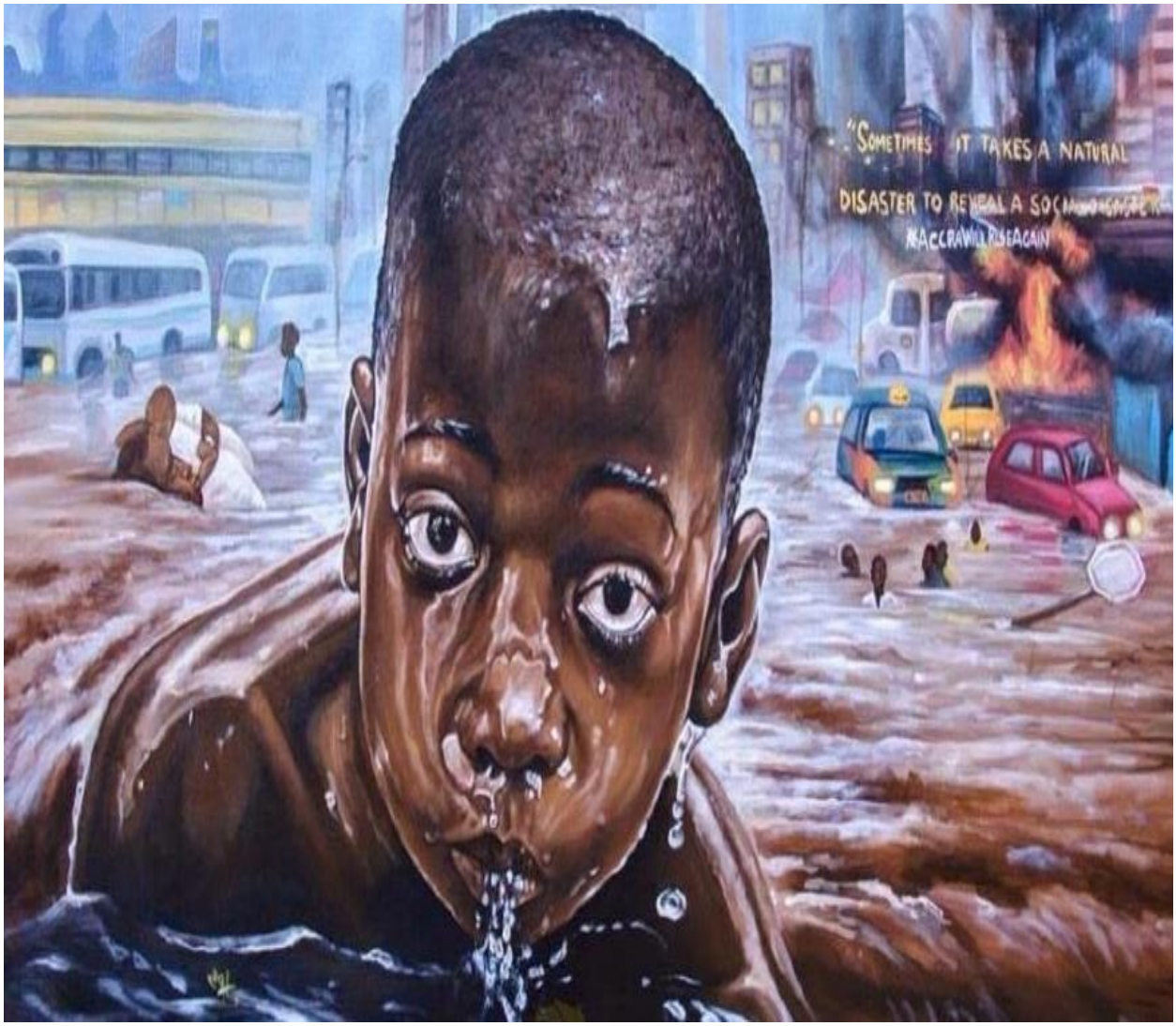
FLOOD RESILIENCE IN ACCRA

Accra's flooding problem



KOFI OSEI ABIRI

TU Delft

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‘’Sometimes it takes a natural disaster to reveal a social disaster.’’

Jim Wallis

Flood Resilience in Accra

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Kofi Osei Abiri

Student number: 4260007

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Graduation committee

Chairperson	: Prof. Dr. Jill H. Slinger, Policy Analysis, TPM
First Supervisor	: Dr. Erik Mostert, Water Management, CITG
Second Supervisor	: Dr. ir. Marian Bosch-Rekveldt, Integral Design & Management, CITG

Dedication

I dedicate this thesis to my parents, Nana Osei Kofi Abiri I and Mrs. Elizabeth Oppong-Abiri, who did not have the opportunity to get higher education but always made sure their children got the best education and climb high on the educational ladder. I will forever be grateful to them.

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Executive Summary

Natural disasters, related to water, in various forms have become more common in our daily lives and on our television screens. Within the past years, flooding has become a phenomenon which affects global, social, psychological and economic development. In Ghana there are major problems related to water and this has increased substantially over the years. Indeed, flooding is a major issue that is evident in urban sub-Saharan Africa and Ghana is no exception to this worrying phenomenon.

Poor and inadequate infrastructure and urban drainage systems have increased the risk of flooding in Accra, a city that has had an exponential increase in population. Flooding has affected the economy of Ghana, claimed the lives of humans and animals and has caused the outbreak of infectious diseases. However, current flood risk management approaches in Accra, which include demolishing affected buildings, have not been effective enough to reduce the impacts of Ghana's floods.

This paper analyzes the current situation in Accra, the capital of Ghana, relating to floods, the factors that played a role in aggravating its effects, and how communities respond to flooding events. This is a main challenge Accra is dealing with and it is therefore imperative to look at the causes of flooding in Ghana as a country and propose an approach that can help mitigate the impact of floods. The challenge is to develop strategies for dealing specifically with increased vulnerability to flooding to reduce economic effects and save human lives, animals and properties. The study area consists of five local suburbs of Accra namely Agbogbloshie, Old Fadama, Adabraka, Weija and Alajo, which have been affected by floods. The effect of floods can be observed in an increased amount of flood events in these communities.

This thesis therefore uses the concept of resilience as the basis in solving this problem. The problem is defined using literature review, a case study, field inspections and interviews. Resilience at multi-level governance level is studied using an analytical framework to examine what policies government authorities have adopted to stimulate the adaptation of Accra into a more flood resilient urban environment. The changes need to be implemented to improve upon the flaws are also studied. The challenges involved in multi-level governance of Flood Risk Management in Ghana from the perspectives of the various actors are also examined. This will help in filling the knowledge gap in the literature on multi-level governance arrangements and the challenges involved for Ghana in the context of Flood Risk Management. To do this, a case study approach in which the interactions between the actors, stakeholders and the policy instruments are looked at, is applied.

The analytical framework is derived from the work of the five elements of flood risk management of Batica et al. (2013) and the two types of multi-level governance defined by Hooghe and Marks (2003). The findings from the analytical framework include key stakeholders in flood risk management as well as aspects of resilience and response and anticipation in flood

risk management. Aspects of resilience in flood risk management strategies comprise Relief, Resist, Response, Recovery and Reflect strategies. The findings are used to analyze the effectiveness of existing strategies and recommend improvements. There are measures for resisting known flood risks, but their implementation is ineffective. Involvement of the local chiefs and key private sector organizations in flood risk management strategies in Accra would allow for advanced resilience regarding their responses to the impacts of land-use changes and the waste disposal in watercourses. This research shows that the effectiveness of flood risk management in Accra depends on implementation and enforcement.

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List of Abbreviations and Acronyms

AMA	Accra Metropolitan Assembly
CBD	Central Business Districts
DUR	Department of Urban Roads
EPA	Environmental Protection Agency
FRM	Flood Risk Management
GAMA	Greater Accra Metropolitan Assembly
CERGIS	Centre for Remote Sensing and Geographic Information Services
GMET	Ghana Meteorological Agency
GOIL	Ghana Oil Company
GRCS	Ghana Red Cross Society
GSS	Ghana Statistical Service
HSD	Hydrological Services Department
LUPSA	Land Use and Spatial Planning Authority
MCRA	Ministry for Chieftaincy and Religious Affairs
MLG	Multi-level governance
MMDAs	Metropolitan Municipal and District Assemblies
NADMO	National Disaster Management Organization
PHC	Population and Housing Census
SUG	Slum Union of Ghana
TCP	Town and Council Planning
WRC	Water Resources Commission

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1 Introduction

This chapter introduces the research, and consists of the background of the research, the research problems, the research objectives, the research question, the methods to answer the research questions, the research conceptual framework, the significance of the study, the scope and limitations, and the structure of the thesis.

1.1 Background

Transforming social and economic factors and systems into the physical urban environment helps in shaping resilient cities (Kapucu et al. 2021). The incidence of issues of water management, with flooding playing a crucial role in the urban environment, have been on the rise and they are currently being addressed worldwide (Albrecht, 2017). The role governance plays in the field of vulnerability and flood resilience cannot be underestimated.

The growing disasters, like flooding, have caused an increase in the vulnerability of many households and communities in affected areas especially in developing countries which mostly affect them economically and therefore making the process of recovery more difficult (Vasta and Krimgold, 2000). According to Asumadu-Sarkodie, et al., (2015) economical loss caused by flooding in Ghana from 1990 to 2015 is estimated to be around US$ 108,200,000. This is a drain on the economy of Ghana and that money could have been used to address other problems in the country.

Cities around the world have lobbied for innovative ways of dealing with the impacts of floods (White, 2010). African cities are no exception to being victims of these extreme weather conditions as urban floods have become more frequent. Accra, the capital of Ghana, is one of the cities to have experienced frequent floods over the past few years. Not too long ago, on 3rd June, 2015, heavy rains caused flooding that resulted in an explosion and fire at a GOIL Fuel Filling Station, killing over 250 people in Accra. It started with normal rainfall volumes, but the rains intensified during the night (BBC News, 2015). This disaster has been called the ‘Twin-Disaster’ by many because of the co-occurrence of the flood and fire.

Flooding ranks among the top ten disasters that occur naturally with respect to the number of people that have been affected in Ghana. Only epidemics, which affect over three million people on a yearly basis, are more prevalent than flooding (Okyere et al. 2013). Given the urgent situation, the government of Ghana instituted multi-level governance by bringing together various actors at all levels to ensure all-inclusive governance in flood risk management. However, flood vulnerability, disaster management and response in Accra has been reactive rather than preventive. The focus of the reactive measures is mostly directed towards the destruction and demolition of affected structures and buildings, flood pathways and eviction of affected victims of flooding (Amoako, Cobbinah, & Mensah Darkwah, 2019)

Multi-level governance, as conceptualised by Hooghe and Marks (2003), is set up in two ways. The first, referred to as Type I multi-level governance by Hooghe and Marks (2003), aims to understand the negotiation of hierarchical and sectoral authorities across different levels of government. Type I multi-level governance is characterised by a vertical structure of decision-making. Flood risk management in Ghana is a top-down organization from national, regional to local level (Poku-Boansi et al. 2020). The Government of Ghana has institutions, agencies and organizations in place that have designated supervisory roles in reducing the effects and impacts of floods on human life and properties.

