessons learned from the Elbe flood in August 2002. *Natural Hazards and Earth System Science*, 5(1), 117–126. <https://doi.org/10.5194/nhess-5-117-2005>
- Kreibich, Heidi, Müller, M., Thieken, A. H., & Merz, B. (2007). Flood precaution of companies and their ability to cope with the flood in August 2002 in Saxony, Germany. *Water Resources Research*, 43(3), 1–46. <https://doi.org/10.1029/2005WR004691>
- Kuhn, T. S. (1970). The Structure of Scientific Revolutions. In *Philosophical Review: Vol. II* (Issue 2). University of Chicago. <https://doi.org/10.1119/1.1969660>
- Lavell, A., Oppenheimer, M., Diop, C., Hess, J., Lempert, R., Li, J., Muir-Wood, R., Myeong, S., Moser, S., Takeuchi, K., Cardona, O. D., Hallegatte, S., Lemos, M.,

## Bibliography

---

- Little, C., Lotsch, A., & Weber, E. (2012). Climate change: New dimensions in disaster risk, exposure, vulnerability, and resilience. In C. B. Field, V. Barros, T. F. Stocker, & Q. Dahe (Eds.), *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: Special Report of the Intergovernmental Panel on Climate Change* (Vol. 9781107025, pp. 25–64). Cambridge University Press. <https://doi.org/10.1017/CBO9781139177245.004>
- Lechowska, E. (2018). What determines flood risk perception? A review of factors of flood risk perception and relations between its basic elements. *Natural Hazards*, 94, 1341–1366. <https://doi.org/10.1007/s11069-018-3480-z>
- Lindell, M. K., & Hwang, S. N. (2008). Households' Perceived Personal Risk and Responses in a Multihazard Environment. *Risk Analysis*, 28(2), 539–556. <https://doi.org/10.1111/j.1539-6924.2008.01032.x>
- Liu, D., Li, Y., Shen, X., Xie, Y., & Zhang, Y. (2018). International Journal of Disaster Risk Reduction Flood risk perception of rural households in western mountainous regions of. *International Journal of Disaster Risk Reduction*, 27(2001), 155–160. <https://doi.org/10.1016/j.ijdrr.2017.09.051>
- Ludy, J., & Kondolf, G. M. (2012). Flood risk perception in lands “protected” by 100-year levees. *Natural Hazards*, 61(2), 829–842. <https://doi.org/10.1007/s11069-011-0072-6>
- Lwasa, S. (2010). Adapting urban areas in Africa to climate change: the case of Kampala. *Current Opinion in Environmental Sustainability*, 2, 166–171. <https://doi.org/10.1016/j.cosust.2010.06.009>
- Mabuku, M. P., Senzanje, A., Mudhara, M., Jewitt, G., & Mulwafu, W. (2018). Rural households' flood preparedness and social determinants in Mwindi district of Zambia and Eastern Zambezi Region of Namibia. *International Journal of Disaster Risk Reduction*, 28, 284–297. <https://doi.org/10.1016/j.ijdrr.2018.03.014>
- Maganda, A. (2012). *Know your hood: Ntinda, the fast-growing commercial hub* - Daily Monitor. Daily Monitor. <http://www.monitor.co.ug/Magazines/HomesandProperty/Know-your-hood--Ntinda--the-fast-growing-commercial-hub/-/689858/1529090/-/y4i7c5/-/index.html>
- Matczak, P., Wiering, M., Lewandowski, J., Schellenberger, T., Trémorin, J. B., Crabbé, A., Ganzevoort, W., Kaufmann, M., Larrue, C., Lieferink, D., & Mees, H. (2016). *Comparing flood risk governance in six European countries: strategies, arrangements and institutional dynamics*. <http://www.starflood.eu/documents/2016/04/comparison-of-countries.pdf>
- Messner, F., & Meyer, V. (2006). Flood Damage , Vulnerability and Risk Perception – Challenges for Flood Damage. *Flood Risk Management: Hazards, Vulnerability and Mitigation Measures*, 149–167. <https://doi.org/10.1007/978-1-4020-4598-1>
- 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, 164–173. <https://doi.org/10.1016/j.jenvp.2007.10.006>
- Moors, G. (2008). Exploring the effect of a middle response category on response style in attitude measurement. *Quality and Quantity*, 42(6), 779–794. <https://doi.org/10.1007/s11135-006-9067-x>
- 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. <https://doi.org/10.1177/2345678906292462>
- Morss, R. E., Mulder, K. J., Lazo, J. K., & Demuth, J. L. (2016). How do people perceive, understand, and anticipate responding to flash flood risks and warnings? Results from a public survey in Boulder, Colorado, USA. *Journal of Hydrology*, 541, 649–664. <https://doi.org/10.1016/j.jhydrol.2015.11.047>
- Muinde, D. K. (2013). *Assessing the effects of land tenure on urban developments in Kampala*. 64. [http://www.itc.nl/library/papers\\_2013/msc/upm/muinde.pdf](http://www.itc.nl/library/papers_2013/msc/upm/muinde.pdf)
- Nadraiqere, E. (2014). *URBAN DESIGN WITH SUSTAINABLE DRAINAGE “A Case Study for Kampala ’s Expansion”*. University of Twente.
- O’Neill, E., Brereton, F., Shahumyan, H., & Clinch, J. P. (2016). The Impact of Perceived Flood Exposure on Flood-Risk Perception: The Role of Distance. *Risk Analysis*, 36(11), 2158–2186. <https://doi.org/10.1111/risa.12597>
- Oakley, M., Himmelweit, S. M., Leinster, P., & Casado, M. R. (2020). Protection motivation theory: A proposed theoretical extension and moving beyond rationality-the case of flooding. *Water (Switzerland)*, 12(7), 1848. <https://doi.org/10.3390/W12071848>
- Osberghaus, D. (2015). The determinants of private flood mitigation measures in Germany - Evidence from a nationwide survey. *Ecological Economics*, 110, 36–50. <https://doi.org/10.1016/j.ecolecon.2014.12.010>
- Patel, C. E., & Fatti, Z. (2013). Perceptions and responses to urban flood risk: Implications for climate governance in the South. *Applied Geography*, 36, 13–22. [http://ac.els-cdn.com/S0143622812000677/1-s2.0-S0143622812000677-main.pdf?\\_tid=abc94be0-02cf-11e5-8a7b-00000aab0f6b&acdnat=1432552846\\_64561c336f102750752c935b3b08bf62](http://ac.els-cdn.com/S0143622812000677/1-s2.0-S0143622812000677-main.pdf?_tid=abc94be0-02cf-11e5-8a7b-00000aab0f6b&acdnat=1432552846_64561c336f102750752c935b3b08bf62)
- Poussin, J. K., Botzen, W. J. W., & Aerts, J. C. J. H. (2014a). Factors of influence on flood damage mitigation behaviour by households. *Environmental Science and Policy*, 40(JUNE 2014), 69–77. <https://doi.org/10.1016/j.envsci.2014.01.013>
- Poussin, J. K., Botzen, W. J. W., & Aerts, J. C. J. H. (2014b). Factors of influence on flood damage mitigation behaviour by households. *Environmental Science and Policy*, 40, 69–77. <https://doi.org/10.1016/j.envsci.2014.01.013>
- Qasim, S., Nawaz Khan, A., Prasad Shrestha, R., & Qasim, M. (2015a). Risk perception of the people in the flood prone Khyber Pukthunkhwa province of Pakistan. *International Journal of Disaster Risk Reduction*, 14, 373–378. <https://doi.org/10.1016/j.ijdr.2015.09.001>
- Qasim, S., Nawaz Khan, A., Prasad Shrestha, R., & Qasim, M. (2015b). Risk perception of the people in the flood prone Khyber Pukthunkhwa province of Pakistan. *International Journal of Disaster Risk Reduction*, 14, 373–378. <https://doi.org/10.1016/j.ijdr.2015.09.001>
- Raaijmakers, R., Krywkow, J., & van der Veen, A. (2008a). Flood risk perceptions and spatial multi-criteria analysis: An exploratory research for hazard mitigation. *Natural Hazards*, 46(3), 307–322. <https://doi.org/10.1007/s11069-007-9189-z>
- Raaijmakers, R., Krywkow, J., & van der Veen, A. (2008b). Flood risk perceptions and spatial multicriteria analysis: an exploratory research for hazard mitigation. *Nat Hazards*, 46, 307–322. <https://doi.org/10.1007/s11069-007-9189-z>
- Rana, I. A., Jamshed, A., Younas, Z. I., & Bhatti, S. S. (2020). Characterizing flood risk

- perception in urban communities of Pakistan. *International Journal of Disaster Risk Reduction*, 46(March), 101624. <https://doi.org/10.1016/j.ijdr.2020.101624>
- Raška, P. (2015a). Flood risk perception in Central-Eastern European members states of the EU: a review. In *Natural Hazards* (Vol. 79, Issue 3, pp. 2163–2179). Springer Netherlands. <https://doi.org/10.1007/s11069-015-1929-x>
- Raška, P. (2015b). Flood risk perception in Central-Eastern European members states of the EU: a review. *Natural Hazards*, 79(3), 2163–2179. <https://doi.org/10.1007/s11069-015-1929-x>
- Richmond, A., Myers, I., & Namuli, H. (2018). Urban Informality and Vulnerability : A Case Study in Kampala , Uganda. *Urban Science*, 2(22), 1–13. <https://doi.org/10.3390/urbansci2010022>
- Robinson, P. J., Botzen, W. J. W., & Zhou, F. (2019). *An experimental study of charity hazard The effect of risky and ambiguous government compensation on flood insurance demand* (No. 19–19; 19-19, Issues 19–19). [www.uu.nl/use/research](http://www.uu.nl/use/research)
- Rogers, R. W. (1975). A Protection Motivation Theory of Fear Appeals and Attitude Change. *The Journal of Psychology*, 91(1), 93–114. <https://doi.org/10.1080/00223980.1975.9915803>
- Rohrmann, B. (1994). Risk perception of different societal groups: Australian findings and crossnational comparisons. *Australian Journal of Psychology*, 46(3), 150–163. <https://doi.org/10.1080/00049539408259490>
- Satterthwaite, D. (2020). *An urbanising world | International Institute for Environment and Development*. Blogpost. <https://www.iied.org/urbanising-world>
- Satterthwaite, D. (2011). How urban societies can adapt to resource shortage and climate change. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 369(1942), 1762–1783. <https://doi.org/10.1098/rsta.2010.0350>
- Satterthwaite, D., Archer, D., Colenbrander, S., Dodman, D., Hardoy, J., Mitlin, D., & Patel, S. (2020). Building Resilience to Climate Change in Informal Settlements. *One Earth*, 2(2), 143–156. <https://doi.org/10.1016/J.ONEEAR.2020.02.002>
- Schlef, K. E., Kaboré, L., Karambiri, H., Yang, Y. C. E., & Brown, C. M. (2018). Relating perceptions of flood risk and coping ability to mitigation behaviour in West Africa: Case study of Burkina Faso. *Environmental Science and Policy*, 89, 254–265. <https://doi.org/10.1016/j.envsci.2018.07.013>
- Schmuck, H. (2000). “An Act of Allah”: Religious Explanations for Floods in Bangladesh as Survival Strategy - International Journal of Mass Emergencies and Disasters. *International Journal of Mass Emergencies and Disasters*, 18(10), 85–95. <http://ijmed.org/articles/167/>
- Seebauer, S., & Babicky, P. (2020). The Sources of Belief in Personal Capability: Antecedents of Self-Efficacy in Private Adaptation to Flood Risk. *Risk Analysis*, 40(10), 1967–1982. <https://doi.org/10.1111/risa.13531>
- Shorten, A., & Smith, J. (2017). Mixed methods research: Expanding the evidence base. *Evidence-Based Nursing*, 20(3), 74–75. <https://doi.org/10.1136/eb-2017-102699>
- 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. <https://doi.org/10.1111/j.1539-6924.2006.00792.x>

