

SOCIAL VULNERABILITY ASSESSMENT IN FLOOD PRONE AREAS: A CASE STUDY OF CHIKUSE VILLAGES T/A MAKHWIRA IN CHIKWAWA DISTRICT, SOUTHEN MALAWI.

[CHISOMO PHIRI]

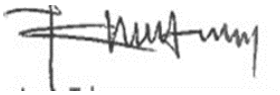
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SOCIAL VULNERABILITY ASSESSMENT IN FLOOD PRONE AREAS: A CASE STUDY OF CHIKUSE VILLAGES T/A MAKHWIRA IN CHIKWAWA DISTRICT, SOUTHEN MALAWI.

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SOCIAL VULNERABILITY ASSESSMENT IN FLOOD PRONE AREAS: A CASE STUDY OF CHIKUSE VILLAGES T/A MAKHWIRA IN CHIKWAWA DISTRICT, SOUTHEN MALAWI.

DECLARATION

I Chisomo Phiri declare that this research project represents my own work and that it has never been submitted to this institution or any other institution for any academic purpose. All sources of information have been appropriately acknowledged.

Signature 

Date: 19/07/2021

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ABSTRACT

This paper analyses the impact of floods on social vulnerability and coping capacity of people in T/A Makhwira in Chikwawa district, Southern Malawi. It seeks to find the linkage between floods, social vulnerability and coping capacity at all disaster risk management stages of the cycle. In order to meet the objectives, observations (physical structures) were made on the recovery status and a survey was conducted in order to assess the impacts (positive/negative) of floods on social vulnerability and enhancing community resilience. In addition to that interviews were conducted to find out the coping capacities which existed in the area and their progress including extra measures they adopt knowing that the area is prone to flooding. This study showed the linkage (direct or indirect) between floods and social vulnerability. It also showed the knowledge people have on their level of vulnerability and their coping capacities. In addition to that it showed the existing gaps and suggestions on how people can improve their coping capacity to floods in the area.

This paper profiles the leading drivers of social vulnerability to floods. The results show that vulnerability to flood in T/A Makhuwira in Chikwawa district is determined by the dwelling type, employment, education and amount of rainfall in a season. The study recommends that public awareness campaigns, early warning systems and improved disaster management strategies must take into consideration differentiated levels of vulnerability and community coping mechanisms and preferences. Chikuse Wilson and Chikuse Gutusu are the main areas prone to flood, social, risk, highlighting the need for a cohesive management approach at all levels to recognize local capacities and increase communication, awareness, and preparedness to mitigate the undesirable effects of such events.

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ACRONYMS/ABBREVIATIONS

ADC: Area Development committee

ENSO: El-Nino Southern Oscillation

FVI: Flood Vulnerability Index

MAX: Maximum

MIN: Minimum

MOVE: Methods for the Improvement of Vulnerability Assessment in Europe framework.

NGO: Non-Governmental Organisation

SPSS: Statistical Package for Social Scientists

T/A: Traditional Authority

WHO: World Health Organization

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1. CHAPTER 1: INTRODUCTION

1.1 Background

Vulnerability to flood is the characteristics and circumstances of a community that make it prone to the damaging effects of floods. According to the international strategy for disaster reduction, vulnerability is defined as a set of conditions and processes resulting from physical, social, environmental and economic factors which increases the susceptibility of a community to the impact of hazard. Floods have been occurring in different parts of the world affecting many people. Areas which were not experiencing floods are now affected by it. Recently flood occurrences have increased in magnitude and intensity.

Floods can occur as both frequent and rare events, as short and long duration, and produce adverse impacts across the range of magnitudes. Human processes such as urbanization and structural defenses have a large influence on the movement and severity of flooding, but amplifying them in others. Ongoing changes in population, land use and climate are intensification of flood disasters in T/A Makhuwira area. An increase in the frequency of floods resulted in loss of people's lives, damage to property and infrastructure, as well as destruction of the natural environment. Most of the coping strategies in T/A Makhuwira communities are temporary relocation, evacuation to a safe area and waiting for government and neighbors to help. Floods can be caused by the natural environment through heavy rainfall and human activities such as development and settlement planning are key attributes.

This study assesses flood vulnerability, levels of vulnerability, determinants of flood vulnerability and coping strategies for flood hazards. The aim of this study is to assess flood vulnerability and adaptation strategies of T/A Makhuwira rural communities. Most households are vulnerable to flood hazards. It is therefore important to measure their level of social vulnerability and assess their responses for current and future planning.

Vulnerability differs between families in a same village. Vulnerability to exist, the capacity of the population to absorb, respond and recover from the impacts must be taken into consideration (Ngie,2012). Some families or social, ethnic or religious

groups may be highly vulnerable to disaster through poverty, location or type of housing and sickness in the family high rate of unemployment and low income have contributed to the lack of resilience to many communities. This is because resource availability influences the level of resilience and recovery. Adequate resources lead to lower vulnerability, whilst a lack of them makes people more exposed and vulnerable to floods because it would take a long period of time for people to recover from damage.

1.2 Problem statement.

It has been a tradition to help people before and after floods, apart from all measures put in place people in prone areas are still vulnerable. Despite all practices, people in T/A Makhuwira are vulnerable to floods almost every year. Do all measures to reduce vulnerability and increase coping capacity really matter?

1.3 Main and specific objectives

The main objective of the study is to assess the social vulnerabilities and coping capacities in flood prone areas of T/A Makhuwira in Chikwawa district. Other specific objectives include:

1. Investigating the level of vulnerability based on social conditions of people in the study area.
2. To find out reasons why the vulnerable people still remain in the flood prone areas.
3. To find out what could be the most effective mitigation strategies based on the condition in the study area.