The second type, referred to as Type II multi-level governance, focuses on network governance and the delegation of authority along functional lines and specific governance functions. One of these organizations is the National Disaster Management Organization (NADMO), which is responsible for disaster management in Ghana. However, the methods employed have not always been effective in solving the problem of flooding (Ahadzie & Proverbs, 2011**).**

This study focuses on identifying flood risk management at different levels of governance in Accra. To come to an understanding of the situation at hand, the next section explains the problems of flood risks and the need to cater for resilience in flood risk management and organization in Accra.

1.2 Problem Definition

Over the years, recurring flood disasters have had disastrous impacts for urban regions and cities. According to White (2010), flooding is one of the most prevalent and most dominant disaster of all natural disasters that occur worldwide. This phenomenon represents a huge threat for cities and this has created awareness that the resilience of flood risk management must be a priority. Thus, flood risk management is a worldwide challenge that needs all stakeholders and parties to make it a success (De Bruijn, 2005; White, 2010).

However, flooding issues are more devastating for developing countries than the more developed countries (The World Bank, 2009). The problem of flooding in Africa is common in the cities, where the infrastructures are most exposed and vulnerable (Douglas et al. 2008, Rain et al., 2011). Ghana is still behind on the aspect of tackling flooding and a lot of work needs to be done to catch up with developed countries in the world. Various policies, plans, programmes and strategies have been developed over the last few years to address the flooding issues in Ghana. However, they have not been able to achieve the expected end results (Owusu & Afutu-Kotey, 2010). Douglas et al. (2008) emphasized the connection between urban flooding and developing countries and cities. They used the June 2006 floods of Accra which affected the urban poor as an example. The floods resulted in 23 deaths and to this day flooding is still an issue. Poor infrastructures and a lack of integrated governance have hampered the process of tackling flooding issues in Accra (Rain et al., 2011).

Flood risk in Ghana is a national problem but the impact is more felt in cities than in rural areas (Oteng-Ababio, 2013). A city in Ghana that is well known for flooding issues is Accra, and thus issues of flood risks in the country cannot be discussed without bringing up Accra. Accra fits the profile of a city that is vulnerable to floods and its impacts (Karley 2009). According to Amoako and Boamah, 2015, flood risks have moved on from being sporadic events to annual events in Accra.

Rain et al., (2011) claim that climate change has also played a role in the flooding issues of Accra, with anthropogenic and societal activities to blame for exacerbating such occurrences. They further go on to state that policy documents see climate change as a cause of the exponential increase in flooding disasters in urban areas. Climate change results in the increase of the amount of rainfall and variability in rainfall patterns that can cause flooding in Accra, which is one of the African cities with a high flood risk (Douglas et al. 2008; Gyekye 2011). Accra records two rainy seasons, a major one between April and July and a minor rainy season from September to November. However, climate change has also led to changes in the patterns of seasonal rainfall resulting in floods in the dry season when there is low preparation for flood risks (Owusu et al. 2013).

Another school of thought claims that population growth, urbanization trends and rural-to-urban migration have played a major role in Accra's flooding problem (Afeku 2005; Douglas et al. 2008; Rain et. al 2011). This has led to pressure on the current infrastructure as this has inadequate capacity to cope with the increasing number of people. Developing cities like Accra have a poorly regulated spatial land-use plan leading to people building on waterways. Moreover, increases in discharges from human waste and other products overload drainage channels. These external factors can increase the hazard and vulnerability and can lead to flooding (Yankson & Grant, 2003).

Looking at the current problems in Accra, there is the need for the city to become safe and liveable, resilient to recurrent flooding. The key stakeholders in Flood Risk Management need to work together to address the problem of flooding in Accra. It is critical for Accra to have regulatory and decision-making powers, and it is of the utmost importance that flood resilience is improved and also implemented so that the impact and hazards of floods are reduced.

1.3 Research Objective

Many cities around the world, as of today, face the challenge of becoming more resilient to flooding. Accra is no exception to this and therefore there is the need to find an approach to address the situation. Transforming Accra, which has experienced several waves of flooding events in the past, into a resilient city is a huge task but a necessity.

Notwithstanding, the aim of this study is to find ways in which Flood Risk Management (FRM) can be organized to make Accra more resilient. According to De Bruijn and Klijn (2001), working towards resilience helps to control flooding and minimize damage. Resilience against

flooding is understood to be the capacity of the system to recover from floods. De Bruijn and Klijn (2001) say that floods may occur, but they should have low impacts in order to be easily recovered from. Aiming for a resilient city plays a huge role in adaption to the effects of flooding, reducing loss of lives and properties. It can also enhance development and reduce the burden on the nation economically.

Flood management strategies of the government cannot be ignored in this research. Distinctive aspects of institutional arrangements on a multi-governmental level that affect the effectiveness of public policies will be examined. Insight into these aspects can help urban authorities to increase the effectiveness of their policy instruments and make Accra flood resilient. In this way developing cities like Accra can become more conducive to life and attractive for investment from both private and public stakeholders. However, Accra as a whole cannot be analyzed, so five communities or neighbourhoods with different characteristics but similar problems, namely – Agbogbloshie, Old Fadama, Weija, Alajo and Adabraka, will be studied.

The choice of these five communities is made to cater for all the flooding issues of the city of Accra as some neighbourhoods have similar profiles but are located in different parts of the city. The five communities have different infrastructure, different geography profiles and different responses to floods and governance systems. On the one hand, Agbogbloshie and Old Fadama are a group of slum communities that are not planned in an orderly fashion unlike planned communities like Adabraka and Alajo. Weija on the other hand is a community that has been developed in a floodplain. Each of the five communities will aid the understanding of the impacts of floods and the responses to flooding in Accra. How flood risk management can be organized at different levels in these communities provides the focus of the study. The study aims to gain insight in how adaptation strategies and policies can stimulate the process of organizing and building flood resilience at various levels of society. To be able to address this, the research questions are formulated in the next section.

1.4 Research Question

The locus of this research is the city of Accra, widely understood to be one of the most flood-prone cities in Ghana (Douglas et al. 2008). The effects of local socio-political and economic factors are also examined.

To aid understanding of the impacts of floods and governmental responses to floods in the urban space of Accra, the research question is: ***How can flood risk management be organized to increase flood resilience in Accra?***

To answer this question, relevant technical and social information on the causes of floods in Accra are analyzed. The relevance of the information is determined by identifying the dichotomy between the existing flood risk management infrastructure and the current situation of recurring floods. An approach for flood resilience is developed and a historical overview of events is also

provided. The process of answering the research question is supported by the following sub-research questions which need to be addressed.

1. What is resilience in the field of flood risk management and to what extent is it significant in the urban environment?
2. What factors have shaped Accra's responses to flood events and what are the current socio-cultural and economic factors hindering flood resilience?
3. What are the actual effects of current flood management practices and what are current strategies for building flood resilience in Accra?
4. What institutional arrangements and aspects of flood resilience can be strengthened in solving the flooding and waste management problem in a developing city like Accra?

RQ 1: What is resilience in the field of flood risk management and to what extent is it significant in the urban environment?

The definition of resilience in flood risk management is determined in answering this research question. The indicators for evaluating resilient flood risk management systems will help to establish the essence of resilience in the urban and flood prone environment.

RQ 2: What factors have shaped Accra's responses to flood events and what are the current socio-cultural and economic factors hindering flood resilience?

The objective of RQ 2 is to describe the underlying patterns that have led to Accra's response to floods. The question aims to identify the social, cultural and economic factors that have hindered the city from being flood resilient. Response capacity is usually associated with financial and technical resources of the agencies responsible for responding to floods. This is also related to historical flooding events that have shaped behavioural responses to floods. The question expands on the individual and governmental responses to floods.

RQ 3: What are the actual effects of current flood management practices and what are current strategies for building flood resilience in Accra?

The third research question seeks at addressing the current attempts and strategies and that have been employed in making Accra flood resilient. It is vital to know whether all the institutions, agencies and stakeholders in Accra apply or support this current approach. The question also aims to look at the repercussions the current flood risk management practices have had on Accra as a city.

RQ 4: What institutional arrangements and aspects of flood resilience can be strengthened in solving the flooding and waste management problem in a developing city like Accra?

For this research question, the aim is to find strategies to improve the current approach to flood risk management and response in Accra. Implementing these strategies at various levels of

government is essential. Flood risk management may need the help of specific experts in order to achieve this.

The answers to these four sub-questions will form the basis of the report, and they can be located as stated in Table 1. This thesis seeks to do this by studying five different cases and employing a cross-case analysis. This is expected to generate the evidence needed to analyse and advise upon the conditions under which Accra can become resilient.

Table 1: Thesis Structure in relation to the Research Questions

	Sub-question	Chapter(s)	Chapter name(s)	Methods for answering
RQ 1	What is resilience in the field of flood risk management and to what extent is it significant in the urban environment?	4	Theoretical Framework	Literature research
RQ 2	What factors have shaped Accra's responses to flood events and what are the current socio-cultural and economic factors hindering flood resilience?	3 and 5	The curious case of Accra Case Study	Literature research, interviews
RQ 3	What are the actual effects of current flood management practices and what are current strategies for building flood resilience in Accra?	5	Case Study	Case study, Literature research, interviews, field visit
RQ 4	What institutional arrangements and aspect of flood resilience can be strengthened in solving the flooding and waste management problem in a developing city like Accra?	6 and 7	Cross-comparative analysis Conclusion and Recommendations	Cross-comparative analysis of case study results, based on the analytic framework

1.5 Justification of the Study

The city of Accra is an interesting case for many reasons. Firstly, Accra is one of West Africa's main hubs and it has been described as one of the fastest growing metropolitan areas in Africa (Grant & Yankson 2003). Persistent flooding can have a great impact on domestic and international activities which can affect the city and the country economically. Accra as a city has the largest number of slums and highest rate of urbanization in Ghana. These factors have increased the risk and likelihood of flood disasters occurring with respect to other cities in Ghana (Rain et al., 2011).

Moreover, the motivation for choosing Ghana as a case is the increasing consequences of water management in Accra. The interconnectivity between political, cultural, social and economic factors which translate into impacts in the physical environment and water management systems for people is an interesting area to examine. So many governance systems in Accra are not working, of which flooding is a manifest consequence. These failures are present at multiple levels of government in Accra.

Since Accra is a large metropolis, it has all the features of multi-level governance. The governance of multi-level arrangements ensures that decisions are made across all levels, both horizontally and vertically. It includes multiple politically independent organizations that depend on one another in the management of floods (Taşan-Kok and Jan Vranken 2011). However effective resilient flood risk management is absent. The impacts from floods on the people of Accra show that a reactionary approach to tackling floods is not enough. Coordination between the levels of government is therefore necessary to organize resilient flood risk management. To achieve a thorough understanding of how Accra can become flood resilient, five neighbourhoods of Accra are examined. This involves doing a thorough document analysis. Clear definition of the key stakeholders is a good start towards a flood resilient Accra.

1.6 Scope and Limitations

The scope of this study is limited to the Accra Metropolitan Area. To be precise, the study covers five communities in Accra namely Alajo, Agbogbloshie, Old Fadama, Weija and Adabraka. The scope of the study is also limited to the relevant institutions, agencies and organizations involved in flooding and its adaptation and control in Accra at national, regional and district level. The major limitation faced was that the number of interviews with institutions. It was initially planned to have at least 16 face-to-face interviews. However due to the corona pandemic travelling became an issue and getting people to interview via telephone and Skype became a herculean task and almost impossible. Five interviews were conducted because of time constraint. Other officials and residents were also reluctant to talk or be interviewed for various reasons. Data was also not easily accessible as initially thought. Inadequate data from some institutions was a common trait.