- 
- Simiyu, S., Cairncross, S., & Swilling, M. (2019). Understanding Living Conditions and Deprivation in Informal Settlements of Kisumu, Kenya. *Urban Forum*, 30, 243–244. <https://doi.org/10.1007/s12132-018-9360-5>
- Sjoberg, L. (1998). Worry and Risk Perception. *Risk Analysis*, 18(1), 85–93. [https://doi.org/0272-4332/98/0200-0085\\$15.00/1](https://doi.org/0272-4332/98/0200-0085$15.00/1)
- Slovic, P. (1987). Perception of Risk. *Science*, 236. <http://www.heatherlench.com/wp-content/uploads/2008/07/slovic.pdf>
- Sultana, F. (2010). Living in hazardous waterscapes: Gendered vulnerabilities and experiences of floods and disasters. *Environmental Hazards*, 9(1), 43–53. <https://doi.org/10.3763/ehaz.2010.SI02>
- Tazen, F., Diarra, A., Kabore, R. F. W., Ibrahim, B., Bologo/Traoré, M., Traoré, K., & Karambiri, H. (2019). Trends in flood events and their relationship to extreme rainfall in an urban area of Sahelian West Africa: The case study of Ouagadougou, Burkina Faso. *Journal of Flood Risk Management*, 12(S1). <https://doi.org/10.1111/jfr3.12507>
- Terpstra, T. (2011a). Emotions, Trust, and Perceived Risk: Affective and Cognitive Routes to Flood Preparedness Behaviour. *Risk Analysis*, 31(10), 1658–1675. <https://doi.org/10.1111/j.1539-6924.2011.01616.x>
- Terpstra, T. (2011b). Emotions, Trust, and Perceived Risk: Affective and Cognitive Routes to Flood Preparedness Behaviour. *Risk Analysis*, 31(10), 1658–1675. <https://doi.org/10.1111/j.1539-6924.2011.01616.x>
- THIEKEN, A. H., KREIBICH, H., MÜLLER, M., & MERZ, B. (2007). Coping with floods: preparedness, response and recovery of flood-affected residents in Germany in 2002. *Hydrological Sciences Journal*, 52(5), 1016–1037. <https://doi.org/10.1623/hysj.52.5.1016>
- Thieken, A. H., Kreibich, H., Müller, M., Merz, B., Thieken, A. H., Kreibich, H., & Müller, M. (2010). Coping with floods : preparedness , response and recovery of flood-affected residents in Germany in 2002 Coping with floods : preparedness , response and recovery of flood-affected residents in Germany in 2002. *Hydrological Sciences Journal*, 52(5), 1016–1037. <https://doi.org/10.1623/hysj.52.5.1016>
- Thistlethwaite, J., Henstra, D., Brown, C., & Scott, D. (2018). How Flood Experience and Risk Perception Influences Protective Actions and Behaviours among Canadian Homeowners. *Environmental Management*, 61(2), 197–208. <https://doi.org/10.1007/s00267-017-0969-2>
- Thompson, H., Shepherd, B., Honwana Welch, G., & Anyimadu, A. (2017). *Developing Businesses of Scale in Sub-Saharan Africa*. <https://www.chathamhouse.org/sites/default/files/publications/research/2017-09-08-business-of-scale-africa-thompson-shepherd-welch-anyimadu.pdf>
- Trenberth, K. E. (2008). The Impact of Climate Change and Variability on Heavy Precipitation, Floods, and Droughts. In *Encyclopedia of Hydrological Sciences*. John Wiley & Sons, Ltd. <https://doi.org/10.1002/0470848944.hsa211>
- Turok, I. (2015). *Informal Settlements: poverty traps or ladders to work?* <http://repository.hsra.ac.za/handle/20.500.11910/9328>
- Twinomuhangi, R., Sseviiri, H., Mulinde, C., Mukwaya, P. I., Nimusiima, A., & Kato, A. M. (2021). Perceptions and vulnerability to climate change among the urban poor in Kampala City, Uganda. *Regional Environmental Change*, 21(2).

- <https://doi.org/10.1007/s10113-021-01771-5>
- Uganda Bureau of Statistics. (2017). *National Population and Housing Census 2014 Area Specific Profiles Kampala Capital City Authority*. [www.ubos.org](http://www.ubos.org)
- UN-Habitat. (2013a). *Flood Risk Assessment, Strategies and Actions for Improving Flood Risk Management in Kampala* (Issue November).  
<https://research.utwente.nl/en/publications/flood-risk-assessment-strategies-and-actions-for-improving-flood->
- UN-Habitat. (2013b). *Flood Risk Assessment, Strategies and Actions for Improving Flood Risk Management in Kampala* (Issue November).
- Vávra, J., Lapka, M., Cudlínová, E., & Dvořáková-Líšková, Z. (2017). Local perception of floods in the Czech Republic and recent changes in state flood management strategies. *Journal of Flood Risk Management*, 10(2), 238–252.  
<https://doi.org/10.1111/jfr3.12156>
- Vermeiren, K., Van Rompaey, A., Loopmans, M., Serwajja, E., & Mukwaya, P. (2012). Urban growth of Kampala, Uganda: Pattern analysis and scenario development. *Landscape and Urban Planning*, 106(2), 199–206.  
<https://doi.org/10.1016/J.LANDURBPLAN.2012.03.006>
- Vinke-de Kruijf, J., Kuks, S. M. M., & Augustijn, D. C. M. (2015). Governance in support of integrated flood risk management? The case of Romania. *Environmental Development*, 16, 104–118. <https://doi.org/10.1016/j.envdev.2015.04.003>
- Wachinger, G., & Renn, O. (2010). Risk perception and natural hazards. In *CapHaz-Net Consortium* (Issue WP3).
- 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. <https://doi.org/10.1111/j.1539-6924.2012.01942.x>
- Wannous, C., & Velasquez, G. (2017). United Nations Office for Disaster Risk Reduction (UNISDR)—UNISDR's Contribution to Science and Technology for Disaster Risk Reduction and the Role of the International Consortium on Landslides (ICL). In *Advancing Culture of Living with Landslides* (pp. 109–115). Springer International Publishing. [https://doi.org/10.1007/978-3-319-59469-9\\_6](https://doi.org/10.1007/978-3-319-59469-9_6)
- Wedawatta, G., Ingirige, B., & Proverbs, D. (2011). Adaptation to flood risk: the case of businesses in the UK. *International Conference on Building Resilience*, 1–12.  
<http://usir.salford.ac.uk/18256/>
- Wiering, M., Kaufmann, M., Mees, H., Schellenberger, T., Ganzevoort, W., Hegger, D. L. T., Larrue, C., & Matczak, P. (2017). Varieties of flood risk governance in Europe: How do countries respond to driving forces and what explains institutional change? *Global Environmental Change*, 44(December 2015), 15–26.  
<https://doi.org/10.1016/j.gloenvcha.2017.02.006>
- Zaalberg, R., Midden, C., Meijnders, A., & McCalley, T. (2009). Prevention, Adaptation, and Threat Denial: Flooding Experiences in the Netherlands. *Risk Analysis*, 29(12), 1759–1778. <https://doi.org/10.1111/j.1539-6924.2009.01316.x>
- Zhang, Y., Hwang, S. N., & Lindell, M. K. (2010). Hazard Proximity or Risk Perception? Evaluating Effects of Natural and Technological Hazards on Housing Values. *Environment and Behaviour*, 42(5), 597–624.  
<https://doi.org/10.1177/0013916509334564>

- 
- Ziervogel, G., Waddell, J., Smit, W., & Taylor, A. (2014). Flooding in Cape Town's informal settlements: barriers to collaborative urban risk governance. *South African Geographical Journal*, June, 1–20. <https://doi.org/10.1080/03736245.2014.924867>
- 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. <https://doi.org/10.1080/03736245.2014.924867>

## Appendices

### Appendix 1: QUESTIONNAIRE FOR ASSESSING FLOOD MITIGATION PROCESSES IN BWAISE (Households)

Good day. Simbarashe Chereni – a PhD student from the University of Twente in the Netherlands is conducting research in your neighbourhood. You have been randomly selected to participate in a household survey for data collection purposes. We kindly request your time to provide answers for the questions below. The information gathered will be used for solely academic purposes and no names will be publicly used without your consent.

**Contacts:**

**Simbarashe Chereni**, *Faculty of Geo-Information Science and Earth Observation, University of Twente, Enschede, The Netherlands. Email: [s.chereni@utwente.nl](mailto:s.chereni@utwente.nl) or [simba.chereni@gmail.com](mailto:simba.chereni@gmail.com)*

**Section A**

1. Gender: Male ☐ Female ☐  
Location of House: \_\_\_\_\_X\_\_\_\_\_Y
2. Age:  Years
3. Household size:  People
4. How long have you been living here?  Years
5. How many people earn a salary in this household?  
People in formal sector  People in informal sector
6. What type of activity/job do household members on a salary do?
  - a. ....
  - b. ....
  - c. ....
  - d. ....



7. What is/was the average daily income for your household during the years indicated in the table?  
**1 = 0-40 000 UGX 2 = 40001-80000 UGX 3 = 80001-120000 UGX 4 = 120001-160000 UGX**  
**5 = 160001-200000 UGX 6 = 200001-240000UGX 7 = 240001-280000UGX 8 = 280001-320000**  
**UGX 9 = 320001-360000 UGX 10 = 360001 UGX and above**

	2015	2016	2017
Income level	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
	6	6	6
	7	7	7
	8	8	8
	9	9	9
	10	10	10

8. How much do you expect to earn next year? Please tick in the appropriate box below

More ☐ Less ☐

9. What is your housing status?

Freehold owner ☐

Leasehold owner ☐

Caretaker/tenant ☐

*If you are not renting your house, please skip question 10.*

10. How much is your rent per month?

11. What is the status of your land?

Mailo ☐

Leasehold ☐ (If leasehold, how much is rent price in UGX/month?)

Freehold ☐

Customary ☐

12. What is the highest education level reached by any member of your household?

Primary ☐ High School ☐ University ☐ None ☐

## Section B

13. Did you experience flooding during the following years?

2015	2016	2017
Yes No	Yes No	Yes No

*If you did not experience flooding, please go to question 14*

14. Please explain the extent of the flooding in the space provided below (Nature, level & duration)

.....  
 .....

## Appendices

.....  
 .....  
 .....

15. Did you suffer property damage during the following years?

2015		2016		2017	
Yes	No	Yes	No	Yes	No

16. Did you or any member incur health problems (e.g., Malaria, dengue, diarrhoea, skin problems) following the floods? If yes please explain in the space provided.