1.4 Research questions.

In order to achieve the research objectives, the following research questions should be answered:

1. What are the determinants of flood vulnerability?
2. To what extent are people vulnerable to floods in T/A Makhuwira area?
3. How can the impact of floods be used to predict social vulnerability?

4. How do communities cope with floods in T/A Makhuwira?

1.5 Research hypothesis.

This study is designed to assess the hypothesis that people in flood prone areas are more vulnerable to floods than those in areas not prone to floods in the same area.

1.6 Significance of the study.

People will keep on suffering from floods without adequate and proper ways to address the risk in absence of correct understanding of vulnerability to floods. Knowledge on the flood vulnerability will help the communities to build resilience and capacity to adapt to changes in hazardous areas by modifying themselves to achieve an acceptable lev

2. CHAPTER 2: LITERATURE REVIEW

Among natural and anthropogenic hazards, water related disasters represent one of the main environmental risks of our time, causing the major obstacles to human security and development (Adikari and Yoshitani, 2009). Mostly obstacles to human security and development are seen in the sub-sahara region where poverty levels are high. The present of the above data have intensified the attention of public authorities and researchers in understanding the factors contributing to such risks (IPCC 2012). Risk derives from the combination of hazard, vulnerability, and exposure to the elements present in a community that may translate into possible adverse effects (Cardona et al. 2012). Vulnerability refers to the social, economic, demographic, and built characteristics of a community that affect its ability to respond to, cope with, recover from, and adapt to environmental hazards (Cutter et al, 2003; HVRI, 2019). Social vulnerability can be defined as the vulnerability of the human environment (Brooks, 2003) and can be related not only to some individual characteristics such as gender, age, education, economic welfare, and race, among others, but even to complex community dynamics and support systems that may influence certain individuals in their ability to respond to particular threats (Cutter et al. 2003; Mechanic and Tanner, 2007). Social vulnerability may also include housing characteristics, besides social and economic inequalities.

A fine-scale social vulnerability assessment could provide insight to support disaster planning, especially at the local level (Reams et al, 2012). In light of increasing flood hazards, the 2007 European Union Floods Directive encourages member nations to adopt a more integrated view of flood risks and management strategies, taking into account the social vulnerabilities of residents (Beurton and Thieken, 2012). Floods are among the most devastating natural hazards and cost many lives every year (Dilley et al., 2005). An increase in the frequency of floods resulted not only in loss of people's lives but also damage to property and infrastructure, as well as the destruction of the natural environment. Concentrating attention on a single hazard may produce accurate and in-depth analysis surrounding it because of the unique physical process

characteristics. The spatial identification and the inclusion of vulnerable people into the risk management planning process have been widely discussed and fostered in the Sendai Framework for Disaster Risk Reduction (Aitsi-Selmi et al., 2016). It emerged that it could enhance effective mitigation plans aimed at increasing social capacities and serving as a communication tool among all the actors involved in the disaster management framework (Dunning and Durden, 2011). To reduce the damage of floods, both structural measures, such as the building of dams and dikes, and non-structural measures, such as forecasting and education, are often employed (Jelmer, 2013).

The number of people at risk due to floods is growing each year and the majority are in developing countries with high poverty levels, making them more vulnerable to disasters (UN/ISDR, 2004). Cardona noted that individuals and communities are differently exposed and are vulnerable to floods because of the socio-economic factors, such as wealth, education, race, ethnicity, religion, gender, age, class, disability and health status (Cardona, 2003). This is because flood vulnerability and adaptations are firmly related to the context of the natural environment and socio-economic factors of a specific area. The assessment of both vulnerability and adaptation are of great importance.

Vulnerability is examined in different fields and has therefore multiple explanations, concepts and methods in the scientific world (Birkman et al, 2013; schneiderbauer and ehrlich, 2004). The Intergovernmental Panel on the Climate Change (IPCC, 2007), wrote a report on climate change and the understanding of impacts, adaptation and vulnerability. In their research IPCC define vulnerability as the degree to which a system is susceptible to, and unable to cope with adverse effects of climate change, including climate change variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate change and variation to which a system is exposed, its sensitivity and its adaptive capacity (Adikari and Yoshitani, 2009). Vulnerability is considered to vary across physical space and within social groups (Birkmann, 2006; Vogel & O Brien, 2004).

There are different components of vulnerability which, however, are used differently over time. The social component in vulnerability plays a central role when determining the components of vulnerability (Cannon, Twigg & rowell, 2003). Firstly, social vulnerability is the extent to which people can protect themselves and how the social system is affected after a hazard. This component covers a broad dimension, such as mental damage, educational disruption, household composition, employment, demographic structure, capacity to cope and discrimination. Secondly, economic vulnerability is a frequently examined component and is usually the easiest dimension to measure (Van der Geest & Schindler, 2017). Economic vulnerability determines the damage to tangible assets that can be replaced after a flood (Birkmann, 2006). An example of economic indicator is the capacity to build stable houses and protection towards danger (Cannon et al, 2003). Lastly, physical vulnerability refers to the probability that physical assets will be damaged (e.g. water sources, hospitals and infrastructure) that disabled households to utilize or supplement resources (birkmann et al, 2013).