1.7 Thesis Structure

This thesis is structured in seven (7) chapters as can be seen in Table 1. The background of the study, problem definition, research objectives, as well as the research question and the justification of the study can be found in Chapter 1. This chapter concludes with the structure of the thesis. The research design and methodology of the thesis is presented in Chapter 2. Methods used in the literature study to support the formation of a theoretical framework are presented. How the data were gathered, analyzed and presented is explained. The choice for a cross-case analysis, supported by semi-structured expert interviews and content analysis, is explained. The limitations of the research design and methods are also discussed in this chapter. Chapter 3 looks at the historical roots of Accra's flooding issues with emphasis on the causes and effects. This includes cultural issues relating to the problem. A literature review on resilience in flood risk management is also undertaken. Chapter 4 delves further into the theoretical background and frameworks that will form the basis of the solutions to the current flooding problems. The review shows that the evolution of flooding can be ascribed to various factors which include the failure to be proactive and poor response by the government and citizens. Multi-level governance arrangements are therefore taken into consideration. The cross-case analysis of five current situations can be found in Chapter 5. This chapter therefore gives an overview of Accra's flooding issue and the plight of many inhabitants and stakeholders. Chapter 6 draws on insights from the analysis to answer the fourth sub-research question. The discussion in this chapter focusses on improving the current flood risk management practices in Accra. The conclusions and recommendations of this research can be found in Chapter 7. This chapter reflects on the overall key findings of the research and provides recommendations for future flood risk management in Accra.

2 Research design and Methodology

The overall design and the methods for the research questions that were posed in Section 1.4 will be explained and presented in this chapter. The overall design is a qualitative analysis and the approach is based on a cross-case study research design which is explained in detail in Section 2.1. The methods for data collection, analysis and interpretation to address the objectives and their corresponding research questions are discussed in Section 2.2. The data collection methods include document and content analysis and semi-structured interviews. The setbacks and challenges of the study are also discussed.

2.1 Research Design

2.1.1 Overall Design

The overall research design approach in this study is a qualitative design. A qualitative methodology is usually applied for a thorough examination of a complex case. Considering the goal of the research, a qualitative approach is the most appropriate for connecting the information the study aims to collect (Verschuren & Doorewaard, 2010). The main data used for this research are qualitative, where availability and accuracy of data is a challenge. The qualitative analysis is done based on an extensive literature study, content analysis of existing policy documents and a cross-case study of five neighbourhoods or areas by examining the flooding situation from national to local level. The study aims to qualitatively explore and assess the organization of flood risk management between different actors and levels that create and shape floods in Accra. The focus is on the causes, consequences, impacts and response to floods at various levels of government.

How Flood Risk Management is organized at various levels of government in Accra is the focus of this research. The scope includes how affected victims and citizens deal with and respond to flood hazards and risks. Thus, only organizations, agencies of Flood Risk Management and inhabitants within the boundaries and administrative areas of Accra are considered. Accordingly, data from existing documents about flood events that focused on Accra are analysed, interpreted and presented following the research questions of this research. The study examines instruments that can be adopted to enhance flood resilience in Accra.

2.1.2 Case study approach

The case study is a cross-case research as the study involves multiple cases, with five neighbourhoods of Accra being analysed. These cases represent the larger population of cases in Accra and the purpose of the study is to look within the case rather than compare it with other cases (Seawright & Gerring, 2008). This involves a comprehensive description and analysis of the problem at hand which is achieved through individual interviews via Skype with representatives of organizations. Personal observation, newspapers and websites of organizations, photographs, videos, news items, reports and information from various documents also serve as sources of data for the research. These sources include the Water Research Institute,

the Environmental Protection Agency, the National Disaster Management Organization, the Accra Metropolitan Assembly, the district assemblies and local governments within Accra.

2.1.2.1 Selection of case study

The case study is about the city of Accra, which has suffered from various flood disasters over the years. The five neighbourhoods, as mentioned in Section 1.3, have been selected for the study based on the flood type and settlement characteristics. The following criteria were considered:

- The recurring flooding issues in the capital city of Ghana, as mentioned in Section 1.5
- The business and socioeconomic position of the city in West Africa.
- The polycentric nature of the city
- My own detailed experience, knowledge and interest in the city.
- The topography of the city

In order to gain more concrete knowledge on real-life situations about flood resilience of cities, a descriptive analysis of five areas or neighbourhoods was used for this study. This involves a description of the selected city using the following categories: geography, social class, location and policies (national, local government, organizational policy).

A cross-case study design was preferred because the study covers contextual conditions and real-life situations about flood resilience in Accra. The types of research questions posed require case studies to provide the needed answers. The strategy gives the opportunity to know ‘how’ or ‘why’ some flood risk management approaches have worked or have not worked.

2.2 Data collection methods

Data was collected from primary and secondary sources. The primary data for this research were obtained through interviews with experts, government officials, organizations and non-governmental organizations, flood victims, traditional leaders and opinion leaders. The secondary data comprises of document reviews by gathering relevant empirical data from organisations and agencies involved in managing floods and water related issues. The collected data covered issues on the role the identified organisations have played in the management of floods. Other sources of secondary data included newspapers, written reports, articles, books, internet sources, archives and studies from official sources or institutions and policy documents. Data from documents analysis and interviews provide a comprehensive understanding of the Flood Risk Management strategies.

2.2.1 Document Analysis

The document analysis involved the process of collating and analyzing two types of documents and literature namely, official policies and plans, and newspaper reports. It focused on the organizations, agencies and institutions and the institutional arrangements and landscape of Accra. Some of these documents include Ghana's National Disaster Management Plan, National Water Policy Plan and Buffer Zone policy. These documents are examined to explain the

institutional responses to flooding in Accra. It gives a clearer view on the various interactions and processes related to humans and floods that occur frequently.

Various data and documents are gathered to do the research. Sources of data include published reports and policy documents such as the Ghana National Disaster Management Action Plan 2010, Operational Response Procedures (NADMO, 2010), online newspapers the Daily Graphic and the Daily Guide. Other useful documents include the Ghana National Disaster Management Action Plan 2010, Operational Response Procedures (NADMO, 2010), Constitution for the Republic of Ghana and Annual Flood Disaster Risk Reports of NADMO. The relevant documents are referenced where appropriate.

2.2.2 Interviews

Interviews were conducted with an AMA official, a NADMO official, EPA official, a traditional leader and a flood victim. They are all directly or indirectly involved in flood risk management in Accra. Expert interviews are useful for collecting comprehensive data to answer research questions because there is room for probing in the data collection process according to Babbie (2012). Most of the interviews were done through phone calls and Skype due to the corona pandemic that brought a lot of inconveniences over the past two years. The findings from the interviews have been used to validate understanding of the current issues, governmental policies and science behind flood risk management in Accra. In total, five (5) interviews were conducted to buttress and substantiate the literature findings from the document analysis. Information from flood victims and citizens were garnered when the possibility arose. The main topics of the interviews included the state of flood risk management, the key institutions involved in the organization of Flood Risk Management, the current Flood Risk Management strategies and the analysis of resilience in Flood Risk Management. These insight and the topics help in understanding the existing situation and the terms and concepts related to resilience, vulnerability, multi-level governance, resilient flood risk management and flood risk management in Accra.

2.3 Data analysis

In this section, data for this study is analyzed qualitatively by transcribing the notes, data and interviews gathered from audio recordings to text (Bryson, 2004) and interpreting them according to the objectives of the research. Content analysis was used as a data analytical approach for this research. Babbie (2012) states that research that draws data from human communication can be done with a content analysis. The interviews were vividly and repeatedly listened to and the key points were transcribed. The data obtained were categorized into three themes to create a link with the response in accordance with the research objectives. The data were categorized under the main themes of resilience, multi-level governance and flood risk management. The study used several data analysis approaches which included a literature study and a desk review. Also, other materials were obtained on the typography of the study area and areas vulnerable to floods in Accra. Secondary data gathered were used mostly for reference

purposes to back and support claims and arguments made in the research. Data analysis allows the research to make more sense of relevant textual materials for a qualitative analysis.

2.3.1 Literature Study

A literature study was done by analyzing and comparing various articles, academic papers and newspapers related to the topic in order to gain in-depth knowledge on the terms and concepts associated with flooding, resilience, multi-level governance and resilient flood risk management, as well as deeper knowledge of the case study. This method helped in identifying the best ways to link the aforementioned concepts. This helped to tackle the research gap and identify which concepts can best be used in analyzing the current situation in the case study. De Bruijn, (2005) looks at the situation of governance and resilience. The indicators of resilience for flood risk management strategies formed the basis for the research. With these concepts, the focus of this study is channeled to waste management, urban flood resilience and implementation. Relevant documents on the flooding situation and its impacts in Accra are referenced where appropriate in the text. Desk research was used in investigating the factors that have shaped Accra's response to flood events.

2.4 Scale of analysis

The analysis of the case took place at different levels of government which include national, regional, municipal, districts and local levels. Agbogbloshie, Old Fadama, Alajo, Weija and Adabraka are the neighbourhoods that are considered in the analysis. This is because information on these neighbourhoods are more easily accessible as compared to other neighbourhoods and they are typical cases for most communities and neighbourhoods in Accra. These flood-prone communities tick all the boxes in terms of being vulnerable and susceptible to flooding events.

Actors at different levels include the Ministry of Sanitation and Water Resources, National Disaster Management Organization (NADMO), government officials and agencies, local authorities, traditional leaders, non-governmental organizations involved in water resources, district assemblies and civilians.

2.5 Cross-comparative analysis

The information obtained from the analysis of Accra's experience of flooding and the actual effects in each of the suburbs were analyzed and cross-compared using the framework of analysis derived from the literature review.

Insights regarding potential improvements were then garnered, leading to conclusions and recommendations on Accra's resilience to flooding.

3 The curious case of Accra

3.1 The Physical Environment

Ghana, well endowed with perennial rivers and groundwater, with a land mass of 238,535 km^2 and a population of about 30,955,204 (Ghana Statistical Service, 2021) is bordered by French speaking countries: Togo to the east, Ivory Coast to the West and Burkina Faso to the north (Jackson 2001). Ghana currently has 16 administrative regions after deciding to split some of the previous 10 administrative regions following a referendum in 2018 (Daily Graphic, 2018).

Figure 1 shows Accra, the capital city of Ghana, which is located in the Accra Metropolitan Assembly. Accra is the most densely populated city in the country. Accra has a total population of almost two million people and has being recognized as the largest and fastest growing metropolis in Ghana (Ghana Statistical Service, 2010). Okyere et al. (2013) report that Accra is located in a low-land area with a slope ranging between −4 and 350 m. Communities within the 350 m contour were found to be food potential zones during the slightest rainfall event. Accra experiences tropical climate conditions with dry and wet seasons (Asumadu-Sarkodie et al. 2015).

According to Amoako and Boamah (2014), Accra has an average annual rainfall of about 810 mm. The major rainy season begins in March to July and the minor rainy season from September to November. Rainfall is usually intensive with short storms, giving rise to annual local flooding. Hence, Accra has experienced at least one major flooding event annually over the past decade with one of the most recent occurrence of such events on 8th June 2020 following hours of rain. This event claimed the life of one person near Odawna in Accra and displaced some residents (Joy News, 2020). Intense rainfall has played a role in such events. However, anthropogenic factors such as population growth, urbanization, poor drainage caused by a lack of, or inadequate, waste management, mismanagement and land use changes have aggravated the impact of flooding events in Ghana's capital city (Afeku 2005; Karley 2009; Rain et al. 2011).