2015		2016		2017	
Yes	No	Yes	No	Yes	No

*If you did not suffer from any flooding related disease please skip the explanation part.*

Explanation

.....  
 .....

17. Have you incurred financial costs after flooding in the period 2015-2017? If yes please indicate the number of times and amounts in the space provided.

2015		2016		2017	
Yes	No	Yes	No	Yes	No

*If you did not incur flood related financial loss please skip the explanation part.*

Explanation

.....  
 .....

### Section C

18 What is your opinion about the following threat dimensions during the indicated years? Please indicate your answer in the appropriate circle where 1 represents no and 4 represents high

	2015		2016		Year/rating 2017	
What is/was your perception about the likelihood of your house flooding	1 No 2 Low 3 Medium 4 High		1 No 2 Low 3 Medium 4 High		1 No 2 Low 3 Medium 4 High	
What is/was your perception about the likelihood of damage to your house	1 No 2 Low 3 Medium 4 High		1 No 2 Low 3 Medium 4 High		1 No 2 Low 3 Medium 4 High	

What is/was your perception about the likelihood of your household property getting damaged?	1	No	1	No	1	No
	2	Low	2	Low	2	Low
	3	Medium	3	Medium	3	Medium
	4	High	4	High	4	High

19. Do you think that floods in the future will be?

20. Fewer  About the same  Much worse

21. Did you get any assistance to help you cope with flooding? Yes  No

*If you did not get any benefit from flooding go to question 22.*

22. When did you get the assistance? Please write your answer below

.....

.....

23. Please write in the space provided, benefits you get during flooding.

(a).....

.....

.....

(b).....

.....

.....

(c).....

.....

.....

#### Section D

24. What, if anything, have you done to avoid or reduce flood damage as a household? Please write your answer in the space below.

(a).....

.....

.....

(b).....

.....

.....

## Appendices

(c).....

(d).....

25. If you did not do anything, why not? Please indicate your answer in the space below:

.....

26. Did you or any member of the family implement the following damage mitigation measures at the times indicated? Please tick in the appropriate circle where one indicates not able and 4 indicates highly able.

Mitigation measure	Year/rating		
	2015	2016	2017
Rebuilding/ Raising floor of the house	1	1	1
	2	2	2
	3	3	3
	4	4	4
Building small dykes	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting sand bags to protect the yard	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting grass on your yard	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting electric sockets higher	1	1	1
	2	2	2
	3	3	3
	4	4	4
Capture rainwater to reduce runoff	1	1	1
	2	2	2
	3	3	3
	4	4	4
Clearing the drainage	1	1	1
	2	2	2
	3	3	3
	4	4	4
Moving away to Friends/relatives	1	1	1
	2	2	2
	3	3	3
	4	4	4

Putting goods	1	1	1
On higher places	2	2	2
	3	3	3
	4	4	4

27. Do you consider the following measures to be effective ways to reduce flood impact? Please indicate your answer in the appropriate circles where 1 indicates ineffective and 4 indicates very effective.

Mitigation measure	Year/rating		
	2015	2016	2017
Rebuilding/ Raising floor of the house	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
Building small dykes	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
Putting sand bags to protect the yard	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
Putting grass on your yard	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
Putting electric sockets higher	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
Capture rainwater to reduce runoff	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
Clearing the drainage	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
Moving away to Friends/relatives	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5

# Appendices

Putting goods	1	1	1
On higher places	2	2	2
	3	3	3
	4	4	4
	5	5	5

28. How do you perceive the time requirements for implementing these measures? Please fill in the appropriate circles where 1 represents very low and 4 represents very high.

Mitigation measure	Year/rating		
	2015	2016	2017
Rebuilding/ Raising floor of the house	1	1	1
	2	2	2
	3	3	3
	4	4	4
Building small dykes	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting sand bags to protect the yard	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting grass on your yard	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting electric sockets higher	1	1	1
	2	2	2
	3	3	3
	4	4	4
Capture rainwater to reduce runoff	1	1	1
	2	2	2
	3	3	3
	4	4	4
Clearing the drainage	1	1	1
	2	2	2
	3	3	3
	4	4	4
Moving away to Friends/relatives	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting goods On higher places	1	1	1
	2	2	2
	3	3	3
	4	4	4

29. What is your opinion about the costs of implementing such measures? Please fill in the appropriate circles where 1 represents very low and 4 represents very high.

Mitigation measure	Year/rating		
	2015	2016	2017
Rebuilding/ Raising floor of the house	1	1	1
	2	2	2
	3	3	3
	4	4	4
Building small dykes	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting sand bags to protect the yard	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting grass on your yard	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting electric sockets higher	1	1	1
	2	2	2
	3	3	3
	4	4	4
Capture rainwater to reduce runoff	1	1	1
	2	2	2
	3	3	3
	4	4	4
Clearing the drainage	1	1	1
	2	2	2
	3	3	3
	4	4	4
Moving away to Friends/relatives	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting goods On higher places	1	1	1
	2	2	2
	3	3	3
	4	4	4

#### Section E

30. How willing were you to spend resources in order to protect your property against flooding during the following years? Please indicate in the appropriate circles were 1 represents unwilling and 4 represents highly willing.

Year	2015	2016	2017
------	------	------	------

## Appendices

Willingness to spend on mitigation	1	1	1
	2	2	2
	3	3	3
	4	4	4

31. Please explain your answer in the space provided below:

.....

.....

.....

## Section F

32. Are you a member of the following organisations?

Organisation	Yes/No	
Shack/Slum Dwellers International	Yes .....	No.....
Act together	Yes .....	No.....
	Yes .....	No.....

33. When did you become a member? .....

What do you benefit by being a member?

.....

.....

.....

34. What kind of help, if any, do these organisations provide to you before flooding?

.....

.....

.....

.....

35. How do these organisations help you, if any, during flooding?

.....

.....

.....

.....

36. How do they help you after flooding?

.....

.....

.....

37. Did you do any of the following in the respective years?

	2015	2016	2017
Looked for flood information	Yes	Yes	Yes
	No	No	No



Received flood information	Yes No	Yes No	Yes No
Received an incentive to implement mitigation measures	Yes No	Yes No	Yes No

*If you did not receive any incentive, please skip the next question.*

38. Please explain the type of incentive you got in the space provided below:

.....

.....

.....

.....

**Question about mitigation and social networks**

39. In how many households do you have friends/relatives that are ready to assist you during flooding?

.....

.....

40. In which parish do they stay?

- a. ....
- b. ....
- c. ....

41. From which sources do you obtain information about flooding?

.....

.....

.....

.....

42. Mention any specific measure that you implement after learning about it from your family/friends/relatives?

Mitigation measure	Year

43. Which other flood damage mitigation measures, if any, do you intend to implement?

.....

.....

.....

.....

**END, THANK YOU FOR YOUR TIME**

Appendix 2: Questionnaire for Businesses

**QUESTIONNAIRE FOR ASSESSING FLOOD MITIGATION PROCESSES IN BWAISE (MSMEs)**

Good day. Simbarashe Chereni – a PhD student from the University of Twente in the Netherlands is conducting research in your neighbourhood. You have been randomly selected to participate in a survey for data collection purposes. We kindly request your time to provide answers for the questions below. The information gathered will be used for solely academic purposes and no names will be publicly used without your consent.

**Contacts:**

**Simbarashe Chereni**, Faculty of Geo-Information Science and Earth Observation, University of Twente, Enschede, The Netherlands. Email: [s.chereni@utwente.nl](mailto:s.chereni@utwente.nl)

**Section A**

1. Gender: Male ☐ Female ☐
- Location of business: ☒ X ☐ Y
2. When was your company established:  Years
3. Staff establishment:  People
4. For how long has your business been using these premises?  Years
5. What is/was the yearly net income for your business during the years indicated in the table?  
**1 = 0-40 000 UGX 2 = 40001-80000 UGX 3 = 80001-120000 UGX 4 = 120001-160000 UGX**  
**5 = 160001-200000 UGX 6 = 200001-240000UGX 7 = 240001-280000UGX 8 = 280001-320000**  
**UGX 9 = 320001-360000 UGX 10 = 360001 UGX and above**

	2015	2016	2017
Income level	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
	6	6	6
	7	7	7
	8	8	8
	9	9	9
	10	10	10

6. What is your profit margin? .....
7. How much do you expect to earn next year? Please tick in the appropriate box below  
 More ☐ Less ☐
9. What is the status of your premises?  
 Freehold owner ☐  
 Leasehold owner ☐  
 Usufruct ☐
- If you are not renting your house, please skip question 10.*
10. How much is your rent per month?
11. What is the status of your land?  
 Mailo ☐  
 Leasehold ☐ (if leasehold, how much is rent price in UGX/month?)  
 Freehold ☐

Customary ☐

12. How many employees for your company stay in the following areas?

Bwaise III

Greater Kawempe .....

Ntinda .....

Greater Nakawa .....

Natete .....

Greater Rubaga .....

### Section B

1. Did you experience flooding on these premises during the following years?

2015		2016		2017	
Yes	No	Yes	No	Yes	No

*If you did not experience flooding please go to question 14*

2. Please explain the extent of the flooding in the space provided below (Nature, level & duration)

.....

.....

.....

.....

.....

3. Did you suffer property damage during the following years?

2015		2016		2017	
Yes	No	Yes	No	Yes	No

4. Did you or any other employee incur health problems (e.g., Malaria, dengue, diarrhoea, skin problems) following the floods? If yes please explain in the space provided.

2015		2016		2017	
Yes	No	Yes	No	Yes	No

*If you did not suffer from any flooding related disease please skip the explanation part.*

Explanation

.....

.....

.....

5. Has your company incurred financial costs after flooding in the period 2015-2017? If yes please indicate the number of times and amounts in the space provided. A bit leading?

2015		2016		2017	
Yes	No	Yes	No	Yes	No

## Appendices

*If you did not incur flood related financial loss please skip the explanation part.*

Explanation

.....

.....

.....

## Section C

18 What is your opinion about the following threat dimensions during the indicated years? Please indicate your answer in the appropriate circle where 1 represents no and 4 represents high

	2015		2016		Year/rating 2017	
What is/was your perception about the likelihood of your premises flooding	1 No 2 Low 3 Medium 4 High		1 No 2 Low 3 Medium 4 High		1 No 2 Low 3 Medium 4 High	
What is/was your perception about the likelihood of damage to your premises	1 No 2 Low 3 Medium 4 High		1 No 2 Low 3 Medium 4 High		1 No 2 Low 3 Medium 4 High	
What is/was your perception about the likelihood of your premises getting damaged?	1 No 2 Low 3 Medium 4 High		1 No 2 Low 3 Medium 4 High		1 No 2 Low 3 Medium 4 High	

6. Do you think that floods in the future will be?

Fewer  About the same  Much worse

7. Did you get any assistance to help you cope with flooding? Yes  No

*If you did not get any benefit from flooding go to question 22.*

8. When did you get the assistance? Please write your answer below

.....

.....

9. Please write in the space provided, benefits you get during flooding.

(a).....

.....

.....

(b).....

.....

.....

(c).....

.....

.....

## Section D

10. What, if anything, have you done to avoid or reduce flood damage on these premises? Please write your answer in the space below.