Vulnerability with regard to floods is explained as the manner in which households can deploy resources in case a flood event occurs to decrease the likelihood of a living space being flooded and reduce the negative impact (Pelling, 1997). Consideration of the social dimension is one of the most common approaches in vulnerability studies. Social vulnerability includes all factors specifically related to the interactions of flood hazards with individuals, populations and communities, including the exposure of people, sociodemographic and socioeconomic profiles, employment, education, household composition, demographic structure, and the capacity of society to cope with hazards and their effects (birkmann et al, 2013). All of these factors affect the resilience of communities to cope with flood effects, but their respective importance is not clear. Floods are among the most devastating natural hazards and cost many lives every year (Dilley et al. 2005).

In Malawi floods are manly caused by the natural environment through heavy rainfall, yet human activities such as development and settlement planning are key attributes (Cardona, 2003). Climate change is also one of the important causes of floods, as it is believed that the rise in global temperatures will result in severe floods

in several regions of the world. These changes are associated with the variability of weather and climate, such as the El-Nino Southern Oscillation (ENSO).

Flooding is the most common disaster in Malawi, accounting for approximately 40% of all recorded disasters (Nillson, Shela & Chavula, 2010). Most recently the floods of January to February 2015 affected some 1.1 million people, displacing 230 000 and leading to 170 fatalities and 172 reported missing (De Angeli, Rossi & trasforini, 2016). Report of 2019 in Malawi shows that 868 900 people were affected, 86 980 displaced, 672 injured, 59 dead and 3 were missing from Mangochi, machinga, Balaka, Zomba, Nsanje and Phalombe districts (Chidanti-Malunga, 2011). Report on the linkages between vulnerability and poverty has shown that these two closely interact with each other (Bourdelais, 2005), while also emphasizing a clear distinction between the two (Hoogeveen et al, 2004).

Recurrent floods also damage infrastructure, and impact local communities social, economic, cultural and psychological values (Mijoni & Izadkhah, 2019). The projected future increase in the frequency and intensity of extreme weather events in the region (Chidanti-Malunga, 2011), coupled with a lack of coping capacity (Mijoni & Izadkhah, 2009), mean that this situation will worsen unless more effective flood risk management strategies are devised.

Much on flood risk has been written and people's social vulnerability on the ground. Despite warnings people insist living in places prone to floods due to the benefit obtained during and after floods. The mere fact one being in flood prone area, do not mean they are vulnerable to flooding (De Marchi and Scolobig 2012). What other people may believe in are the problems with floods are not actually the real problems faced on the ground. The major flood areas in Malawi are along the shores of Lake Malawi (Chidanti-Malunga, 2011). Malawi is at risk of floods but the lower shire valley is the most affected area. The threat of the flood hazard has become complex and interrelated whilst the number of the vulnerable is growing fast. High intensity and long duration rains cause rivers in the area across the plateau to burst their banks flooding homes and farmland, and causing severe damage to crops and property (Shela et al., 2008). The lack of food and shelter increases the vulnerability of flood

victims, heavily impacting on their health and nutritional status (Mijoni & Izadkhah, 2019).

Previous research has indicated that natural disaster such as flooding can impact upon people's health in a number of ways (Parker et al & tapsell, 2000). Good health being defined as complete physical, mental and social well-being (World Health Organisation, 1948). Many people reported suffering from diarrhea and upset stomachs following the floods, while others spoke of other types of infection.

Flooding adversely affects mortality, physical health and mental health where the most substantial impact on health from floods is death by drowning (Mwale, 2014). Approximately one third of all deaths during flood events occur away from floodwater, however some are as a result of dehydration, lack of medical supplies and health issues that are overlooked prior to the flood events (World Health Organization, 1948). The psychological effects of floods are more acute after the floods and they are long standing.

The occurrence of floods in the Dakar suburbs, Senegalese capital used the Methods for the Improvement of Vulnerability Assessment in Europe (MOVE) framework which characterizes vulnerability through three key factors, exposure, susceptibility and lack of resilience (O. D. Sané et al. 2015). Also, this approach underlines the necessity to consider multiple thematic dimensions when assessing vulnerability in the context of natural and socio-natural hazards. It is the case in the study area because flooding is not only caused by extreme events like a heavy rainfall but it is a combination of many factors that trigger natural hazard-associated risk that threatens human security. In MOVE framework flood vulnerability index (FVI) was applied to measure the extent of flood vulnerability. The FVI method uses three factors of flood vulnerability, namely, exposure, susceptibility and resilience. Exposure and susceptibility positively influence vulnerability and indicators belonging to exposure and susceptibility increase the FVI, whereas resilience negatively influences vulnerability and indicators belonging to resilience decrease the FVI (Quang et al. 2012:103). Because the framework proved to be effective in assessing flood vulnerability, this study will adopt the framework.

3. CHAPTER 3: METHODOLOGY

3.1 The study area

The area of traditional authority Makhuwira is part of Lower Shire Valley that lies at the southern tip of Malawi in Chikwawa district and is part of the Shire Basin, which extends into Mozambique. Annual rainfall in the basin is highly spatially variable, reaching about 2000mm in the eastern part due to orographic influences. This often results in high flows of up to 5400m3 s−1 at the Sinoya station on the Ruo River, causing devastating floods particularly in areas near its confluence with the main Shire River (Shela et al., 2008).

Poverty rates in Chikhawa district is one of the highest in the country, with over 80% living on less than USD0.4/capita/day (National Statistical Office, 2012). Livelihoods are derived from subsistence farming, livestock rearing and casual labour, all of which are threatened by a multiplicity of stressors including floods, droughts and HIV/AIDS, among others (Casale et al., 2008). As a compromise, the Area Development Committee (ADC) level was selected as the scale for the study. The ADC is headed by a Chief, the Traditional Authority (TA). In general, developmental work in Malawi through NGOs and others is also much tied to administrative boundaries of T/As (Malcomb et al., 2014).