Figure 1: Map and Regions of Ghana, showing the study area, Accra (Adapted from Ghana Districts, 2019)

3.2 Historical Ovreview of Flood-prone Accra

Accra as a city is vulnerable to floods in general and this is as a result of the intensity and frequency of rainfall, climate change, timing of the West African Monsoon, formal and informal urbanization, urban poverty, population growth and occupation on flood plains (Gencer, 2013, Amoako and Frimpong Boamah, 2015; Karley, 2009). This has been a headache for city authorities, tourists and residents.

The Daily Graphic newspaper of July 2001 stated that one of the earliest floods in Accra was in colonial Ghana, when it was still called the Gold Coast. It happened in 1936, a few years before Ghana's independence. However, Ghana experienced its first documented flood in 1968. These floods affected at least 25,000 people including loss of property and life (Asumadu-Sarkodie et al. 2015).

In Ghana's modern history, the June 3, 2015 flooding disaster which claimed at least 152 lives, has kept the nation on its toes in planning for more resilience. It is often referred to as the Twin Disaster due to the fact that there was a fire as well as a water disaster. The effects of floods have become more severe because of the increasing population and rapid urbanization. There has been a lot of coverage within the print and electronic media over flooding in the past ten to twenty years. This has helped in bringing the effects to the attention of the general public.

Newspapers, literature, radio and media have captured flood events that occurred in Accra during colonial and post-colonial Ghana. Table 2 below shows the chronology of the historical occurrences of flooding in Accra based on the report in the June 2015 edition of Ghana's Daily Graphic. In addition, the table has been updated by including the recent flood events that have occurred in Accra after 2015. However, the table has been updated by including the recent flood events that have occurred in Accra since 2015. The focus of the historical events is between 1995 and 2022 as this timeline has consistent records of flood events that happened in Accra.

Table 2: Flood disasters and their impact in Accra (Adapted from Graphiconline.com (2015))

Flood date	Affected neighbourhoods, impact and severity of flood event
4th July, 1968	Accra records the heaviest rainfall in 9 years, a record rainfall of 127 mm
4th July, 1995	Flooding resulted in the death of over 17 people. Over 1000 families were reportedly displaced in the process. Properties and infrastructures worth thousands of dollars were also reportedly destroyed, and economic activities disrupted. It led to the collapse of the bridge on the Spintex Road.
5th July, 1995	Rains which started at midnight caused flooding by morning in low-lying neighbourhoods of the Accra metropolis. The flood affected not only business, commuters and vehicles but also the Achimota VRA substation, resulting in power outage. It claimed the lives of 30 people
13th June, 1997	Hours of intermittent downpour for two days in Accra caused floods which threatened to cut communication in various parts of the city. Some roads in the metropolis were affected, making it difficult for motorists to ply them. Major rivers such as the Odaw and Onyasia appeared on the brink of breaking their banks, forcing some residents to desert their homes for higher and safer grounds. The water in these rivers rose steadily when the rain started about 3 p.m., raising fears of a possible flood disaster as happened on July 4, 1995 claiming lives and property.
28th June 2001	The worst in Accra since July 5, 1995. An early morning downpour submerged portions of the city, with many houses and structures at Madina, Achimota, Dzorwulu, Avenor, Santa Maria and Adabraka Official Town being affected. Residents of the affected areas who were trapped by the flood waters had to climb to safety in trees and rooftops until they were rescued or the flood waters subsided. Floods caused the death of twenty people, displaced thousands of households, and destroyed millions of dollars worth of property.

5th May 2010	Rains caused havoc in Central Accra, Ofankor and Begoro. Parts of the city and its streets were deeply submerged in water after two hours of stormy rains resulting in property damage and disruption of business.
24th February 2011	A downpour caused extensive havoc on property in most parts of Accra and some of its surrounding communities. The property of residents of areas such as Adabraka, Kisseman, Alajo Junction, A-Lang at Santa Maria, Oyarifa, Haatso, Adenta and the Tema Timber Market were flooded.
1st November 2011	The death toll in Accra rose to 12, while about 43,087 people were said to have been affected by the downpour according to officials of the National Disaster Management Organisation (NADMO)
31st May 2013	Heavy morning downpour caused flooding in some parts of Accra. The rains, which started in some areas around 4.30 a.m., flooded areas such as the Kwame Nkrumah Circle, DarkumanKokompe, the Obetsebi Lamptey Circle and portions of the Graphic Road, Santa Maria and the Dansoman Roundabout, having a direct and indirect impact.
6th June 2014	Deluge hits Accra; more rains predicted: Accra's poor planning was exposed when a deluge hit the national capital after more than10 hours of downpour. The heavy rains caused flooding in the city and its environs, including Adabraka, Awoshie, the Kwame Nkrumah Circle, Mallam, North Kaneshie, Abeka, Dansoman and Odorkor. There were direct and indirect impacts on life and property.
4th July 2014	Heavy rains resulted in havoc, with the worst hit areas in Accra such as Anyaa, Taifa, Dome, NiiBoi Town, Dansoman, some parts of Kaneshie, Adabraka, Awoshie, the Kwame Nkrumah Circle, Mallam, Abeka, Dansoman and Odorkor submerged
3rd and 4th June 2015	Residents of Ghana's capital, Accra experience unprecedented flood. A combination of extreme floods and an explosion and subsequent fire at a sales point of the Ghana Oil Company (Goil) at the Kwame Nkrumah Circle claimed over 152 lives and displaced thousands of residents. The disaster started with normal rainfall, but the rains intensified as the night wore on resulting in a historic flooding in many parts of the city.
10th June 2016	Flood hits parts of Accra leaving one missing (feared dead)
21st April 2017	Many parts of Accra were devastated by floods. The situation made it very difficult for some motorists to continue their journeys due to the flood waters on highways.
18th June 2018	At least three people died, including a young doctor who lost his life in Teshie, Accra. The rains also caused flooding in Tema and other areas along the coastal belt.
8th June 2020	This event claimed the life of one person and displaced some residents.
24th May 2022	7 hours of rainfall led to damage of roads and disruptions to transport

3.3 Accra's flooding problem

Climate change has played a role in the flooding issues of Accra, with human activities to blame for such occurrences. Accra has a bimodal rainfall regime, meaning that the city records two rainy seasons. The major season occurs from late March or early April to July that often leads to floods. The minor rainy season occurs from September to late October/early November. The seasonal rainfall changes are as a result of the variations in the intensity and timing of the West African Monsoon (Owusu et al. 2013). Floods are the most frequently occurring disasters in Accra and come second compared with all the rest of the disasters in terms of the number of lives lost (Okyere et al. 2013). The information in Table 1 suggests that most of Accra's floods occur in the rainy season.

Accra's flooding problem has been a major issue in the city since the early 1930s (Karley 2009). There have also been severe floods in recent years namely, in 2007, 2010, 2012, 2015 and 2018 (Table 1). The 'GOIL' station Twin disaster explosion in 2015 is the one that lives in the memories of the people of Accra. It was both a flood and fire disaster which claimed many lives, destroyed properties and damaged and impacted livelihoods. Experts, policymakers, journalists and citizens have made an attempt to explain the causes and impact of floods in Accra.

The causes of floods in Accra are manifold due to a combination of environmental, political and socio-economic factors. Okyere et al. (2013) believe that the increasing intensity and erratic nature of rainfall owing to climate change could make it easier to forecast natural disasters and hazards that would happen in the near future. Karley (2009) further states that the floods are a result of human-nature interactions. Human activities can create or aggravate floods. Negligence, poor planning and lack of discipline are seen as lying at the basis of such occurrences.

3.3.1 Causes

Population growth, urbanization trends and rural-to-urban migration have played a major role in aggravating Accra's flooding problem. This growing population has led to pressure on the current stormwater drains as there are insufficient drainage networks and those that exist have inadequate capacity to contain the loads. The drains are choked and clogged with refuse and silt (Rain et al., 2011). Major rivers in Accra have become receptors of wastewater including faecal matter, and solid waste, which poses a serious threat to public health. For instance, major storm drains at Agbogbloshie are choked with solid wastes due to the inadequacy of the drainage systems. The solid wastes are carried into the Korle Lagoon during heavy rainfall (Boadi et. al. 2002). Most of these drainage networks are not properly maintained and repaired. Increases in discharges from human waste and other products are overloading the drainage channels.

Exacerbated by rapid urbanization, Douglas et al. 2008, explain how informal settling has indirectly led to the development of slums resulting in further habitat loss, degradation of the environment and nearby waterbodies. There are no or very little social amenities such as toilets and people defecate and release waste into waterbodies indiscriminately. This remains the

primary cause of pollution in the Korle Lagoon in Accra and increases damages resulting from flooding.

The topography of Accra, which is low-lying, also plays a role in the never ending flooding story (Attipoe 2014). Building in floodplains is common in Accra due to the scarcity of land. Ironically, houses are still being built in floodplains like Weija and Gbawe (Karley, 2009) and this is a recipe for future disaster. Inadequate drainage, poor waste management, poor planning and maintenance are issues most developing countries and cities face currently (Karley, 2009). Accra faces all these problems too.

The laissez-faire attitude of citizens and government officials of Ghana cannot be ignored as contributory factors of these problems (Cobbinah P. B et al, 2015). It has become a common habit to dispose waste and garbage into open drains and gutters which causes blockages and exacerbates flooding.

In the past, traditional beliefs and practices were dominant in Ghana. The communities believed in lesser gods that took residency in streams, rivers, trees and sacred groves (Sarpong 2004). These practices, which were very strict, were also related to water. They were adhered to before the influence of Christianity. Some of the traditional practices see to it that fisherman don't go fishing on Tuesdays so that the sea gods can rest that day. Believing citizens did not dare to do that because they were afraid to be killed by the sea gods. Building in floodplains was also not allowed because the paths of the river gods could be disturbed. Nowadays, these practices are slowly phasing out, and are not yet replaced by the active environmental stewardship ideals of Christianity (Golo and Yaro, 2013).

3.3.2 How serious is Accra's flooding problem?

The flooding issues of Accra have aggravated and become increasingly more severe over the years, especially during the rainy season. It has become common that at the start of every rainy season the topic of flooding crops up its ugly head. Yet the efforts by authorities and officials to curb flooding do not materialize in results. The flooding situation causes many communities in the capital to be submerged at least once every year, destroying properties and life.

These are many instances that explain how serious Accra's flooding problem is. A lot of damage has been done in a short period of time. The seriousness of Accra's flooding problem can be seen from the damage caused and the lives lost in Table 1. Over almost two decades after the 1995 flood disaster, the damage and losses associated with subsequent flood events have continued to increase. For example, on July 4, 1995, *The Daily Graphic* newspaper reported the death of over 17 people as a result of flooding. Over 1000 families were displaced in the process. Properties and infrastructures like roads and buildings worth thousands of dollars were also destroyed, and economic activities disrupted.

A similar incident occurred on June 28, 2001 when Accra recorded its worst flooding event in 6 years. Thousands of residents became homeless and properties were destroyed. To make matters

worse, 20 people were killed directly and indirectly by the floods. Between 1995 and 2022, more than ten incidents of flooding were recorded in Accra that resulted in human casualty, displacement of households, infrastructure damage, and disruption of economic activities.