(a).....  
 .....  
 .....  
 (b).....  
 .....  
 .....  
 (c).....  
 .....  
 .....  
 (d).....  
 .....  
 .....

11. If you did not do anything, why not? Please indicate your answer in the space below:

.....  
 .....

12. Do you think your company had the capacity to implement the following measures during the indicated years? Please indicate your answer by ticking in the appropriate circle, where 1 represents No, 2 represents less, 3 represents more, 4 represents very high.

Mitigation measure	Year/rating		
	2015	2016	2017
Rebuilding/ Raising floor of the premises	1	1	1
	2	2	2
	3	3	3
	4	4	4
Building small dykes	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting sand bags to protect the yard	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting grass on your yard	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting electric sockets higher	1	1	1
	2	2	2
	3	3	3
	4	4	4
Capture rainwater to reduce runoff	1	1	1
	2	2	2
	3	3	3
	4	4	4

### Appendices

Clearing the drainage	1	1	1
	2	2	2
	3	3	3
	4	4	4
Moving your business from these premises	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting goods On higher places	1	1	1
	2	2	2
	3	3	3
	4	4	4

13. Do you consider the following measures to be effective ways to reduce flood impact? Please indicate your answer in the appropriate circles where 1 indicates ineffective and 4 indicates very effective.

Mitigation measure	Year/rating		
	2015	2016	2017
Rebuilding/ Raising floor of the premises	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
Building small dykes	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
Putting sand bags to protect the yard	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
Putting grass on your yard	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
Putting electric sockets higher	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
Capture rainwater to reduce runoff	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5

Clearing the drainage	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
Moving your business from these premises	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5
Putting goods On higher places	1	1	1
	2	2	2
	3	3	3
	4	4	4
	5	5	5

14. How do you perceive the time requirements for implementing these measures? Please fill in the appropriate circles where 1 represents very low and 4 represents very high.

Mitigation measure	Year/rating		
	2015	2016	2017
Rebuilding/ Raising floor of the premises	1	1	1
	2	2	2
	3	3	3
	4	4	4
Building small dykes	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting sand bags to protect the yard	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting grass on your yard	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting electric sockets higher	1	1	1
	2	2	2
	3	3	3
	4	4	4
Capture rainwater to reduce runoff	1	1	1
	2	2	2
	3	3	3
	4	4	4

# Appendices

Clearing the drainage	1	1	1
	2	2	2
	3	3	3
	4	4	4
Moving your business from these premises	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting goods On higher places	1	1	1
	2	2	2
	3	3	3
	4	4	4

15. What is your opinion about the costs of implementing such measures? Please fill in the appropriate circles where 1 represents very low and 4 represents very high.

Mitigation measure	Year/rating		
	2015	2016	2017
Rebuilding/ Raising floor of the premises	1	1	1
	2	2	2
	3	3	3
	4	4	4
Building small dykes	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting sand bags to protect the yard	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting grass on your yard	1	1	1
	2	2	2
	3	3	3
	4	4	4
Putting electric sockets higher	1	1	1
	2	2	2
	3	3	3
	4	4	4
Capture rainwater to reduce runoff	1	1	1
	2	2	2
	3	3	3
	4	4	4
Clearing the drainage	1	1	1
	2	2	2
	3	3	3
	4	4	4
Moving your business from these premises	1	1	1
	2	2	2
	3	3	3
	4	4	4



Putting goods	1	1	1
On higher places	2	2	2
	3	3	3
	4	4	4

#### Section E

16. How willing was your company to spend resources in order to protect these premises against flooding during the following years? Please indicate your answer in the appropriate circles where 1 represents unwilling and 4 represents highly willing.

Year	2015	2016	2017
Willingness to spend	1	1	1
on mitigation	2	2	2
	3	3	3
	4	4	4

17. Please explain your answer in the space provided below:

.....

.....

.....

#### Section F

18. Does your company associate with the following organisations?

Organisation	Yes/No	
Shack/Slum Dwellers International	Yes .....	No.....
Act together	Yes .....	No.....
	Yes .....	No.....

19. Since when ? .....

20. What do you benefit by associating with them?

.....

.....

.....

21. What kind of help, if any, do these organisations provide to your company before flooding?

.....

.....

.....

22. How do these organisations help your company, if any, during flooding?

.....

.....

.....

## Appendices

23. How do they help your company after flooding?

.....

.....

.....

24. Did your company do any of the following in the respective years?

	2015	2016	2017
Looked for flood information	Yes No	Yes No	Yes No
Received flood information	Yes No	Yes No	Yes No
Received an incentive to implement mitigation measures	Yes No	Yes No	Yes No

*If you did not receive any incentive please skip the next question.*

25. Please explain the type of incentive you got in the space provided below:

.....

.....

.....

.....

## Question about mitigation and social networks

26. How does your company ensure that its employees report for duty on a flooding day?

.....

.....

.....

27. From which sources do you obtain information about flooding?

.....

.....

.....

28. Mention any specific measure that you implement after learning about it.

Mitigation measure	Year
--------------------	------

--	--

29. Which other flood damage mitigation measures, if any, does your company intend to implement?

.....

.....

.....

.....

END

THANK YOU FOR YOUR TIME



## Appendices

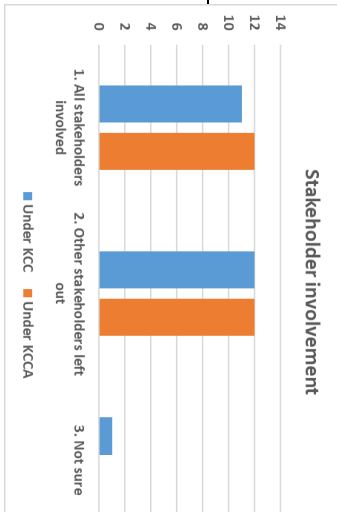
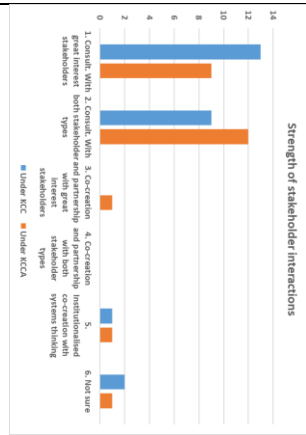
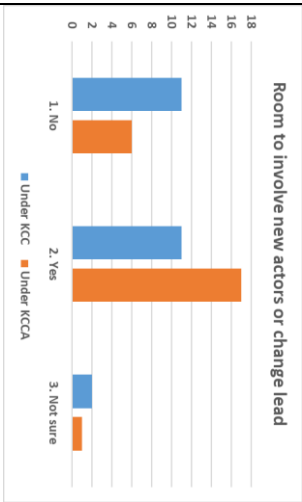
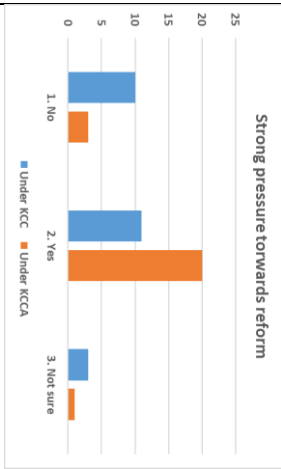
### Appendix 3: Perceptions of governance quality change in Kampala from the KCC era to the KCCA era. a. Levels and scales

Criteria																																																															
	Extent	Coherence	Flexibility	Intensity																																																											
Levels and Scales	<p>1. How many levels are/were involved in dealing with the issue?</p> <p>Scale</p> <p>1. level 2. levels 3. levels 4. levels 5. levels in respect of LCs 6. Not sure</p>	<p>2. Do/was the levels work together and do they trust each other?</p> <p>Scale</p> <p>1. no 2. work together without trust 3. work together with trust 4. Not sure</p>	<p>3. Is/was it possible to move up and down scales (upscaling and downscaling) given the issue at hand?</p> <p>Scale</p> <p>1. No 2. Yes 3. Not sure</p>	<p>4. Is/was there a strong impact from a certain level towards behavioural change or management reform?</p> <p>Scale</p> <p>1. No 2. Yes 3. Not sure</p>																																																											
	<table><caption>Governance levels involved</caption><thead><tr><th>Level</th><th>Under KCC</th><th>Under KCCA</th></tr></thead><tbody><tr><td>1 Level</td><td>2</td><td>3</td></tr><tr><td>2 Levels</td><td>6</td><td>4</td></tr><tr><td>3 Levels</td><td>6</td><td>8</td></tr><tr><td>4 Levels</td><td>5</td><td>6</td></tr><tr><td>5 Levels</td><td>3</td><td>2</td></tr><tr><td>6 Not sure</td><td>0</td><td>1</td></tr></tbody></table>	Level	Under KCC	Under KCCA	1 Level	2	3	2 Levels	6	4	3 Levels	6	8	4 Levels	5	6	5 Levels	3	2	6 Not sure	0	1	<table><caption>Co-operation and trust</caption><thead><tr><th>Category</th><th>Under KCC</th><th>Under KCCA</th></tr></thead><tbody><tr><td>1. No</td><td>6</td><td>4</td></tr><tr><td>2. work together without trust</td><td>12</td><td>14</td></tr><tr><td>3. Work together with trust</td><td>6</td><td>4</td></tr><tr><td>4. Not sure</td><td>0</td><td>1</td></tr></tbody></table>	Category	Under KCC	Under KCCA	1. No	6	4	2. work together without trust	12	14	3. Work together with trust	6	4	4. Not sure	0	1	<table><caption>Upscaling and downscaling</caption><thead><tr><th>Category</th><th>Under KCC</th><th>Under KCCA</th></tr></thead><tbody><tr><td>1. No</td><td>14</td><td>10</td></tr><tr><td>2. Yes</td><td>8</td><td>13</td></tr><tr><td>3. Not sure</td><td>2</td><td>2</td></tr></tbody></table>	Category	Under KCC	Under KCCA	1. No	14	10	2. Yes	8	13	3. Not sure	2	2	<table><caption>Strong Impact towards reform</caption><thead><tr><th>Category</th><th>Under KCC</th><th>Under KCCA</th></tr></thead><tbody><tr><td>1. No</td><td>4</td><td>3</td></tr><tr><td>2. Yes</td><td>20</td><td>22</td></tr><tr><td>3. Not sure</td><td>1</td><td>0</td></tr></tbody></table>	Category	Under KCC	Under KCCA	1. No	4	3	2. Yes	20	22	3. Not sure	1
Level	Under KCC	Under KCCA																																																													
1 Level	2	3																																																													
2 Levels	6	4																																																													
3 Levels	6	8																																																													
4 Levels	5	6																																																													
5 Levels	3	2																																																													
6 Not sure	0	1																																																													
Category	Under KCC	Under KCCA																																																													
1. No	6	4																																																													
2. work together without trust	12	14																																																													
3. Work together with trust	6	4																																																													
4. Not sure	0	1																																																													
Category	Under KCC	Under KCCA																																																													
1. No	14	10																																																													
2. Yes	8	13																																																													
3. Not sure	2	2																																																													
Category	Under KCC	Under KCCA																																																													
1. No	4	3																																																													
2. Yes	20	22																																																													
3. Not sure	1	0																																																													