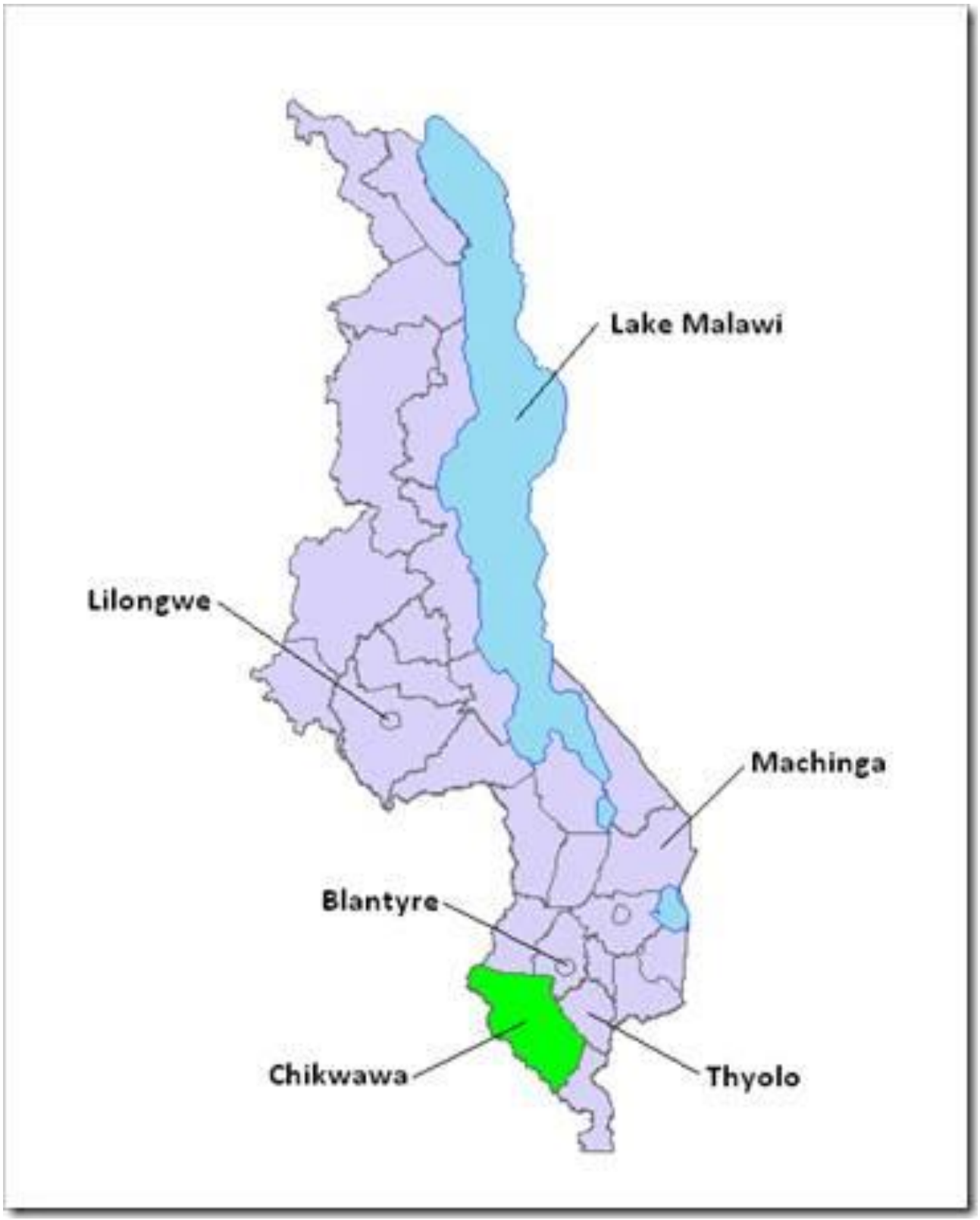


Figure 1: Geographical location of Chikwawa on the map of Malawi

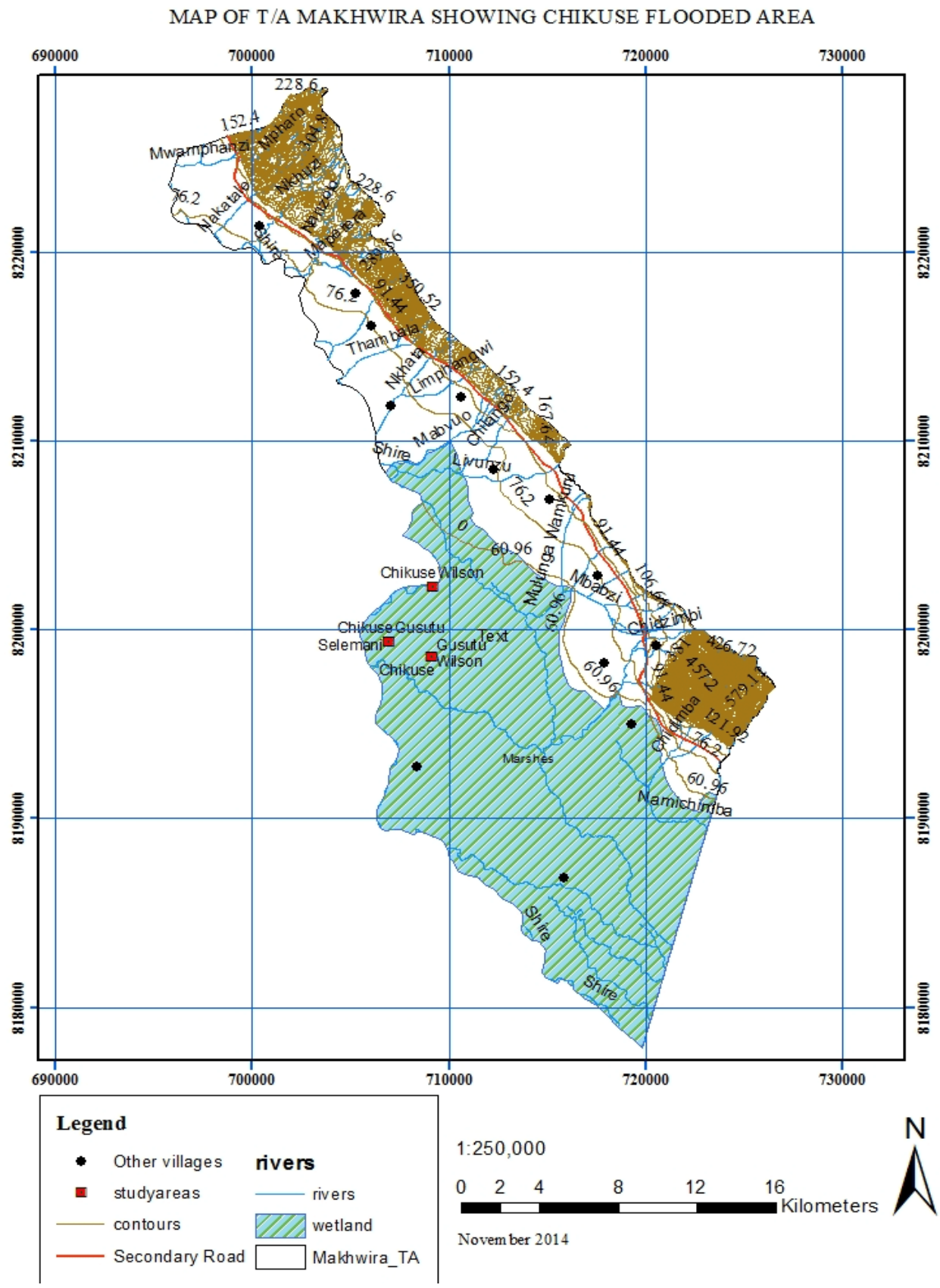


Figure 2: Geographical location of the study area

3.2 Research Design

Research design determines what type of data is needed, methods of data acquisition and how it is going to answer the problem. It also provides the overall framework for data collection in a manner that aims to combine relevance to the research purpose (Inaam, 2016).

In this study, a mixed method of data collection was used. The mixed method approach is defined as research in which the investigator collects and analyses data, integrates the findings and draws inferences using both qualitative and quantitative approaches or methods in a single study or a program of inquiry (Tashakkori & Teddlie). By mixing the datasets, it provides a better understanding of the problem than if either dataset had been used alone.

3.2.1 Materials and Methods

Key factors of the MOVE framework are related to the exposure, susceptibility, resilience and adaptive capacity. Exposure is the extent to which a unit of assessment falls within the geographical range of a hazard event. susceptibility is the predisposition of elements at risk to suffer harm. Lack of capacity is the limitations in responding to a particular hazard. Based on data availability, previous research and personal judgement, the following indicators were selected under each vulnerability component (Table 1). This table gives the functional relationship between the indicators and the vulnerability.

Table 1; components, number of indicators and the functional relationship.

Components	Number	Indicators	Functional relationship
Exposure	1	Household size	Positive