Almost ten years later, on February 24, 2011, a 7-hour rainfall event caused damage on properties in most parts of Accra. The rainfall measured 71.5 mm according to an official from NADMO.

On 18th June 2018, heavy rains and thunderstorms caused flooding, resulting in the deaths of at least 3 people, including a young doctor whose car was swept away as she tried to drive through a flooded area. The hour-long rain blocked roads, inundated homes and even left large stretches of walkways flooded at knee-level (Daily Graphic 2018). This is one of many instances that illustrate how serious Accra's flooding problem is. A lot of damage was done in a short period of time. Ironically, Accra had observed the third anniversary of the June 2015 twin disaster a few days before that and the then president of Ghana, John Mahama, vowed to curb this recurring problem. He said:

*"**Drastic steps are necessary here if we are to permanently address this perennial problem. We will intensify efforts to expand and modernize our drainage system."*** (Ghana.Gov, June 2015)

Four years down the line, the issues still exist and no-one is surprised there was another flooding event on May 24, 2022. The damage the flood caused in some parts of Accra can be seen in Figure 2. A large section of a tarred road was damaged by a flooding event. Residents and citizens still reside in nearby flood prone areas despite several subsequent warnings**.**

Figure 2: Aftermath of May 24 Flooding at Abossey Okai source (Daily Graphic (2022))

The increasing variability in rainfall patterns have made it a herculean task for citizens and inhabitants of Accra to prepare for possible floods. Flooding usually happens after intense or continuous rainfall, resulting in high run-offs. Inhabitants of flood-prone areas are mostly ordered to relocate but such orders are usually fruitless as people may not have anywhere else to go. The frequency, impact and severity of these flood events can be seen in Table 1 that describes the most prominent flood events in Accra.

These flood events mostly occur in informal settlements (Douglas et al., 2008). Informal neighbourhoods in Accra such as Agbogbloshie and Old Fadama suffer severely after periodic flood events.

3.4 Flood Management in Accra

Recognizing the disasters likely to occur because of effects of climate change predictions, the Government of Ghana in 1996 established the National Disaster Management Organization (NADMO) under the Ministry of the Interior to coordinate prevention and management of disasters and similar emergencies in the country. Structurally, NADMO is well placed to perform its function because it has offices in all the regions and districts of Ghana. However, in terms of financial and logistics, the organization is handicapped to perform its coordinating role. Aside NADMO, there are other state departments and agencies also handling aspects of flood issues. Organizations from national, regional and local levels as well as non-governmental agencies and organizations, traditional, business and private parties take part in Flood Risk management. The Hydro Service Department under the Ministry of Water Resources, Works and Housing (MWRWH) for instance is in charge of all storm drainage systems in the country.

Flood risk management in Accra is done at three levels – from the upper level to the lowest level – which includes national, regional and local levels. The local level institutions can be seen as city, metropolitan, municipal, district and zonal institutions – as stated by Poku-Boansi et al. (2020). These institutions are in charge of local planning, legislations and development implementation.

The National Disaster Management Organization (NADMO) is the organization responsible for disaster management and the coordination of the activities of the prominent bodies involved in managing disasters in Ghana. The National Disaster Management Plan was prepared in 2010 in accordance with Act 517 to ensure the effective management of disasters in a more systematic and efficient way. It presents guidelines to NADMO in delivering on its mandate to ensure proper management of disasters in Ghana (National Disaster Management Plan, 2010). The National Disaster Management Plan is in the process of being updated, and in December 2016 it concluded work on a Ghana Disaster Risk Management Country Plan, which focused reducing the country's vulnerability to floods and its underlying risks. It was developed under the auspices of the World Bank (Ghana - Disaster Risk Management Country Plan Project).

Flood risk management in Accra on a national level is structured to involve organisations from a national level and organizations from various levels of government. Flood Risk Management is embedded in the Ghana National Disaster Management Plan. The National Disaster Management Organization (NADMO) is the agency responsible for designing and formulating the flood management framework at national level. The president appoints NADMO coordinators. NADMO has units in every municipality to make sure that flood victims are assisted and given support. A National Flood Contingency Plan has been developed to help solve the flooding problem. The Accra Metropolitan Assembly (AMA), the Water Research Institute, the Hydrological Services Department (HSD) of the Ministry of Works and Housing and other state departments and agencies work together with NADMO to oversee flood management in Accra. (Ahadzie & Proverbs, 2011; Poku-Boansi et al., 2020).

At the regional level, institutions harmonize and coordinate the plans, policies and activities of the Metropolitan, Municipal and District Assemblies. Implementation of the National Disaster Management Plan is executed at the local level by the NADMO district offices, metropolitan, municipal, district assemblies, the Hydrological Service Department (HSD) district offices, Environmental Protection Agency (EPA), the Land Use and Spatial Planning Authority (LUPSA), Department of Urban Roads (DUR) district offices and other agencies (Poku-Boansi et al. 2020).

The Districts are the next-level administrative subdivisions of Ghana, below the regional level. The AMA is the highest local authority in charge of the overall planning and development of the Accra Metropolitan Area. Section 10 (2e) of the legislative instrument (LI 1500) that established the AMA specifies that the AMA is a very essential institutional actor in the implementation of effective flood adaptation in Accra. The AMA is therefore the highest institution at the city level with the mandate for flood management and response in Accra. This legal power and mandate is derived from the NADMO Act 517 of 1996 and the Local Government Act 1993 (Act 462), which currently has been amended as the Local Governance Act, 2016 (ACT 936), and under Legislative Instrument (L.I) 2034 (AMA, 2022).

It is the AMA's duty and obligation to manage floods. This is usually done by constructing drains and gutters, managing solid and liquid waste, de-silting of storm drains, clearing of waterways through demolitions of illegal settlements and neighbourhoods.

Traditional authorities and chiefs are involved in flood risk management by executing their power and influence in local areas through public education, awareness and emergency shelter provision. In Accra, traditional authorities are represented by the Ga Traditional Council of Chiefs. They have local power to influence Flood risk management. They have the power, influence and authority to control illegal encroachment of water ways, regulate land-use, manage stool lands, ostracize members of the local community and provide refuge and land for resettlement flood victims. The role of traditional authorities in Flood risk management is bound by customary law and traditions. The Accra Metropolitan Disaster Management Plan 2010 states

that traditional authorities, members of parliament and assembly members have legitimacy in Flood risk management. However, traditional authorities are not involved in disaster management committee of the AMA and therefore do not have a direct contribution in the preparation of Flood risk management plans. (Atanga 2020, NADMO, 2010: 18, 25).

Roles and responsibilities overlap resulting in poor coordination among state actors, non-state actors and traditional leaders.

3.5 Administration and Governance context

A weak urban administration and governance system has hampered urban development in Ghana (Yankson and Bertrand 2012). The present-day municipal and metropolitan assemblies have proved to be incapable of providing and managing adequate levels of services and amenities. This has worsened the problem for poor urban households in their attempts to access adequate and decent accommodation in the cities. Living conditions have worsened by the day and the poor have migrated to informal settlements over the years making them more vulnerable to floods.

Historically, Ghana's water and flooding laws fall under legal pluralism, a mix between customary and statutory laws (Agyenim & Gupta, 2010). The same applies to the level of governance in Ghana which a multi-level form of governance. In t' Veld (2011) states that although the traditional form of government specifies borders between public and private actors with hierarchy and regulatory powers, governance is not solely assigned to the central government. They are not the only actor that has the sole control over the national policy making processes. However, this does not take the power from the central government as a commanding actor. Geaves & Penning-Rowsell (2016) supports this by stating that Flood Risk Management is a public good or service.

The Ministry of the Interior is mandated to ensure internal security, strengthening of disaster prevention, management, social mobilization, improvement of institutional capacity and enforcement of law and order in Ghana. The Ministry is headed by the Minister for the Interior, who is appointed by the President of Ghana and is approved by the Ghana Parliament after a vetting process. To achieve its mandate, the Ministry of the Interior operates through ten (10) agencies that have specific functions. The National Disaster Management Organization is one of those 10 agencies. Disaster management is a security issue under the Ministry (Ministry of the Interior, 2022).

There are various organizations, municipalities and districts with various decision makers. The pluralism of governance involves traditional authorities. Governance is shaped by national, regional and local government policies and by informal interactions and relationships among various levels of government and local actors. The Ministry for Chieftaincy and Religious Affairs serves as a link between the Government of Ghana and the traditional authorities in the country for national development. The Ministry was established in 1993 and is backed by the

Civil Service Law, 1993 PNDC Law 327 (MCRA, Medium-Term Development Plan 2018-2021; Civil Service Act 1993). The Ministry for Chieftaincy and Religious Affairs functions along the same lines of the Ministry of the Interior by overseeing, preserving and integrating the traditional and cultural values and practices for the development of the region (MCRA, Medium-Term Development Plan 2018-2021)

Table 3: The governance context of Ghana (Adapted from Alam & Koranteng (2011), Honyenuga & Wutoh (2019) with the parallel structure of the traditional authorities indicated in italics.

Level	Administrative Structure and Authorities	Responsible Person
Political	Parliament (275 members)	President
National	Ministry of the Interior *Ministry for Chieftaincy and Religious Affairs*	Minister for the Interior *Minister for Chieftaincy and Religious Affairs*
Regional	Greater Accra Region *House of chiefs*	Greater Accra Regional Minister *President of the House of Chiefs*
District	Metropolitan, Municipal and District Assemblies *Ga Traditional Council of Chiefs*	Mayor of Accra *The Ga Mantse (President of the Ga Traditional Council of Chiefs)*
Zonal	Suburbs	*Traditional leaders* Assemblymen

The Greater Accra Regional Minister is responsible for overseeing the administration of the Greater Accra Region. The Ministry works together with the House of Chiefs. The House of Chiefs is a body under the Ministry for Chieftaincy and Religious Affairs that unites all traditional rulers, chiefs and kings. A president is selected among the members of the house to direct their affairs at regional and district level (MCRA, Medium-Term Development Plan 2018-2021).

Metropolitan, municipal and district assemblies is a collective term to describe the District or local administrative divisions of Ghana. They mean the same thing but there is a difference in

connotation due to the population of a particular local administrative division. In Ghana, districts are classified into three types: Ordinary Districts with a minimum population of 75,000 inhabitants, Municipal Districts with a minimum population of 95,000 inhabitants, and Metropolitan Districts with a minimum population of 250,000 inhabitants. The Accra Metropolitan District is one of the 261 local metropolitan, municipal and district assemblies (MMDAs) in Ghana and forms part of the 29 MMDAs in the Greater Accra Region (Ghana Districts, 2022).

The Accra Metropolitan Assembly at district level has a Disaster Management and Prevention Unit that works in collaboration with NADMO. The head of the Unit reports to the Chief Executive of the Accra Metropolitan Assembly who is the Mayor of Accra. The Ga Traditional Council of Chiefs is made up of traditional leaders and chiefs in the Greater Accra Region. The Ga Mantse is the President of the Ga Traditional Council of Chiefs. Ga Mantse is the title given the king of the Ga state in the Greater Accra Region. An assemblyman is a resident of a neighbourhood or suburb who is selected by the neighbourhood to help develop the neighbourhood based on the guiding principle of voluntarism (AMA, 2022).

Multi-level governance helps in managing resilience according to Djalante, 2011. In this way, various levels of governance can be used to make decisions in tackling the flooding issues in Accra. Table 3 reveals the complexity of the current administrative structure and the traditional governance structure in Ghana and in Accra which is worth investigating further in relation to flood risk management.