a. Levels and scales Continued

<p>5. Are there any important gaps or missing levels?</p> <p>Scale</p> <p>1. No    2. Yes    3. Not sure</p> <table border="1"><caption>Existence of gaps or missing levels</caption><thead><tr><th>Category</th><th>Under KCC</th><th>Under KCCA</th></tr></thead><tbody><tr><td>1. No</td><td>10</td><td>11</td></tr><tr><td>2. Yes</td><td>12</td><td>11</td></tr><tr><td>3. Not sure</td><td>1</td><td>0</td></tr></tbody></table>	Category	Under KCC	Under KCCA	1. No	10	11	2. Yes	12	11	3. Not sure	1	0	<p>6. To what degree is/was the mutual dependency among levels recognised</p> <p>Scale</p> <p>1. smaller extent    2. greater extent    3. Not sure</p> <table border="1"><caption>Mutual dependency among levels</caption><thead><tr><th>Category</th><th>Under KCC</th><th>Under KCCA</th></tr></thead><tbody><tr><td>1. Smaller extent</td><td>9</td><td>9</td></tr><tr><td>2. Greater extent</td><td>14</td><td>15</td></tr><tr><td>3. Not sure</td><td>1</td><td>0</td></tr></tbody></table>	Category	Under KCC	Under KCCA	1. Smaller extent	9	9	2. Greater extent	14	15	3. Not sure	1	0
Category	Under KCC	Under KCCA																							
1. No	10	11																							
2. Yes	12	11																							
3. Not sure	1	0																							
Category	Under KCC	Under KCCA																							
1. Smaller extent	9	9																							
2. Greater extent	14	15																							
3. Not sure	1	0																							

b. Stakeholders and Networks

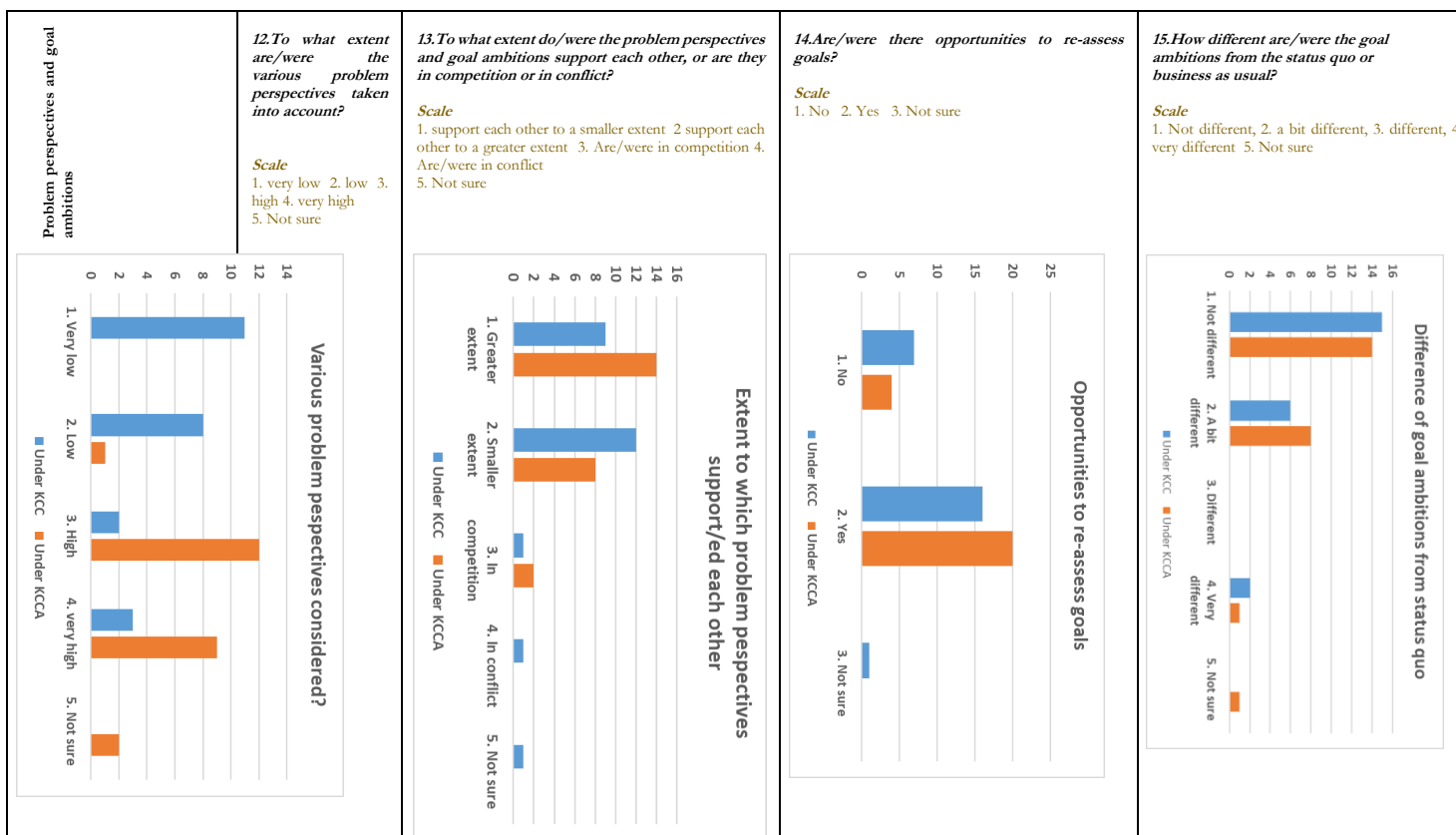
Stakeholders and networks	<p>7.Are/were all relevant stakeholders involved? Are there other stakeholders not involved or even excluded?</p> <p>Scale</p> <p>1. All stakeholders involved</p> <p>2. Other stakeholders left out</p>	<p>8.What is/was the strength of interactions among stakeholders? In what ways are these interactions institutionalised in stable structures?</p> <p>Scale</p> <p>1. consultation with stakeholders of great interest</p> <p>2. Consultation with both great interest and marginalised stakeholders</p> <p>3. Innovation and collaboration – co-creation and partnership with great interest stakeholders</p> <p>4. Innovation and collaboration – co-creation and partnership with great interest and marginalised stakeholders</p> <p>5. Institutionalised collaboration and innovation with systems thinking, see (Guy Morgan et al., 2016)</p> <p>6. Not sure</p>	<p>9.Is/was it possible that new actors are included or that the lead is changed from one actor to another when there are pragmatic reasons for this?</p> <p>Scale</p> <p>1. No 2. Yes 3. Not sure</p>	<p>10.Is there strong pressure from an actor or actor coalition towards behavioural change or management reform?</p> <p>Scale</p> <p>1. No 2. Yes 3. Not sure</p>																																																								
	 <table><caption>Stakeholder involvement</caption><thead><tr><th>Category</th><th>Under KCC</th><th>Under KCCA</th></tr></thead><tbody><tr><td>1. All stakeholders involved</td><td>10</td><td>11</td></tr><tr><td>2. Other stakeholders left out</td><td>11</td><td>11</td></tr><tr><td>3. Not sure</td><td>1</td><td>0</td></tr></tbody></table>	Category	Under KCC	Under KCCA	1. All stakeholders involved	10	11	2. Other stakeholders left out	11	11	3. Not sure	1	0	 <table><caption>Strength of stakeholder interactions</caption><thead><tr><th>Category</th><th>Under KCC</th><th>Under KCCA</th></tr></thead><tbody><tr><td>1. Consult. With great interest</td><td>12</td><td>8</td></tr><tr><td>2. Consult. With both great interest and marginalised stakeholders</td><td>8</td><td>11</td></tr><tr><td>3. Co-creation with great interest</td><td>1</td><td>1</td></tr><tr><td>4. Co-creation with both great interest and marginalised stakeholders</td><td>1</td><td>1</td></tr><tr><td>5. Institutionalised collaboration</td><td>1</td><td>1</td></tr><tr><td>6. Not sure</td><td>1</td><td>1</td></tr></tbody></table>	Category	Under KCC	Under KCCA	1. Consult. With great interest	12	8	2. Consult. With both great interest and marginalised stakeholders	8	11	3. Co-creation with great interest	1	1	4. Co-creation with both great interest and marginalised stakeholders	1	1	5. Institutionalised collaboration	1	1	6. Not sure	1	1	 <table><caption>Room to involve new actors or change lead</caption><thead><tr><th>Category</th><th>Under KCC</th><th>Under KCCA</th></tr></thead><tbody><tr><td>1. No</td><td>11</td><td>5</td></tr><tr><td>2. Yes</td><td>11</td><td>16</td></tr><tr><td>3. Not sure</td><td>2</td><td>1</td></tr></tbody></table>	Category	Under KCC	Under KCCA	1. No	11	5	2. Yes	11	16	3. Not sure	2	1	 <table><caption>Strong pressure towards reform</caption><thead><tr><th>Category</th><th>Under KCC</th><th>Under KCCA</th></tr></thead><tbody><tr><td>1. No</td><td>10</td><td>2</td></tr><tr><td>2. Yes</td><td>10</td><td>20</td></tr><tr><td>3. Not sure</td><td>2</td><td>1</td></tr></tbody></table>	Category	Under KCC	Under KCCA	1. No	10	2	2. Yes	10	20	3. Not sure	2
Category	Under KCC	Under KCCA																																																										
1. All stakeholders involved	10	11																																																										
2. Other stakeholders left out	11	11																																																										
3. Not sure	1	0																																																										
Category	Under KCC	Under KCCA																																																										
1. Consult. With great interest	12	8																																																										
2. Consult. With both great interest and marginalised stakeholders	8	11																																																										
3. Co-creation with great interest	1	1																																																										
4. Co-creation with both great interest and marginalised stakeholders	1	1																																																										
5. Institutionalised collaboration	1	1																																																										
6. Not sure	1	1																																																										
Category	Under KCC	Under KCCA																																																										
1. No	11	5																																																										
2. Yes	11	16																																																										
3. Not sure	2	1																																																										
Category	Under KCC	Under KCCA																																																										
1. No	10	2																																																										
2. Yes	10	20																																																										
3. Not sure	2	1																																																										