Susceptibility	1	Number of children under 5 years	Positive
Lack of resilience	1	Distance to nearest health center	Positive

Development of indices

To measure vulnerability, the study adapted the Community Based Disaster Risk Index (CBDRI).

$$CBDRI=\lambda(H+E+S-C) \qquad Eq \quad (1)$$

$$H = h \; X \; i=1 \; w_i x_i; \qquad E= q \; X \; j=1 \; w_j x_j;$$

$$S = r \; X \; k=1 \; w_k \; x_k; \qquad C = z \; X \; y=1 \; w_y x_y \qquad Eq \quad (2)$$

where H, E, S and C are the hazard, exposure, susceptibility and capacities sub-components; h, q, r, z are the total number of variables in the hazard, exposure, susceptibility and capacity components respectively; x is a score allocated to the variable in the sub-component based on the answer from the community and is equal to either 1 (low), 2 (medium) or 3 (high); w is the weight attached to each score based on respondents perception of the importance of a given variable (the w's summed over all the factors for each sub-component=33); and λ (=0.33) is a factor that helps ensure that the final index also lies in the interval [0, 100].

CBDRI was developed to measure risk directly, however, it is being adapted here for indexing vulnerability. The adaptation of the index carried out in the current study was to quantify the vulnerability from the Exposure, Susceptibility and Resilient

components and aggregate these to the total vulnerability using the arithmetic aggregation scheme as follows (Allison et al., 2009; Hahn et al., 2009).

$V = 1/3[E+S+(1-R)]$,

where (1−R) represents the lack of capacity. The vulnerability is categorized as: 0–0.2=very low, 0.2– 0.4=low, 0.4–0.6=medium, 0.6–0.8=high and 0.8– 1.0=very high. Table 2 contains a partial list of the factors considered for evaluation.