4 Theoretical Framework

To have a good analysis of the situation at hand and coming to terms with the phenomena leading to the flooding problem in Accra, the central concepts need to be defined thoroughly and vividly to eliminate any issues of ambiguity. Flood risk, vulnerability, and exposure are vital in discussing resilience and flood risk management. The latter two concepts form the basis of this study and a connection is established to look at resilience in the context of flood risk management. Other concepts such as susceptibility are also defined to give a better picture of the situation at hand and the context in which the concepts are used.

4.1 Flood and its impacts

Floods can affect individuals and communities at different scales and levels. Flooding is a natural hazard which displaces people by destroying their land, houses and other tangible goods and assets (Haque, 1997). The consequences and impacts of floods, both negative and positive, can differ depending on the location and extent of flooding. In Accra, floods have social, political, economic, and environmental consequences.

From the above definition, it is easy to conclude that flooding is as a result of the submergence of dry land, most of the time, by a large volume of water. This phenomenon occurs from the cascading effects of excessive rainfall or an overflowing water body.

Flooding can occur in different forms. To plan for floods, the type of flood that may occur need to be understood. Every flood has a different impact in terms of duration, occurrence, forecast, the damage that it causes, and type of protection needed. The different types of floods that may occur are stated below.

4.1.1 Pluvial Flooding

Pluvial flooding takes place when an extreme rainfall event creates ponding and overland flow. The runoff enters a watercourse, drainage system or sewer, or cannot enter it because the network is overwhelmed (Acosta-Coll et al., 2018). Pluvial flooding usually happens after prolonged or intense rainfall events (Echendu, 2022). According to Houston et al. (2011) pluvial flooding can also occur after rainfalls of smaller intensity, almost 10 mm per hour, that happen over longer periods, depending on the location especially if the ground surface is impermeable by being developed, frozen or saturated (Houston et al., 2011). However pluvial flooding also occurs after short-duration storms, up to three hours with rainfalls that exceed 20 to 25 mm per hour (Prokić et al., 2019). This type of flood can happen in any location, urban or rural; even in areas with no water bodies.

4.1.2 Fluvial Flooding

Fluvial or river flooding occurs when rivers exceed their capacity by rains or excessive runoff from areas upstream and snow melt move downstream. Water levels in rivers rise and the banks overflow causing an overlap and overflow on the banks (Echendu, 2022).

Fluvial flooding can occur without rainfall taking place. Fluvial floods usually aggravate over days or months thereby eroding river banks and cause destruction to properties and structures close to the river or water body. Within a river flood event, several flash flood events can occur. (Doswell III, 2003). River flood events can take place hundreds of kilometres from where the rain falls and can have a long-lasting effect and impact.

4.1.3 Flash flood

The World Meteorological Organization defines a flash as short duration flood with a relatively high peak discharge. Flash floods are usually a type of fluvial floods and they are associated with high-intensity rainfall and are storm-driven. In simplistic terms, flash floods can be described as events involving too much water in too little time (Grundfest & Ripps, 2000). Flash floods are caused by extreme rainfall events or the sudden release of water over a short period of time. These floods are often related to other natural disasters and are destructive not only because of the force of the water, but also the debris that is swept up in the flow. (Iverson, 1997) Flash floods are a sudden and an expected occurrence, which can be hard to control. Long-term changes may be associated with impacts from climate and developmental changes. These could be drought and changes in rainfall patterns in the case of climate change.

4.1.4 Coastal Flooding

Coastal flooding occurs when dry low-lying land is flooded by seawater. They are caused by tsunamis, waves, strong winds, tides, heavy rainfall or storm surges that move towards a coast (Ramsay & Bell, 2008). Coastal flooding is usually the most extreme when the storm surge is high. Several factors determine the severity of a coastal flood. The strength, size, speed, and direction of the windstorm can cause loss of life and property. For instance when powerful waves breach the coast's dike, the area is usually flooded. Coastal areas with fewer defenses and lower elevation are the most affected. The best time to repair the breach is during low tide.

4.1.5 Urban floods

Urban flooding occurs due to the lack or inadequate drainage in an urban area. The drainage system in a city or town fails to absorb the water from heavy rainfall. However, urban floods can also be caused by flash floods, coastal floods, or river floods. Falconer et al. (2009) support this point by stating that urban flooding can be a combination of pluvial flooding, sewer flooding, flooding from small open-channels and overland flows from groundwater springs. Urban floods can cause significant structural damage and be a hindrance to daily activities. The economic damages are high but the number of casualties is most of the times minimal, due to the nature of the flood.

4.2 Flood vulnerability

The various types of floods make communities and cities vulnerable to the dangers of the phenomenon. Flood vulnerability can therefore be defined as the conditions determined by physical, institutional, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards (UNISDR (2017)). Water resource systems are vulnerable to floods due to three main factors namely; exposure, susceptibility and resilience (Munyai et al 2021). Thus, Douben, 2006 states that flood vulnerability can be seen as the extent of harm, which can be expected under certain conditions of exposure, susceptibility and resilience. The vulnerability of any society or system, under different cases and situations, is dependent on the situation of exposure and susceptibility of that system to hazardous conditions. It is also the ability, capacity or resilience of the system to cope, adapt and recover from the effects of those conditions (Smit & Wandel, 2006).

Accra as a city is exposed to flood hazards. The city is also vulnerable and susceptible to natural disasters as the systems are inadequate. It has been a major concern for city authorities and residents and the aim of vulnerability studies is to look at the right actions that can be taken to reduce vulnerability before the damage occurs. Pro active measures need to be taken to enhance the process.

Figure 3 shows the factors of flood vulnerability as a function of exposure, susceptibility and resilience

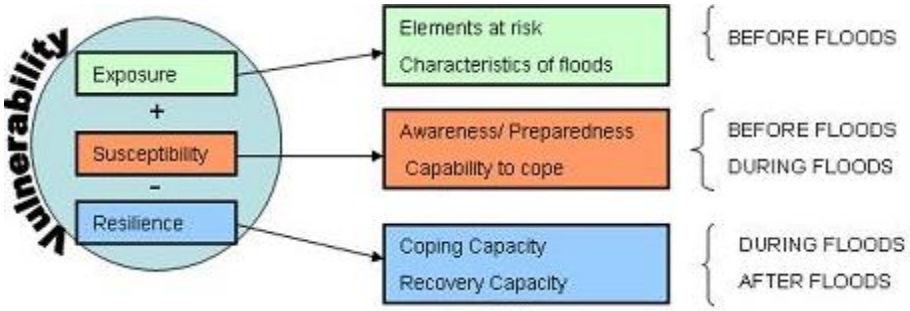

Figure 3: Factors of Vulnerability (Balica and Wright (2010))

The Vulnerability equation states that Vulnerability = Exposure + Susceptibility – Resilience (Balica, 2007). Vulnerability, exposure and susceptibility have similar connotations. Moreover, the three factors of vulnerability have different impacts (Luers et al., 2003). Exposure and susceptibility increase vulnerability while resilience decreases vulnerability.

Dow (1993) states that vulnerability is built on two attributes, namely: exposure, which is the risk of experiencing a hazardous event; and coping ability. According to the author, coping

ability is subdivided into resistance, which is the ability to absorb impacts and continue functioning, and resilience, which is the ability to recover from losses after an impact).

4.3 Exposure

Exposure is the likelihood that humans and/or physical items will be impacted by flooding (Penning-Rowsell et al. 2005). Exposure can be understood as the values that are present at the location where floods can occur. These values can be goods, infrastructure, cultural heritage, agricultural fields or mostly people (UN 2003). There is a clear interconnection between exposure to threats and vulnerability: high exposure can increase vulnerability and vice versa. For example, residing in unsafe locations or proximity to hazards can illustrate low socio-economic status (Blaikie et al 2004).

Exposure can however be reduced by seeing to it that laws and policies are enforced to prevent and stop building in floodplains. Open defecation and throwing garbage into gutters and water bodies should be frown upon to reduce exposure to floods.

4.4 Susceptibility

According to (Balica, Wright et. al (2012)), susceptibility is defined as susceptibility to damage within the system. It influences the chance of being harmed at times of hazardous floods. From the definition it can be deduced that a system that is exposed is more susceptible than an unexposed system. Infrastructures situated in hazard-prone areas are susceptibility to damage. Most of the time, slums and the poorest homes are located in areas most susceptible to flooding. It is of upmost importance that awareness is created regarding the dangers of being susceptible to floods and preparedness of affected people regarding how risk averse they are.

4.5 Resilience

The concept of resilience is broad and has many connotations, application and interpretations as it has been applied in different fields of study (Djalante and Thomalla 2011). Generally, resilience is defined as the ability to recover from damaging. It is the ability of communities to cope, recover, self-organize and learn to adapt to extreme disasters (Carpenter et al. 2001). Resilience of a system is related to the capacity of a system to cope with shocks or disturbances and the ability to bounce back and maintain its functions (De Bruijn, 2004).

Tourbier (2012) defines resilience as the ability to withstand and recover from crises through financial insurance assistance and support from governmental institutions. This includes the communication of information on floodproofing steps that individuals can embark on. To achieve that, resilience is added and applied to flood risk management to study the reaction of an urban system. Gallopín (2006) and Miller et al. (2010) state that resilience is associated with vulnerability and adaptability. Gallopín (2006) further goes on to state that resilience is described in terms of response capacity, coping capacity or adaptive capacity of a system to disruptions. Economically, Perrings (2006) defines resilience as the ability of a system to withstand either market or environmental shocks without losing the capacity to allocate resources efficiently. Okyere et al. (2013) point out that developing cities like Accra are facing political, social and

environmental changes as a result of urbanization and the related problems associated with it. This has an effect on flood risk impacts among poor communities in the city of Accra.

The concept of resilience was developed in the field of ecology (Holling 1973) but it has been applied to various fields over the years to describe stable systems. Holling defined resilience as a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations and state variables.

As aforementioned in the current section, several perspectives from different scholars in the fields of engineering, ecology, management and social science have defined resilience. However, for the purpose of this research, the definition of resilience adopted is the ability of a system to recover from a disturbance. This includes its response and recovery. The application of resilience in flood risk management is taken into account. To stay in line with aforementioned concept, resilient urban systems have the ability to accept, resist, recover and learn from past and present flood events. The connection between resilience and Flood Risk management is discussed in the subsequent sections.

4.6 Flood Risk Management

A risk is an uncertain, future event, that if occurs has a negative or positive impact on project promises (Hillson & Simon, 2012). According to Nicholas & Steyn (2012), risk identification is focused on the risk of failure and therefore the threats of flood risks need to be curbed. They further go on to define a risk as a function of the uniqueness of a project and the experience of the project team. In this case there is at least one – either the likelihood that a problematic event will occur or the impact of the event is large. For instance, flooding in Accra could be a risk when the potential impact is human fatality or huge economic loss even when the likelihood is small.

De Bruijn (2005) defines a risk as a function of flood probabilities and flood impacts. It can be quantified as the excepted annual damage. The size of the risk of an event can be assessed by the product of its probability of occurrence and the impact of its occurrence (Hillson & Simon, 2012). The size of a risk is the product of the probability of the risk occurring and the impact of the risk that has occurred, as can be seen in the risk assessment matrix in Figure 4 from Hillson & Simon, 2012. For flood risk management, risk is assessed by the product of the probability of the flood occurring and the flood impact.