b. Stakeholders and Networks Continued

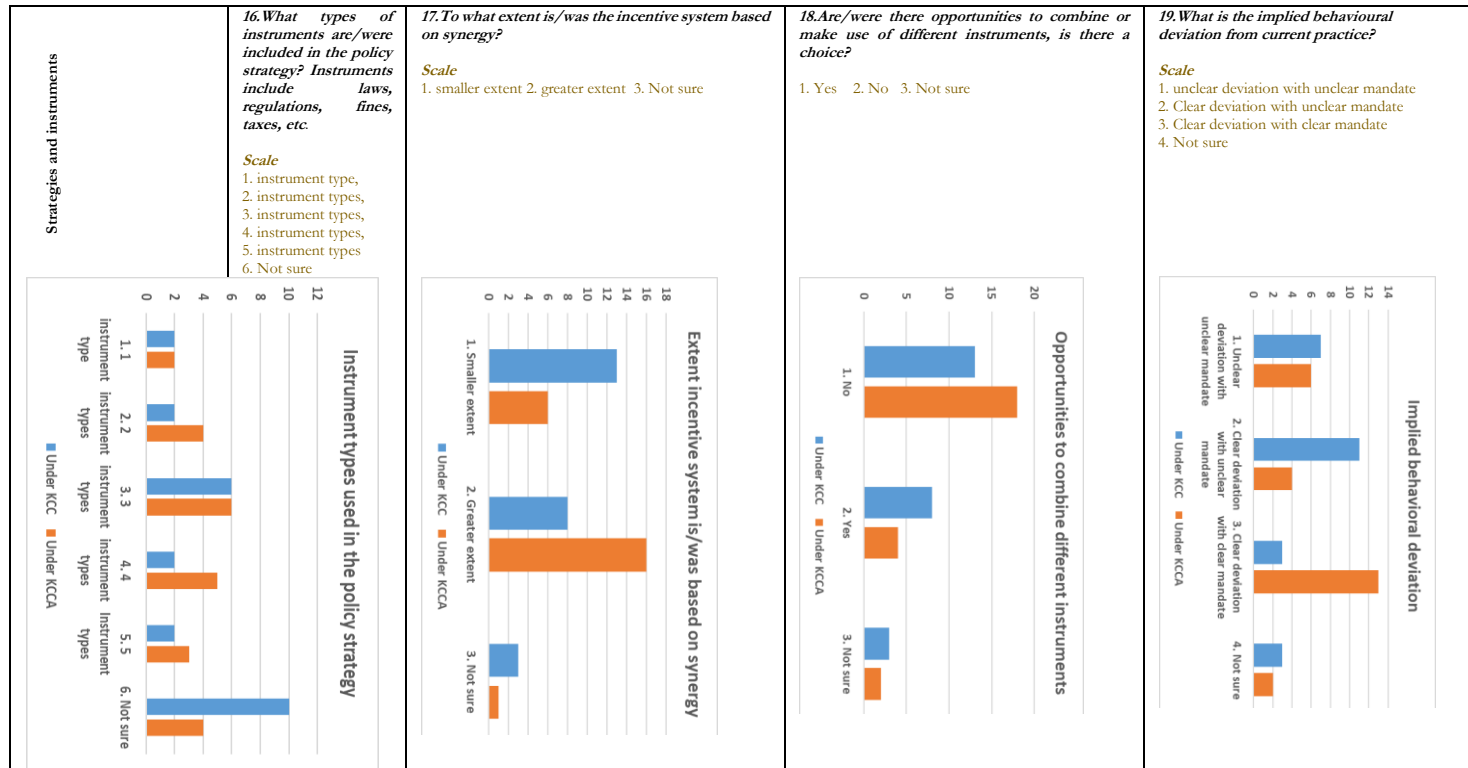
		<p>11.Do/did the actors share in social capital to support each other?</p> <p>Scale</p> <p>1. No 2. Yes 3. Not sure</p> <table><caption>Share of social capital</caption><tr><th></th><th>Under KCC</th><th>Under KCCA</th></tr><tr><td>1. No</td><td>4</td><td>3</td></tr><tr><td>2. Yes</td><td>16</td><td>17</td></tr><tr><td>3. Not sure</td><td>2</td><td>1</td></tr></table>		Under KCC	Under KCCA	1. No	4	3	2. Yes	16	17	3. Not sure	2	1	
	Under KCC	Under KCCA													
1. No	4	3													
2. Yes	16	17													
3. Not sure	2	1													



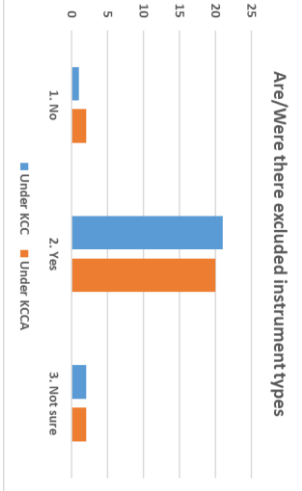
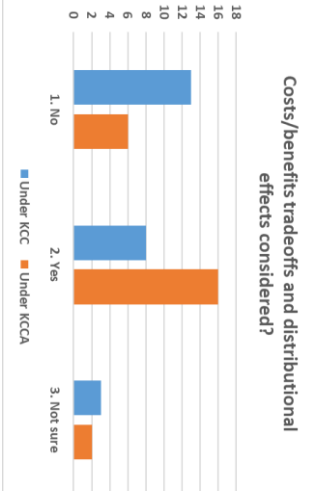
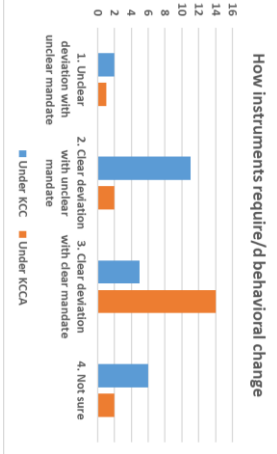
## c. Problem perspectives and goal ambitions



a. Strategies and instruments



d. Strategies and instruments continued

<p>20.Are/were there any excluded types?</p> <p>1. Yes   2. No   3. Not Sure</p>	<p>21.Are/were trade-offs between costs and benefits and distributional effects considered?</p> <p>1. Yes   2. No   3. Not sure</p>		<p>22.How do/did the instruments require and enforce this?</p> <p>Scale</p> <p>1.unclear deviation with unclear mandate</p> <p>2. Clear deviation with unclear mandate</p> <p>3. Clear deviation with clear mandate</p> <p>4. Not sure</p>																																							
<p>Are/Were there excluded instrument types</p>  <table><thead><tr><th>Category</th><th>Under KCC</th><th>Under KCCA</th></tr></thead><tbody><tr><td>1. No</td><td>1</td><td>2</td></tr><tr><td>2. Yes</td><td>22</td><td>20</td></tr><tr><td>3. Not sure</td><td>2</td><td>2</td></tr></tbody></table>	Category	Under KCC	Under KCCA	1. No	1	2	2. Yes	22	20	3. Not sure	2	2	<p>Costs/benefits tradeoffs and distributional effects considered?</p>  <table><thead><tr><th>Category</th><th>Under KCC</th><th>Under KCCA</th></tr></thead><tbody><tr><td>1. No</td><td>12</td><td>6</td></tr><tr><td>2. Yes</td><td>8</td><td>16</td></tr><tr><td>3. Not sure</td><td>2</td><td>1</td></tr></tbody></table>	Category	Under KCC	Under KCCA	1. No	12	6	2. Yes	8	16	3. Not sure	2	1		<p>How instruments require/d behavioral change</p>  <table><thead><tr><th>Category</th><th>Under KCC</th><th>Under KCCA</th></tr></thead><tbody><tr><td>1. Unclear deviation with unclear mandate</td><td>1</td><td>1</td></tr><tr><td>2. Clear deviation with unclear mandate</td><td>12</td><td>2</td></tr><tr><td>3. Clear deviation with clear mandate</td><td>4</td><td>14</td></tr><tr><td>4. Not sure</td><td>4</td><td>1</td></tr></tbody></table>	Category	Under KCC	Under KCCA	1. Unclear deviation with unclear mandate	1	1	2. Clear deviation with unclear mandate	12	2	3. Clear deviation with clear mandate	4	14	4. Not sure	4	1
Category	Under KCC	Under KCCA																																								
1. No	1	2																																								
2. Yes	22	20																																								
3. Not sure	2	2																																								
Category	Under KCC	Under KCCA																																								
1. No	12	6																																								
2. Yes	8	16																																								
3. Not sure	2	1																																								
Category	Under KCC	Under KCCA																																								
1. Unclear deviation with unclear mandate	1	1																																								
2. Clear deviation with unclear mandate	12	2																																								
3. Clear deviation with clear mandate	4	14																																								
4. Not sure	4	1																																								

d. Strategies and instruments continued

<p>23.Are/were monitoring and enforcing instruments included?</p> <p>1. Yes 2. No 3. Not sure</p>	<p>24.Are/were there overlaps or conflicts of incentives created by the included policy instruments?</p> <p>1. Yes 2.No 3. Not sure</p>																										
<p>Monitoring and enforcing instruments included?</p> <table><thead><tr><th>Response</th><th>Under KCC</th><th>Under KCCA</th></tr></thead><tbody><tr><td>1. No</td><td>7</td><td>2</td></tr><tr><td>2. Yes</td><td>12</td><td>18</td></tr><tr><td>3. Not sure</td><td>2</td><td>1</td></tr></tbody></table>	Response	Under KCC	Under KCCA	1. No	7	2	2. Yes	12	18	3. Not sure	2	1	<p>Were there overlaps in policy instruments?</p> <table><thead><tr><th>Response</th><th>Under KCC</th><th>Under KCCA</th></tr></thead><tbody><tr><td>1. No</td><td>16</td><td>2</td></tr><tr><td>2. Yes</td><td>6</td><td>16</td></tr><tr><td>3. Not sure</td><td>2</td><td>2</td></tr></tbody></table>	Response	Under KCC	Under KCCA	1. No	16	2	2. Yes	6	16	3. Not sure	2	2	Under KCCA	Under KCCA
Response	Under KCC	Under KCCA																									
1. No	7	2																									
2. Yes	12	18																									
3. Not sure	2	1																									
Response	Under KCC	Under KCCA																									
1. No	16	2																									
2. Yes	6	16																									
3. Not sure	2	2																									

## Responsibilities and resources

Responsibilities and resources	25.Are/were all responsibilities clearly assigned and facilitated with resources	26.To what extend do the assigned responsibilities create competence struggles or cooperation within and across institutions? Are they considered legitimate by the main stakeholders?	27.To what extent is/was it possible to pool together the responsibilities and resources as long as accountability and transparency are not compromised	28.Is/was the amount of allocated resources sufficient to implement the measures needed for the intended change?
	<p><b>Scale</b></p> <p>1. not clearly assigned without resources 2. not clearly assigned with resources 3. clearly assigned without resources 4. clearly assigned with resources 5. Not sure</p>	<p><b>Scale</b></p> <p>1. Create competence struggles and considered illegitimate 2. Create competence struggles but considered legitimate 3. Show co-operation but considered illegitimate 4. Show co-operation and considered legitimate 5. Not sure</p>	<p><b>Scale</b></p> <p>1. Smaller extent 2. Greater extent 3. Not sure</p>	<p><b>Scale</b></p> <p>1. No 2. Yes 3. Not sufficient but there is/was a big positive difference 4. Not sure</p>
	<p>Responsibilities clearly assigned and facilitated with resources?</p>	<p>Competence, co-operation and legitimacy</p>	<p>Possibility to pool resources together</p>	<p>Implementation resources sufficient?</p>

## Appendices

### Appendix 4: Logistic regression model outputs for the influence of coping appraisal on mitigation behaviour

a.: Binary logistic regression model summary of perceived response efficacy against mitigation behaviour