This study mainly adopts the use of primary data but secondary data was used. A survey was carried out through a structured questionnaire to generate the primary data. In addition to that other organizations that provides services to vulnerable people from floods were interviewed on the services they offered to the people in the area.

3.2.2 Survey

A pretesting questionnaire will be developed. The area was visited aiming at seeking formal permission, make the respondents aware of the study and guide the people on how to fill the questionnaire using the pretesting questionnaire to reduce errors. The questionnaire contained both open ended and closed questions.

3.2.3 Interviews

Key informant interviews were conducted to ask those that provide services to the flood prone community on how they operate within the disaster-prone areas.

3.2.4 Sampling Methods

Simple sampling method was used to target those that took part in the study. Sixty households were sampled. Qualitative key informant interviews, questionnaires and field observations were used to collect the data. The key informant interviews were held with one community leaders, one organisational representative and one member of the Disaster Management Centre.

3.2.5 Sample Size

The formula used to come up with the sample size was as follows;

$$n = \frac{z^2(1-p)p}{e^2}.$$

Where:

n= sample size

p= estimated proportion of population (p=0.5 since no previous is given)

z= z-value yielding to desired level of confidence (z = 1.96 i.e. 95% confidence level)

e= the absolute size of error allowed by the study (e = 0.1)

From the equation above after substituting with the values. Therefore

$$n = \frac{1.96^2(1-0.5)0.5}{0.1^2} = \frac{3.8416(0.5)0.5}{0.01} = 96.4 = 96$$(Nearest Whole Number)

For 10% non-responses then the sample size increased as follows 96*1.10=106.644.

The total sample size comprised of 68 households.

3.3 Data Analysis

The data was subjected to both descriptive and inferential statistical methods. Thematic analysis was used for qualitative data. The statistical package for social sciences (SPSS) spreadsheet was used to enter data. Questionnaires, key informant interviews, and field observations was the sources of indicators. Predetermined indicators were adopted from the study of Balica (2012:53). These indicators were reviewed and merged to suit the study area. Table 1 presents the analysis and interpretation of the FVI. The index gives a number from 0 to 1, signifying low or high flood vulnerability.

Table 1: Interpretation of flood vulnerability index.

Index value	Description
0 to 0.2	Very low vulnerability to floods
0.2 to 0.4	Low vulnerability to floods
0.4 to 0.6	Medium Vulnerability to floods
0.6 to 0.8	High vulnerability to floods
0.8 to 1	Very high vulnerability to floods

Table 2: Vulnerability indicators, components, factors and function/relationship with vulnerability.

Indicators	Components	Factors	Function/relationship with vulnerability
number of children less than 5 years	Social	Susceptibility	Higher number of children less than 5 years, higher vulnerability
Household size	Social	Exposure	Higher household size, higher vulnerability
Distance to nearest health center	Social	Capacity	Nearest to health center, low vulnerability

Table 3: T/A Makhwira flood vulnerability indicator results.

indicators	FVI values	FVI designation
Number of children less than 5 years	0.8	High vulnerability to floods
Household size	0.4	Medium vulnerability to floods
Distance to nearest health center	0.5	Medium vulnerability to floods