The management of flood risks includes identifying the risks, making decisions and taking measures towards the prevention and reduction of the vulnerability, exposure and impact of flood risks and hazards. A management body that engages in evaluation, analysis and reduction of flood risk carries out flood risk management at a decision making level. Predicting the consequences of these risks is also vital. The necessary background information before; during and after a flood event is vital for risk management as you can only manage things that you are aware of (Schanze, 2006; Schanze, 2009; Nicholas & Steyn, 2012).

Hillson & Simon (2012) explain that flood risk levels range from very high, high, medium, low, to very low and zero risk. Flood risk is weighed in order to have an idea if it will be an opportunity or a threat to society by looking at the probability and impact of the risk occurring. An opportunity is a risk in a different sense which is used to describe an upside risk with positive impacts while a threat is used for downside risks with negative consequences. A management decision is made on risk levels that can be addressed and those that should be ignored. Flood Risk Management strategies may aim at reducing risk to levels to zero or acceptable levels (Hillson & Simon, 2012; Nicholas & Steyn, 2012).

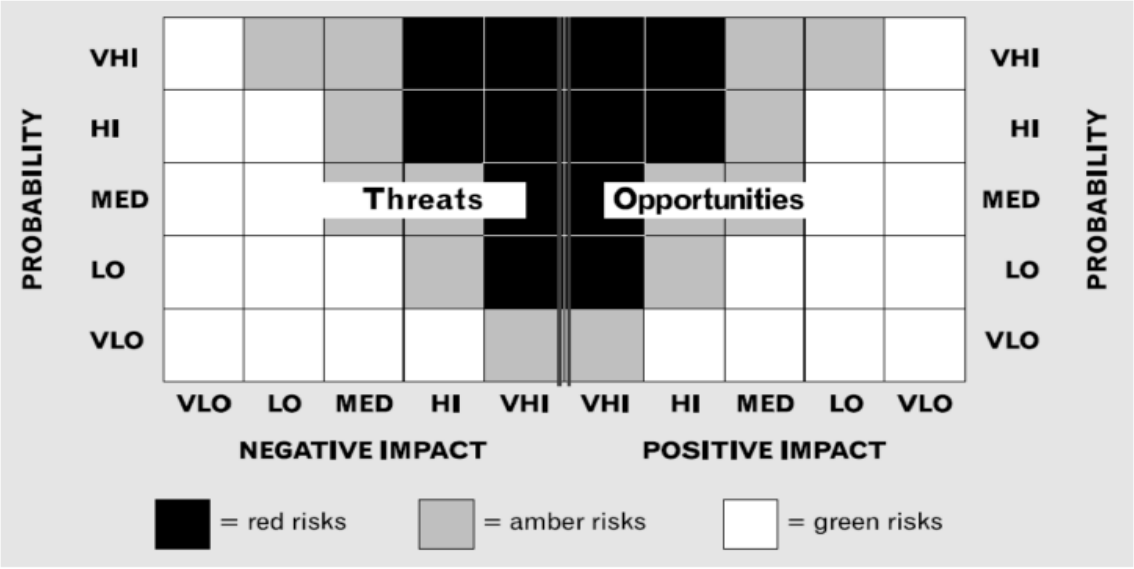

Figure 4: Risk assessment matrix (Hillson & Simon, 2012)

According to Plate (2002), flood risk management is the process of planning and managing an existing flood risk situation to reduce the flood risk, control flood disasters and to minimize its impact. Plate (2002) emphasizes that the decision-making process must involve social groups of society, from governmental organizations, political authorities, to the people directly affected by floods. Post-flood event measures may include demolitions of buildings and eviction and compensation of affected victims as stated in Section 3.4.

There are four main stages in the management of flood risks and disasters, which include Preparedness, Response, Recovery and Mitigation (Morrow 1999). Moreover, flood risk management involves all the activities that enable a region to cope with floods. According to Schanze (2009), risk management should include a combination of measures that can be integrated to ensure a successful reduction in flood risk. Schanze (2009) stipulates that social, economic, physical and environmental vulnerabilities need to be integrated in the decision-making and planning process. The ideas of engineers, policy makers and political authorities will be needed for an effective flood risk management process.

Hillson & Simon, 2012 look at response strategies which can be used in risk management. The ATOM approach, which stands for Active Threat and Opportunity Management, is used in the management of risks, which include flood risks. The methodology focuses on down-siding the risks or the threats and up-siding the opportunities (Hillson & Simon, 2012). The elements that are used to manage and handle risks are group under Threats and Opportunities. The response strategies as can be seen in Figure 5 are Avoid, Transfer, Reduce, Share, Enhance, Exploit, and Accept.

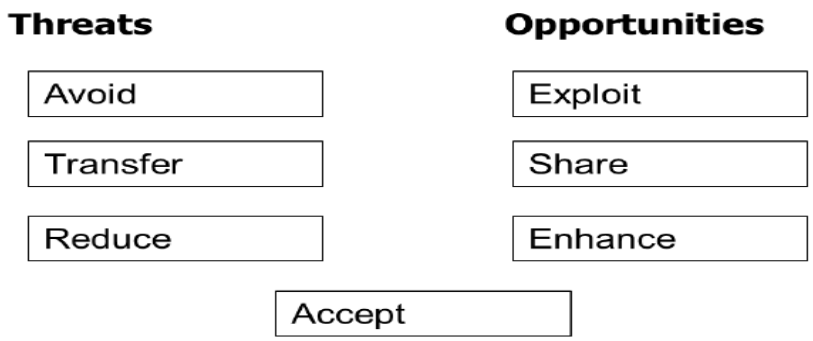

Figure 5: ATOM Response Strategy (Hillson& Simon, 2012)

An avoid response might lead to change of plans if the level of the risk before a potential flood event remains unacceptable. An avoid risk response leaves no residual risks but it can introduce a secondary risk. A residual risk is a risk that remains after you have responded to a risk or treated a risk (Hillson 2016). According to Hillson (1999a), a secondary risk is a risk that is introduced as a direct result of implementing a risk response. Secondary risks are introduced after Avoid or Transfer responses have been taken. There could be another risk from the response. For instance, after settling or building in another neighbourhood, there is still a chance that flooding can occur there after initially avoiding the risk somewhere else.

According to Hillson (2016), transfer response strategies require involving another party in managing the risks. Risks can be transferred by covering yourself with an insurance against floods. If you want to insure against floods you are probably going to pay a very high premium because floods in Accra tend to happen frequently so an insurance company will charge a high premium. The damage may not be so much in financial losses because of the insurance but there is a safety issue. Not all the consequences are covered by the insurance company after transferring the responsibility of the risk. Even if risks are transferred, you cannot be immune to it so Health, Safety, Security and Environment issues are still there.

Reduce response aims to reduce the probability and/or the impact of the threat of floods. Reduce response in the management of floods does not always reduce the probability and impact at the same time. It is either the probability or the impact of the flood that is reduced (Hillson & Simon, 2012). For instance, a risk is reduced by making the design of buildings and structures more

robust so that they can withstand larger flood disasters. It is advisable to overdesign a bit to see if they can deal with the high magnitude floods to make sure the damage is minimal. In this case, the impact of the floods is reduced because the probability of flooding occurring cannot be influenced.

To exploit an opportunity means to make it definitely happen, making sure that the project gains the additional benefits (Hillson 2016). Crisis management measures can be implemented to exploit the opportunities of finding new ways to tackling the flooding problem.

For sharing, the potential profit from a risk response can be shared in return for the other party taking responsibility for managing the opportunity. A structure involving all parties increases the effect of the response by sharing the risks.

An enhance response aims to increase the probability and/or impact of an opportunity by improving plans and policies or changing the scope and boundaries of these plans after a flood event has occurred.

Accept response involves accepting the threats and opportunities of floods. Usually, proactive action is either impossible or not cost-effective according to Hillson (2016). Doing nothing may sound strange but it is also a way of responding to and managing flood risks. An accept response leaves the full residual risk and the probability of the risk remains the same. An accept response might result in human casualty and damage becoming enormous.

Table 4 below describes the response strategies involved in Flood Risk Management as retrieved from Hillson & Simon, 2012.

Table 4: ATOM Risk Response Strategies (Adapted from Hillson & Simon (2012))

Risk Response strategy	Implementation phase	Description
THREATS		
Avoid	Before the flood	Avoid the flood risk in advance by not building in flood-prone zones and waterways.
Transfer	Before and after the flood	By transferring risks, other parties are made responsible for flood risks
Reduce	Before and after the flood	Reduce the probability or impact of the flood occurring or both probability and impact.
OPPORTUNITIES		
Exploit	During and after the flood	Evade the risks and try to make as much of it as possible. It is the opposite of Avoid response. Implement crisis management measures
Share	Before and after the flood	Increase the effect of your response by not transferring the risk but rather sharing it.
Enhance	After the flood event	Enhance the opportunities available from the risk response. It is the opposite of Reduce
THREATS & OPPORTUNITIES		
Accept	Before and after the flood	Do nothing and accept the current flood situation

4.7 Resilient Flood Risk Management

According to Tourbier (2012), resilience combines spatial, structural, social, and risk management levels of flood preparedness. The combination of these four levels help in the planning process and monitoring of performance by building robust instructions and structures that can withstand and recover from crises and damage. For instance, social flood resilience refers to the building of robust institutions and governance systems that underpin the capacity to prepare for and cope with uncertainty, change, and disasters when they occur (Tourbier 2012).

The link between resilience and Flood Risk Management is the process of risk analysis. To support these statements, Batica et al. (2013) incorporate resilience into Flood Risk Management through a framework that evaluates the level of flood risks by looking at five elements called the 5R's namely - Relief, Resist, Response, Recovery and Reflect. These five elements have similar connotations and approaches to the stages in which flood risks are managed, including the Avoid, Reduce, Accept, Enhance, Exploit, Share and Transfer response strategies. They cover the measures related to preparedness, recovery and mitigation of risks. The type of response is related to the degree of preparedness (Morrow 1999). The five elements for flood risk management can be seen in Figure 6 below.

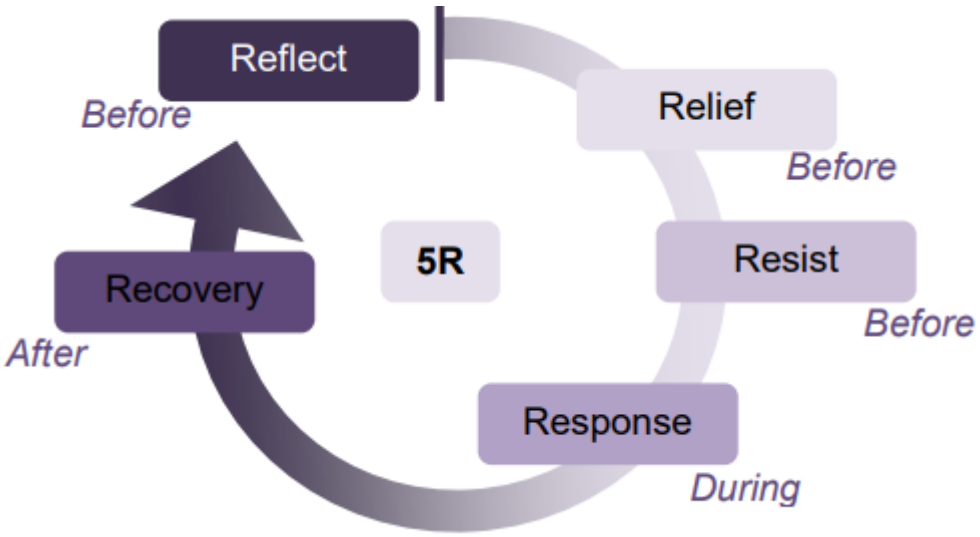

Figure 6: Elements for flood risk management cycle - CORFU project (Batica et al. (2013)

Similarly, Batica et al. (2013) state that five dimensions, namely – social, economic, environmental, technical and institutional – can contribute to evaluating resilience by bringing innovation and improvement to Flood Risk Management. The actions and measures that are taken are directly connected with flood resilience. This leads to cities becoming more capable of dealing with flood risks and their impacts by being prepared through emergency evacuation, early warning systems, evacuation, relief aid, education, action plans and recovery from flood impacts. The aim of these activities is to reduce the vulnerability and exposure to floods as well as the probability of occurrence and consequences of flooding. Therefore the factors of vulnerability developed by Balica and Wright (2010) are related to the 5R's of Batica et al. (2013). Thus the basis for long term management decisions for flood protection is provided.