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
RE of raising sockets (Ref.)			6.69	3	0.08			
Somewhat effective (1)	-0.06	1.05	0.00	1	0.95	0.94	0.12	7.30
Effective (2)	-1.89	0.84	5.06	1	0.02	0.15	0.03	0.78
Very effective (3)	-1.45	0.83	3.06	1	0.08	0.23	0.05	1.19
RE of capturing rainwater (Ref.)			4.52	3	0.21			
Somewhat effective (1)	0.52	0.75	0.50	1	0.48	1.69	0.39	7.27
Effective (2)	-1.35	0.86	2.46	1	0.12	0.26	0.05	1.40
Very effective (3)	-0.29	0.82	0.13	1	0.72	0.75	0.15	3.74
RE of relocation (Ref.)			1.97	3	0.58			
Somewhat effective (1)	-1.14	0.94	1.48	1	0.22	0.32	0.05	2.01
Effective (2)	0.02	0.88	0.00	1	0.98	1.02	0.18	5.73
Very effective (3)	-0.04	0.74	0.00	1	0.96	0.97	0.23	4.15
RE of raising goods (Ref.)			4.36	3	0.23			
Somewhat effective (1)	-2.16	1.43	2.27	1	0.13	0.12	0.01	1.91
Effective (2)	-0.12	0.98	0.02	1	0.90	0.89	0.13	6.06
Very effective (3)	-0.70	0.85	0.67	1	0.41	0.50	0.09	2.65
RE of rebuilding/raising floor (Ref.)			1.16	3	0.76			
Somewhat effective (1)	1.40	2.12	0.43	1	0.51	4.05	0.06	260.10
Effective (2)	1.81	1.70	1.13	1	0.29	6.12	0.22	171.58
Very effective (3)	1.24	1.50	0.69	1	0.41	3.46	0.18	65.15
RE of building small dyke (Ref.)			2.59	3	0.46			
Somewhat effective (1)	-1.12	0.89	1.59	1	0.21	0.33	0.06	1.87
Effective (2)	-1.04	1.01	1.05	1	0.31	0.36	0.05	2.59
Very effective (3)	-0.13	1.03	0.02	1	0.90	0.88	0.12	6.61
RE of putting sandbags (Ref.)			8.90	3	0.03			
Somewhat effective (1)	0.15	0.75	0.04	1	0.84	1.17	0.27	5.11
Effective (2)	-0.03	0.92	0.00	1	0.97	0.97	0.16	5.90
Very effective (3)	2.02	0.78	6.67	1	0.01	7.51	1.63	34.70
RE of putting grass (Ref.)			0.09	3	0.99			
Somewhat effective (1)	0.17	0.76	0.05	1	0.82	1.19	0.27	5.25
Effective (2)	-0.10	0.82	0.01	1	0.91	0.91	0.18	4.50
Very effective (3)	-0.02	0.96	0.00	1	0.98	0.98	0.15	6.36

## Annex 4 a. Continued

RE of clearing drainage (Ref.)			0.29	3	0.96			
	-	40192.8						
Somewhat effective (1)	20.83	6	0.00	1	1	0	0	.
	-	40192.8						
Effective (2)	20.19	6	0.00	1	1	0	0	.
	-	40192.8						
Very effective (3)	20.55	6	0.00	1	1	0	0	.
	-	40192.8				1.25E+0		
Constant	20.95	6	0.00	1	1	9		

The coding of the categories is as follows: Reference: ineffective; 1: somewhat effective; 2: effective; 3: very effective

*Variables with significant p-values are highlighted in yellow*

## Appendices

4b: Binary logistic regression model summary of perceived self-efficacy against mitigation behaviour

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
SE of raising sockets (Ref.)			2.84	3	0.42			
A bit able (1)	-1.34	0.81	2.76	1	0.10	0.26	0.05	1.27
Able (2)	-0.55	0.63	0.76	1	0.38	0.58	0.17	1.98
Highly able (3)	-0.24	0.53	0.21	1	0.65	0.78	0.28	2.23
SE of capturing rainwater (Ref.)			2.38	3	0.50			
A bit able (1)	0.61	0.66	0.84	1	0.36	1.84	0.50	6.72
Able (2)	-0.54	0.64	0.71	1	0.40	0.58	0.17	2.05
Highly able (3)	0.02	0.48	0.00	1	0.96	1.02	0.40	2.64
SE of relocation (Ref.)			2.18	3	0.54			
A bit able (1)	0.41	0.93	0.19	1	0.66	1.51	0.24	9.33
Able (2)	0.35	0.66	0.28	1	0.60	1.42	0.39	5.18
Highly able (3)	0.80	0.55	2.10	1	0.15	2.22	0.76	6.50
SE of raising goods (Ref.)			0.76	3	0.86			
A bit able (1)	-0.08	0.85	0.01	1	0.92	0.92	0.17	4.89
Able (2)	-0.39	0.62	0.40	1	0.53	0.68	0.20	2.27
Highly able (3)	-0.40	0.54	0.55	1	0.46	0.67	0.24	1.93
SE of rebuilding/raising floor (Ref.)			2.94	2	0.23			
A bit able (1)	1.59	0.93	2.93	1	0.09	4.92	0.79	30.48
Able (2)	0.44	0.60	0.55	1	0.46	1.55	0.48	4.99
SE of building small dyke (Ref.)			1.23	3	0.75			
A bit able (1)	-0.24	0.79	0.09	1	0.76	0.79	0.17	3.70
Able (2)	-0.45	0.66	0.46	1	0.50	0.64	0.18	2.31
Highly able (3)	0.18	0.56	0.10	1	0.75	1.19	0.40	3.56
SE of putting sandbags (Ref.)			12.51	3	0.01			
A bit able (1)	-0.20	0.78	0.07	1	0.80	0.82	0.18	3.73
Able (2)	-0.42	0.56	0.56	1	0.45	0.66	0.22	1.98
Highly able (3)	1.36	0.51	7.14	1	0.01	3.88	1.44	10.50
SE of putting grass (Ref.)			15.41	3	0.00			
A bit able (1)	1.04	0.79	1.71	1	0.19	2.82	0.60	13.32
Able (2)	-2.13	0.69	9.46	1	0.00	0.12	0.03	0.46
Highly able (3)	-1.90	0.72	6.97	1	0.01	0.15	0.04	0.61
SE of clearing drainage (Ref.)			12.33	3	0.01			
A bit able (1)	0.86	1.33	0.42	1	0.52	2.35	0.18	31.58
Able (2)	-1.39	0.66	4.36	1	0.04	0.25	0.07	0.92
Highly able (3)	0.39	0.53	0.54	1	0.46	1.48	0.52	4.20
Constant	0.16	0.52	0.09	1	0.76	1.17		



In 4b above, the coding of the categories is as follows: Reference: not able; 1: a bit able; 2: able; 3: highly able

*Variables with significant p-values are highlighted in yellow*

In 4c below, the coding of the categories is as follows: Reference: very low; 1: low; 2: high; 3: very high

*Variables with significant p-values are highlighted in yellow*

## Appendices

### 4c: Binary logistic regression model summary of perceived response costs against mitigation behaviour

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
RC of raising sockets (Ref.)								
			4.67	3	0.20			
Low (1)	-0.89	0.69	1.70	1	0.19	0.41	0.11	1.57
High (2)	-0.71	0.71	1.02	1	0.31	0.49	0.12	1.96
Very high (3)	-1.41	0.67	4.43	1	0.04	0.25	0.07	0.91
RC of capturing rainwater (Ref.)								
			3.10	3	0.38			
Low (1)	0.35	0.48	0.53	1	0.47	1.42	0.55	3.64
High (2)	-0.08	0.66	0.01	1	0.91	0.93	0.26	3.37
Very high (3)	-0.83	0.65	1.65	1	0.20	0.44	0.12	1.55
RC of relocation (Ref.)								
			16.73	3	0.00			
Low (1)	-1.08	0.84	1.67	1	0.20	0.34	0.07	1.75
High (2)	-2.60	0.83	9.84	1	0.00	0.07	0.02	0.38
Very high (3)	-0.37	0.67	0.30	1	0.58	0.69	0.19	2.58
RC of raising goods (Ref.)								
			7.07	3	0.07			
Low (1)	-0.88	0.71	1.53	1	0.22	0.41	0.10	1.68
High (2)	0.46	0.67	0.47	1	0.49	1.58	0.43	5.84
Very high (3)	-0.52	0.60	0.75	1	0.39	0.59	0.18	1.93
RC of rebuilding/raising floor (Ref.)								
			6.56	3	0.09			
Low (1)	4.54	1.82	6.23	1	0.01	93.47	2.65	3301.81
High (2)	3.31	1.47	5.10	1	0.02	27.50	1.55	488.84
Very high (3)	3.19	1.40	5.16	1	0.02	24.20	1.55	378.10
RC of building small dyke (Ref.)								
			3.42	3	0.33			
Low (1)	-0.82	0.71	1.32	1	0.25	0.44	0.11	1.79
High (2)	-0.96	0.73	1.73	1	0.19	0.38	0.09	1.60
Very high (3)	-0.03	0.71	0.00	1	0.96	0.97	0.24	3.89
RC of putting sandbags (Ref.)								
			7.94	3	0.05			
Low (1)	0.24	0.54	0.20	1	0.65	1.27	0.45	3.64
High (2)	0.84	0.63	1.75	1	0.19	2.31	0.67	7.99
Very high (3)	1.54	0.59	6.83	1	0.01	4.68	1.47	14.86
RC of putting grass (Ref.)								
			4.49	3	0.21			
Low (1)	0.23	0.49	0.22	1	0.64	1.26	0.49	3.25
High (2)	-0.20	0.55	0.13	1	0.72	0.82	0.28	2.42
Very high (3)	-1.22	0.66	3.45	1	0.06	0.30	0.08	1.07
RC of clearing drainage(Ref.)								
			4.52	3	0.21			
Low (1)	-2.27	1.11	4.20	1	0.04	0.10	0.01	0.91
High (2)	-1.69	0.91	3.42	1	0.07	0.19	0.03	1.11
Very high (3)	-1.40	0.89	2.49	1	0.12	0.25	0.04	1.41
Constant	0.57	1.53	0.14	1	0.71	1.78		

## Appendices

## Summary

Globally, the damage caused by floods is increasing because of rising urbanisation and climate change. In developing world cities, the impacts of these floods are wide-reaching because of high levels of vulnerability, unplanned development (usually in environmentally sensitive areas), and the weak enforcement of existing by-laws and planning standards by some local authorities. This is exacerbated by high poverty levels, with a big part of the population living on less than a dollar per day. The economy is also highly reliant on informal activities in which micro small and medium enterprises contribute a big percentage of employment, yet they operate in the open and lack access to lines of credit which are critical for resilience building

By and large, the problem of flooding has been tackled using city-wide engineering solutions, which have proved to be inadequate, and burdensome to local authorities, especially in the developing world cities. Local-level protective measures by households, businesses, and communities, have become integral in augmenting city-wide efforts. In supporting local level self-protective efforts, it is key to understand their motivations for doing it and vice versa. While scholars have done much in this direction, very little effort has been applied in Africa.

Cities in the developing world are also facing governance problems that militate against revenue generation and implementation of planning standards. Governance models promoted by international development agencies are proving to be problematic and more innovative and pragmatic governance models and evaluative frameworks are needed. Moreover, rapid innovative ways of researching resilience-building efforts in the developing world cities are needed to close the data gap between the developing world and the developed world.

I addressed these problems by carrying out a case study of three neighbourhoods in Kampala - a city which faces recurrent flash floods and has in the past 6 years undergone governance reform.