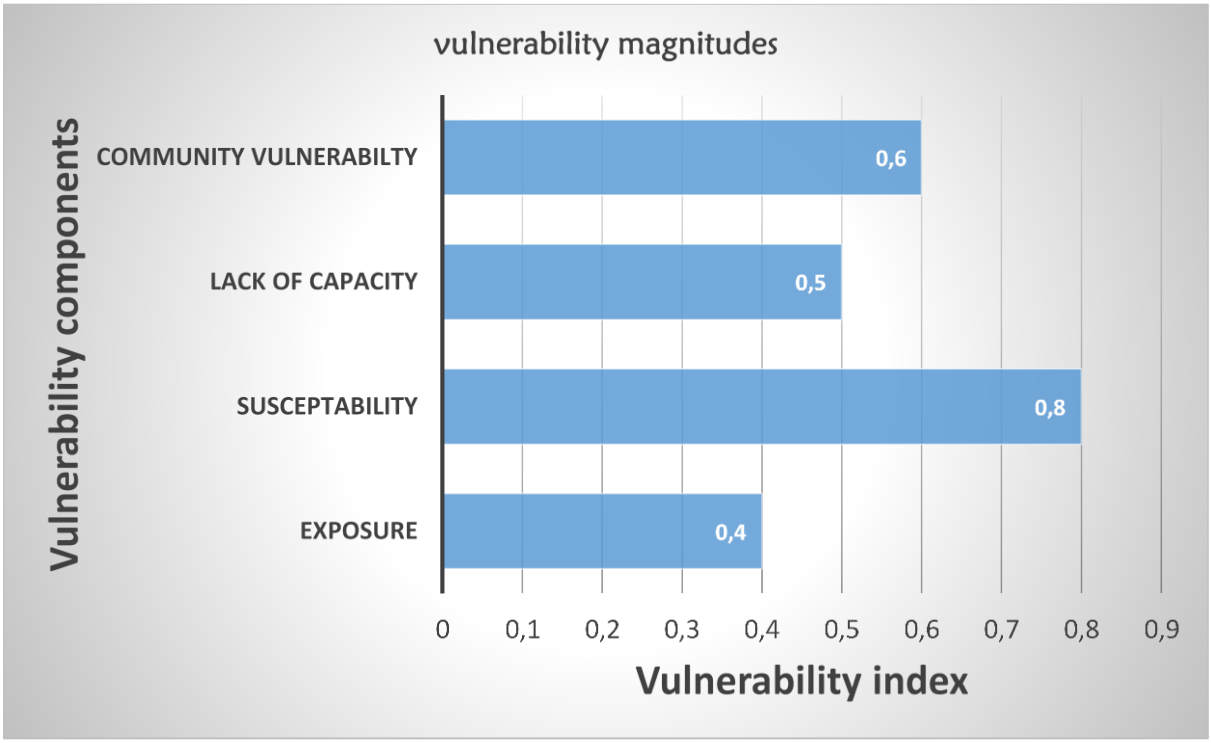


Figure 3: Vulnerability magnitudes from exposure, susceptibility and a lack of capacity across communities.

4. CHAPTER 4: RESULTS AND CONCLUSION

Data on components of the vulnerability were collected by administering questionnaires.

Figure 2 shows the resulting levels of vulnerability by exposure, susceptibility, capacities as well as aggregately, from where it is clear that aggregate community vulnerability is medium (0.4–0.6) to high (0.6–0.8) but predominantly medium. Exposure tends to be medium while susceptibility as high to very high (0.8–1.0), thus dominating the vulnerability.

The strong societal capacity within the communities has largely been responsible for tempering the capacity component of the vulnerability as shown in Fig. 2. Although the communities lacked economic and physical capacity, most respondents scored the societal support, e.g. the existence of Civil Protection Committees, reasonable community participation, substantial awareness, use of sms, drumming and whistling for flood warning, etc. very highly. Such community strength has also been described by Nilson et al. (2010).

On the flood hazardousness of T/A Makhuwira area, figure 2: through vulnerability index of the community, it showed that the area is affected by medium to high flood levels but with a predominance of the medium hazard.

4.1. Precipitation analysis.

The chance of wet days in Chikwawa varies significantly throughout the year. The wetter season lasts 4.1 months, from November to March, with a greater than 37% chance of a given day being a wet day. The chance of wet day peaks in January. Chikwawa experiences extreme seasonal variation in monthly rainfall. The rainy period of the year lasts for 6.9 months, October to May, with a sliding 31-day rainfall of at least 0.5 inches. The most rain falls during the 31 days centered around January, with an average total accumulation of 9.0 inches. The rainless period of the year lasts for 5.1 months, from May to October. The least rain falls around August with an average total accumulation of 0.1 inches. Rainfall is by far the most crucial variable that influences the climate and people's lives. Even though lives depend on rainfall,

extremes like floods are destructive for crops in agricultural activities and for human settlement

4.2. Vulnerability Analysis

The first element to be analyzed is exposure which is determined by the size of household. It is ranked from low to medium expose.

The susceptibility index is composed of the number of children less than 5 years of age in a given household. These households have the predisposition to suffer the most harm due to flood events during the rainy season. It is also ranked from high to very high. Some households are very highly susceptible because they have an important number of children less than five years who are known to be fragile to recurrent flood events in T/A Makhwira. Diseases such as cholera and water related diseases like malaria are very dangerous to this age group.

Resilience is determined by the distance from the nearest health centre. The nearer the household to the health centre, the higher is their resilience. the farther a household from the health centre the lower is the resilience and the higher the vulnerability in terms of health. The households located in villages of Cikuse Wilson, Chikuse Seleman and Chikuse Gutusu experience medium vulnerability. These households live permanently in flood situation during the rainy seasons and encounter many challenges regarding their health. Inhabitants in flood prone areas of T/A Makhwira are not resilient.

The overall risk profile showed that communities in T/A Makhuwira fall in the medium to high categories of the flood risk spectrum. Medium risk communities are dominant.

Social vulnerability index to floods is not limited to the set of indicators assessed. The reason for the restriction is due to absence and lack of accurate data to have a more composite index. However, the household size for the exposure, children less than four years of age for susceptibility and the distance from the nearest health centre for the lack of resilience appear to be relevant in assessing the social vulnerability of the community to flood in the study area.

This study has quantified and profiled vulnerability of rural communities in T/A Makhuwira as an example of the prevailing situation in much of flood prone areas in Malawi. It characterised vulnerability by exposure, susceptibility and capacity and then measured vulnerabilities by integrating indicators and components.

While the vulnerability to flooding is medium to very high, there were significant variations in the three dimensions. For example, although the susceptibility component was high to very high, the exposure component was medium. The lack of resilience or capacity is medium, which the study links to considerable societal capacity.

Traditional Authority Makhuwira area is really vulnerable to floods. This vulnerability is not only related to climatic conditions but a combination of factors. Rainfall is the most crucial variable on the climate and people's lives. Extreme rainfall is one of the manifestations of climate change which causes flood events. Many people in the area depend on agriculture which is subsistence and not highly paid. The statistics with the linkage to the literacy rate confirm that T/A Makhuwira inhabitants in general have limited economic means to buy land elsewhere where the amenities already exist.

Finally, the social vulnerability index to floods is limited to a few numbers of indicators. The reason for this restriction is due to the absence and lack of accurate data to have a more composite index. However, the household size for the exposure, children under five years of age for susceptibility and the distance from the nearest health centre for the lack of resilience appear to be relevant in assessing the vulnerability of community to flood.

5. CHAPTER 5: LIMITATION AND RECOMMENDATION

5.1. Limitations

The results are much dependent on variables in the index and their classification i.e. whether the variable is an exposure, susceptibility or capacity factor. Results are further affected by the thresholds set and the aggregation process applied. The spatial scale of application is another factor. Further, vulnerability data were sourced from communities which also make them potentially subjective.

5.2. Recommendation

It is necessary to promote a culture of prevention that favours the study of the different types of vulnerability in a certain area to save money, avoid the loss of accumulated wealth and, above all, save human lives in the face of disasters.

The present research focuses on the social aspect and proposes a method for quantifying it based on the integration of exposure level and resistance components. With this purpose, the developed method is based on vulnerability indices as they allow dimensionless results to be obtained at the social level that can be objectively compared with vulnerability in different areas, during different periods of time and at different scales.

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Appendices

APPENDEX A: THE INFORMED CONSENT FORM IN ENGLISH

My name is Chisomo Phiri from The Malawi University of Science and Technology (MUST). I am conducting a study on the social vulnerability and coping capacity in flood prone areas. The study will seek to find out the social vulnerability of people in T/A Makhwira and how floods have impacted the people living in the area in enhancing their resilience and reducing their vulnerability. I would like to request your participation in providing data related to disasters which will be used to inform decision makers with regard to disaster management.

Your participation in this questionnaire will contribute vital information required to achieve the intended goal of the study. Your participation in this study is entirely voluntary. It is your choice whether to participate or not.

There will be no direct benefit to you, but your participation is likely to help us find out more about how to improve disaster risk management interventions in disaster prone areas.

Kindly, note that the data provided will only be used for the purpose indicated here and will not be discussed to any third party.

If you have questions, feel free to ask them now or at any point during the interview. You can also ask by contacting my supervisors (Dr. Isaac Tchuwa) Tel:0881370317.

Consent Statement

I_____ (*Name of Participant*) am willing to take part and do declare that I **was not** forced to take part in this study.

Questions

1. Sex of the participant. Tick in the appropriate box.

Gender	Tick
Male	
Female	

2. Choose the age range that suits you. Tick in the appropriate box.

Age range	Tick
18-35	
36-45	
46-64	
Above 65	

3. Name the economic activity that you are involved in.
_____
_____
_____
_____

4. Is the house you live in

Permanently Owned	
Semi-Permanent	
Rented	

Observe the type of building dependent on materials used to build

Permanent(Cement, burnt or cemented brick Iron sheets)	
Semi-Permanent (Missing either cement, burnt or cemented bricks or iron sheets)	
Temporary(Mud and grass thatched)	

5. How much money do you earn in a day from the economic activity given in 3? Tick in the appropriate box.

Amount	Tick
Less than K1,000.00	
K1,000.00-K10,000.00	
K10,000.00-K20,000.00	
More than K20,000.00	

6. Is the amount of money earned from the economic activity given in 3 adequate? Tick in the appropriate box.

Adequacy	Tick
Adequate	
Inadequate	
Not available	

7. Give the number of individuals in your household. Tick in the appropriate box.

Number of individuals	Tick
2 or less	
3-5	
6-8	
More than 8	

8. Where is your household located? How close is it to the health center place? Tick in the appropriate box.

Distance to the health centre	Tick
Less than 1km	
1km-2km	
3km-5km	
More than 5km	

9. What is the reason for the choice of the location of the household? Tick in the appropriate box.

Reason	Tick
Ancestral land (family land)	
Close to economic activity	
The only available place	

Other: _____

10. To what extent does a disaster affect you? Tick in the appropriate box.

Extent	Tick
Barely	
Fairly	
Heavily	

11. How long does it take for you to recover from the impact of the flood disaster? Tick in the appropriate box.

Length of time	Tick
Less than 2 weeks	
2-3 weeks	
More than 3 weeks	

12. How easy is it to access information on flood disasters? Tick in the appropriate box.

Easiness	Tick
Very easy	
Easy	
Hard	

13. Do you get any assistance after floods in your area? Tick in the appropriate box.

Exist	Tick
Yes	
No	

14. How do you access information on floods? Tick in the appropriate boxes.

Source	Tick
Friends and relatives	
Newspaper	
Radio	
Television	
Promotion campaigns by disaster related organisations	

15. What are the services offer after a flood that you get?

_____

_____

_____

16. To what extent do you know about flood vulnerability? Tick in the appropriate box.

Extent	Tick
Less	
Moderate	
High	

17. How do you recover from a disaster? Tick in the appropriate boxes.

Means of recovery	Tick
Through personal savings	
Selling out personal/household assets	
Loan from friends and relatives	
Loan from informal financing sources	
Loan from microfinance institution	

Other: _____

18. Are you able to access services based on your level of income?

Accessing	Tick
Yes	
No	

i. If yes.
Has accessing these services improved your life?

Improvement	Tick
No	
Partially	
Completely	

How?

_____
_____
_____
_____
_____

Do the organizations offer other measures to contain the disaster? If yes. What are they?

_____
_____
_____
_____
_____

ii. No. What are the factors that increases exposure to flooding that need to be added by the organizations?

_____

19. What do you think can improve coping capacities in the area?

_____
_____
_____
_____
_____

Appendix B.

Key Informant Interview Question guide (To disaster management organisations)

1. What services do you offer?
2. What's the significance of the services offered?
3. Have the services mentioned above improved the livelihoods of the people
4. Knowing that this area is prone to disasters
    a) Are there measures that are put in place to carter those vulnerable?
    b) If yes. What are they and how do they operate or work?
    c) Have the measures been a success both to the institution and the clients?
    d) If so how has the institution and the clients benefitted?