In chapter 2, I examined the influence of governance rearrangements from a decentralised system to a hybrid system, on the performance of the city administration on flood risk mitigation. I adapted a Water Governance Assessment Framework to measure the anticipated changes. A positive change was established in flood mitigation because of improved revenue generation and intensity in the implementation of planning standards

In Chapter 3, I provided a research fieldwork management technique (Extended Briefing and Debriefing Technique) which can help carry out rapid surveys with multi-lingual research assistants in cross-language/national settings. Researchers can apply this technique to

counter financial barriers to more studies of this nature in other developing world cities.

Chapters four and five document the influencing factors of threat and coping appraisal respectively, among households. Flood mitigation efforts by the government, coupled with the transient nature of informal settlements, negatively influence threat appraisal.

Regarding coping appraisal by households, first, income negatively influences perceptions of self-efficacy for lower-cost structural measures because, in informal economies, those with lower incomes tend to do manual jobs themselves. Second, our findings from the affluent neighbourhood confirm what past studies report – that higher education is associated with lower perceptions of self-efficacy for structural measures by contrast with what was found in the slum areas. Here too, we expect that income is playing a role since it is correlated with education level. Third, social capital does not necessarily lead to perceptions of a lower cost of implementing non-structural measures, which may signal weak social networks. Fourth, instead of past flood damage motivating households to do more to protect themselves in the future, we see evidence that such events incapacitate them and undermine their sense of resilience. This suggests that low severity but high-frequency floods, such as those in Kampala, can have significant impacts on the resilience of affected communities which should not be underestimated in flood risk reduction strategies and programs

Business perceptions about flood risk and coping, and motivations to self-protect, are presented in Chapter 6. micro-enterprises were found to be more likely to implement mitigation measures compared to small enterprises contradicting two past studies in the United Kingdom in two states of the USA. A probable reason found behind such relations is that more than half of the small businesses had mitigation measures already in place at the time of the study. This highlights the importance of time in such studies and perhaps indicates why there are mixed results in the literature.

The businesses that rent their premises were more likely to implement mitigation measures compared to those that own. In Kampala, business tenants may be more self-reliant in this respect; they may have little confidence that the property owner will invest in such measures given their low incomes and the lack of legal instruments that require owners to invest to protect their tenants.

Having experienced flooding did not motivate businesses to implement flood mitigation measures. The financial impacts were significant enough to show a change in mitigation behaviour unlike property damage and health issues, but it is important to note that most of the financial impacts include costs incurred due to hospital bills and

property/goods damages. Also, while floods may be frequent in our three study areas they are, mostly not extreme so major property damage and health impacts may be quite rare.

The businesses that are more willing to spend on mitigation measures are more likely to implement such measures. The influence of coping appraisal elements was not consistent across the nine mitigation measures analysed in this research, and not all were significant contributors to the models predicting the mitigation behaviour.

Government actions, like the expansion of the primary drainage channel in Bwaise III which was completed in 2013, increased the confidence among local businesses about the measure 'clearing drainage' relative to Natete where such action has not yet been undertaken, despite the approval of a Drainage Master Plan in 2002. Such capital investments in drainage infrastructure are important elements of the flood reduction strategy of Kampala, though the shortage of funding often means long lead times for implementation, and the lack of attention and funds for drainage maintenance may compromise the effectiveness of the measure for long-term flood protection, even in Bwaise III.

## Summary

## Samenvatting

De schade die wereldwijd door overstromingen wordt veroorzaakt, wordt in toenemende mate veroorzaakt door toenemende verstedelijking en klimaatverandering. In de steden in de ontwikkelingslanden zijn de gevolgen van deze overstromingen verstrekkend vanwege de hoge mate van kwetsbaarheid, ongeplande ontwikkeling (vaak in ecologisch kwetsbare gebieden), en het negeren van bestaande verordeningen en planningsnormen door sommige lokale autoriteiten. Dit wordt nog verergerd door de hoge armoedeniveaus, waarbij een groot deel van de bevolking leeft van minder dan een dollar per dag. De economie is ook sterk afhankelijk van informele activiteiten waarbij mkb's een groot deel van de werkgelegenheid vertegenwoordigen, maar vaak opereren ze in de open lucht en hebben geen toegang tot kredietlijnen die essentieel zijn voor het opbouwen van veerkracht.

Over het algemeen is het probleem van overstromingen aangepakt met behulp van technische oplossingen voor de hele stad, die echter ontoereikend zijn gebleken en belastend voor de lokale autoriteiten, vooral in de steden in de ontwikkelingslanden. Beschermende maatregelen op lokaal niveau door huishoudens, bedrijven en gemeenschappen zijn een integraal onderdeel geworden van het vergroten van de stadsbrede inspanningen. Bij het ondersteunen van zelfbeschermingsinspanningen op lokaal niveau is het van cruciaal belang om hun beweegredenen om het te doen te begrijpen en vice versa. Hoewel wetenschappers veel in deze richting hebben onderzocht, is er in Afrika relatief weinig onderzocht.

Stadsgemeenten in ontwikkelingslanden hebben ook te maken met bestuursproblemen die het genereren van inkomsten en de implementatie van planningsnormen in de weg staan. Bestuursmodellen die door internationale ontwikkelingsagentschappen worden gepromoot, blijken problematisch te zijn en er zijn meer innovatieve en pragmatische bestuursmodellen en evaluatiekaders nodig. Bovendien zijn er snelle innovatieve manieren nodig om onderzoek te doen naar inspanningen om de veerkracht in steden in ontwikkelingslanden te vergroten om de gegevenskloof tussen de derde wereld en de ontwikkelde wereld te dichten.

Ik heb deze problemen aangepakt door een case study uit te voeren van drie buurten in Kampala - een stad die te maken heeft met terugkerende overstromingen en de afgelopen zes jaar een bestuurshervorming heeft ondergaan.



In hoofdstuk 2 heb ik de invloed onderzocht van bestuursherschikkingen van een gedecentraliseerd systeem naar een hybride systeem, op de prestaties van het stadsbestuur op het verminderen van overstromingsrisico's. Ik heb een Toetsingskader Water Governance aangepast om de verwachte veranderingen te meten. Er werd een positieve verandering vastgesteld in de beperking van overstromingen vanwege een verbeterde inkomstengeneratie en intensiteit bij de implementatie van planningsnormen

In hoofdstuk 3 heb ik een techniek voor het beheer van onderzoeksveldwerk gegeven (Extended Briefing and Debriefing Technique) die nuttig kan zijn bij het uitvoeren van snelle enquêtes met meertalige onderzoeksassistenten in meertalige/nationale instellingen. Onderzoekers kunnen deze techniek toepassen om financiële barrières weg te nemen voor meer van dit soort studies in andere ontwikkelingssteden.

Hoofdstuk vier en vijf documenteren de beïnvloedende factoren van respectievelijk dreigings- en copingbeoordeling bij huishoudens. De inspanningen van de overheid om overstromingen tegen te gaan, in combinatie met het voorbijgaande karakter van informele nederzettingen, hebben een negatieve invloed op de beoordeling van de dreiging.

Wat betreft de copingbeoordeling door huishoudens, ten eerste, heeft inkomen een negatieve invloed op de perceptie van *self-efficacy* voor goedkopere structurele maatregelen, omdat in informele economieën mensen met lagere inkomens de neiging hebben om zelf handmatig werk te doen. Ten tweede bevestigen onze bevindingen uit de welvarende buurt wat eerdere studies rapporteren - dat hoger onderwijs wordt geassocieerd met lagere percepties van *self-efficacy* voor structurele maatregelen in tegenstelling tot wat werd gevonden in de sloppenwijken. Ook hier verwachten we dat het inkomen een rol speelt aangezien het samenhangt met het opleidingsniveau. Ten derde leidt sociaal kapitaal niet noodzakelijkerwijs tot percepties van lagere kosten van het implementeren van niet-structurele maatregelen, wat kan wijzen op zwakke sociale netwerken. Ten vierde, in plaats van dat de schade door overstromingen uit het verleden huishoudens motiveert om meer te doen om zichzelf in de toekomst te beschermen, zien we aanwijzingen dat dergelijke gebeurtenissen hen onbekwaam maken en hun gevoel van veerkracht ondermijnen.

Dit suggereert dat overstromingen met een lage ernst maar met een hoge frequentie, zoals die in Kampala, aanzienlijke gevolgen kunnen hebben voor de veerkracht van getroffen gemeenschappen, wat niet mag worden onderschat in strategieën en programma's voor het verminderen van overstromingsrisico's.

Bedrijfspercepties over overstromingsrisico en coping, en motivaties om zichzelf te beschermen, worden gepresenteerd in hoofdstuk 6. Micro-ondernemingen bleken meer geneigd om mitigerende maatregelen te implementeren in vergelijking met kleine ondernemingen, wat in tegenspraak is met twee eerdere studies in het Verenigd Koninkrijk in twee staten van Verenigde Staten. Een mogelijke reden voor dergelijke relaties is dat meer dan de helft van de kleine bedrijven op het moment van het onderzoek al mitigerende maatregelen had genomen. Dit benadrukt het belang van tijd in dergelijke studies en geeft misschien aan waarom er gemengde resultaten in de literatuur zijn.

De bedrijven die hun bedrijfspand huren, waren eerder geneigd mitigerende maatregelen te nemen dan bedrijven die eigenaar waren. In Kampala kunnen zakelijke huurders wat dat betreft zelfredzamer zijn; ze hebben misschien weinig vertrouwen dat de eigenaar van het onroerend goed in dergelijke maatregelen zal investeren, gezien hun lage inkomen en het gebrek aan juridische instrumenten die eigenaren verplichten te investeren om hun huurders te beschermen. Het ervaren van overstromingen motiveerde bedrijven niet noodzakelijkerwijs om overstromingsbeperkende maatregelen te nemen.

De financiële gevolgen waren groot genoeg om een verandering in het mitigatiegedrag te laten zien, in tegenstelling tot materiële schade en gezondheidsproblemen, maar het is belangrijk op te merken dat de meeste financiële gevolgen kosten omvatten die zijn gemaakt als gevolg van ziekenhuisrekeningen en schade aan eigendommen/goederen. Hoewel overstromingen in onze drie studiegebieden vaak voorkomen, zijn ze meestal niet extreem, zodat grote materiële schade en gezondheidseffecten vrij zeldzaam kunnen zijn.

De bedrijven die meer willen uitgeven aan mitigerende maatregelen, zullen dergelijke maatregelen eerder implementeren. De invloed van coping-beoordelingselementen was niet consistent in de negen mitigatiemaatregelen die in dit onderzoek werden geanalyseerd, en niet alle droegen significant bij aan de modellen die het mitigatiegedrag voorspelden.

Overheidsacties, zoals de uitbreiding van de primaire afwateringskanaal in Bwaise III, voltooid in 2013, laten zien dat bedrijven van Bwaise III zeer positief zijn over de maatregel 'opruimen van drainage' ten opzichte van Natete, waar dergelijke actie nog niet is ondernomen, ondanks de goedkeuring van een Masterplan voor drainage in 2002. Dergelijke kapitaalinvesteringen in drainage-infrastructuur zijn belangrijke elementen van de strategie voor het terugdringen van

overstromingen van Kampala, hoewel het gebrek aan financiering leidt vaak tot lange aanlooptijden voor de uitvoering en het gebrek aan aandacht en geld voor drainageonderhoud wat leidt tot en afnemende effectiviteit van de maatregel voor langdurige bescherming tegen overstromingen, ook in Bwaise III.