The first two elements of the cycle – Relief and Resist – are similar to the Accept and Reduce response strategies respectively as stated in Hillson & Simon (2012). Moreover, exposure and susceptibility are similar to the Relief and Resist elements of the cycle (Balica and Wright (2010)).

Relief measures for resilient flood risk management are implemented before a flood event as can be seen in the diagram formulated by Batica et al. (2013). According to them, this element serves an opportunity by implementing measures related to wet flood proofing by allowing systems to be flooded and looking at how they will react.

Resist elements involve mitigation measures before a flooding events. Limiting flood damage and easing recovery by preparedness, planning and adapting buildings, infrastructure, surfaces and economic activity relate to the concept of resistance.

A response element is taken during the flood and the focus is on crisis management and adaptive coping capacity. This refers to the adaptability of a community or system and it measures the response capacity of a community to environmental changes. Nelson et al. (2007) define adaptation as the set of actions undertaken to maintain the capacity to deal with future change or perturbations to social ecological systems without undergoing significant changes in function, structural identity, or feedbacks of that system while maintaining the option to develop. Flood impacts are reduced by implementation of physical and technical measures related to coping with floods. Coordination among organisations can enhance response capacities to cope with unexpected course of flood disasters. The recovery processes from a response entails engagement and building capacity in communities to enable to cope with the impacts after flooding events (Batica et al. 2013).

Reflecting on a recovery involves focusing on creating more awareness, engagement and adaptive capacity of flood risk at all levels in the urban environment. Educating the general public through sharing of information and learning by including policymakers, professionals, insurance companies and the general public is crucial. This is achieved through internet portals, distributing brochures and public presentations. The Reflect element has similar attributes to the share response strategy in the sense that the upside is shared (Hillson 2016).

The concept of resilience is broad and has many connotations, application and interpretations as it has been applied in different fields of study (Djalante and Thomalla 2011). Generally, resilience is defined as the ability to recover from damaging. It is the ability of communities to cope, recover, self-organize and learn to adapt to extreme disasters (Carpenter et al. 2001). Resilience of a system is related to the capacity of a system to cope with shocks or disturbances and the ability to bounce back and maintain its functions (De Bruijn, 2004).

Resilience is a factor of vulnerability (Balica and Wright (2010)) and it is a combination of the Response, Recovery and Reflect elements of the 5R's of Batica et al. (2013). Coordination throughout disaster risk management and networks can bring stakeholders to reinforce their response resources for improved performance. The application of resilience in Flood Risk Management may play a key role in the successful response to floods and expected risks from floods. This can help responsible actors respond to these uncertainties in an effective way.

Table 5 gives a brief description on the phases involved in the resilient Flood Risk Management cycle as proposed by Batica et al. (2013).

Table 5: Elements for flood risk management cycle and their Implementation Phases

Resilient FRM element	Implementation phase	Description
Relief	Before flooding event	Using existing urban structures for the collection of flood water
Resist	Before the flood	Mitigate flood risk and enhance threshold capacity by adaptation measures to limit flood impact and damage. Mitigation to ensure ease of response and recovery
Response	During flooding event	Implement crisis management measures and adaptive coping capacity by measuring the response capacity of a community to environmental changes
Recovery	After the flood	Restore damaged infrastructures and livelihoods, and support communities
Reflect	After/Before the flood	Increase awareness creation, engagement and adaptive capacity through education, workshops, learning and transforming. Management at all levels - policy level, professional and public participation.

4.8 Multi-level governance

Multi-level governance (MLG) conceptualizes decision-making arrangement that involves a multiple interdependent public and private actors operating at multiple government and non-government or political levels. Decision-making power is spread along the vertical and horizontal interactions of actors (Marks 1993; Schmitter 2004; Stein and Turkewitsch 2014). The herculean task of flooding issues cannot be left for the national and city authorities alone to handle. In other words, multi-level governance creates problem-solving capacity beyond the national government without destroying it entirely and this has been highlighted on by Scharpf (1997). Taşan-Kok and Jan Vranken (2011) define multi-level governance as an arrangement for making binding decisions that engages multiple politically independent but otherwise interdependent actors and it does not assign exclusively policy competence or assert a stable hierarchy of political authority to any levels.

Multi-level governance also identifies the way power is spread vertically between many levels of government and horizontally across multiple quasi-government and non-governmental organizations and actors (Cairney et al., 2019).

In simple terms, Hooghe and Marks (2003) describe multi-level governance as the interface between central governments and non-state actors in terms of designing and implementing policies at various levels of actions. According to them, multi-level governance presents the

basis for understanding the vertical governance between different scales of government and horizontal governance across multiple sectors of the same level of government.

4.8.1 Types of Multi-level Governance

Multi-level governance offers flexibility by accommodating the changes in citizen preferences and enhancing problem solving capacities (Hooghe & Marks, 2010). This flexibility is absent in the traditional bureaucratic top-down approach (Scharpf, 1997). Thus multi-level governance eliminates the traditional top-down approach to handling flood risks and there are two types of governance according to Hooghe and Marks (2003). They have classified those two types as Type I and Type II.

According to them, Type I multi-level governance is a general-purpose form of governance. In this way, authority is shared across non-intersecting jurisdictions in a small number of packages which are responsible for providing a number of policies. They operate at regional level, municipal, district and local level. However, Hooghe and Marks also made it clear that Type I governance does not necessarily exist only within nation states but can be extended to larger political systems that share the same basic characteristics. A typical example is the Accra Metropolitan Assembly that oversees the management of Accra but in a sense also oversees the districts at municipal and local level in the region through various departments.

However, Type II multi-level governance consists of a set of special-purpose jurisdictions that carry out specific tasks, in where the jurisdictions operate at numerous territorial levels and may overlap. Hooghe and Marks, 2010 state that Type II arrangements can be found at the national or international level. Type II governance arrangements typically work with experts that are relatively isolated from the wider public and claim legitimate expertise and competency on a specific policy issue (Haas 1992). For example, NADMO (National Disaster Management Organization) operates at all levels of governance and falls under Type II due to its special-purpose attributes. Their main task is to manage and respond to disaster in Accra using their expertise. According to (McGinnis & Walker, 2010), American political economist Vincent Ostrom, well known for being at the forefront of polycentricity, categorized special-purpose attributes as a feature of polycentricism. Polycentricity is a complex form of governance with multiple centers of decision making. For Type I multi-level governance, authority is relatively stable, but for Type II it is more flexible dealing with the changing demands of governance (see Table 6).

Table 6: Types of Multi-level Governance (Source: Marks and Hooghe (2003))

Type I	Type II
General-purpose jurisdictions	Task-specific jurisdictions
Non-intersecting memberships	Intersecting memberships
Jurisdictions at a limited number of levels	No limit to the number of jurisdictional levels
System-wide architecture	Flexible design

Source: Marks and Hooghe (2003)

Flood risk management is a collective effort and is therefore a public good or service as its end result may or may not benefit members of a society. Geaves & Penning-Rowsell (2016) are of the view that Flood Risk Management is a public good or service. According to McGinnis (1999), based on Vincent Ostrom's work, polycentric governance is needed for the effective provision of public goods and service. Polycentric governance institutions promote self-organization and formation of networks and therefore have a significant impact on the capacity to manage resilience (Djalante, Holley, & Thomalla, 2011). Multi-level governance aims at bringing together various actors and authorities at local, regional and national levels of government to enhance better coordination of decision making (Walsh, 2012)

4.8.2 Vertical and Horizontal Dimensions of Multi-Level Governance

Effective multi-level governance of Type I and Type II needs coordination in the governance process and this has two dimensions namely; vertical and horizontal dimensions, according to Hooghe and Marks (2003). These dimensions can be classified according to whether they hinge on denationalization (Zürn 2000) in upwards, downwards or sideways directions (Hooghe and Marks 2003; Schakel et al. 2015).

The vertical dimension refers to the link between higher and lower levels of government, including their institutional aspects. Vertical dimension of multi-governance ensures that national governments can only implement national strategies effectively by establishing close working relationships with regional and local governments. For instance, the local government agencies in Accra that initiate actions in relation to flooding do so within the legal and institutional framework at higher scales (Hooghe and Marks, 2003).

The horizontal dimension refers to co-operation arrangements between regions or between municipalities to improve the effectiveness of local public service delivery and implementation of development strategies. AMA has launched an initiative christened 'Electoral Area Sanitation Challenge' aimed at stimulating and rewarding community participation and ownership of

innovative schemes to improve environmental health and sanitation in the city of Accra. There is collaboration between the communities in Accra and private waste management companies like Zoomlion to ensure that total waste management solutions are delivered (Ghana News Agency, 2021; Oduro-Kwarteng, 2011).

Actors work across organizational boundaries to influence objectives and results on the horizontal dimension with interconnectivity between cities, regions and national governments. For example (NADMO), together with its key partners has implemented disaster risk reduction strategies to manage and reduce existing risk levels and to avoid the creation of new risk. Platforms like the National Platform for Disaster Risk Reduction (DDR) and Climate Change Adaptation (CCA) have been established. Regional and District Platforms for DDR and CCR are headed by all Regional Ministers and District Chief Executives in their respective Regions and Districts to enhance collaboration (NADMO, 2020).

Although there are multiple approaches to multi-level governance (McGinnis & Walker (2010); Taşan-Kok and Jan Vranken (2011); Cairney et al., 2019), the Type I and Type II categories defined by Hooghe and Marks (2003) are suitable for identifying and examining the linkages at play in Flood risk management across a tripartite view of multilevel governance. The theory addresses interactions taking place at three different analytical levels and these will be used in the further analysis.

4.9 Analytical Framework

The analytical framework (Table 5 and Table 6) is derived from the work of the 5R's of Batica et al. (2013) and the Type I and Type II multi-level forms of governance defined by Hooghe and Marks (2003). Together, these provide a clear and promising framework that deals explicitly with the 5 factors forming resilience and the need for co-ordination of policy measures across the various administrative levels, regions and localities. However, it is noted at this stage that the analytical framework from literature underestimates the potential role of traditional leaders in the Type I multi-level form of governance.

5 CASE STUDY

A resilient city has the ability to tolerate risks and hazard from climate extremes by reducing or limiting the impact of the eventual damage. This chapter looks at the flooding problem in Accra (Figure 7) and the various issues surrounding it. As already stated in Section 1.3, five communities will be considered.

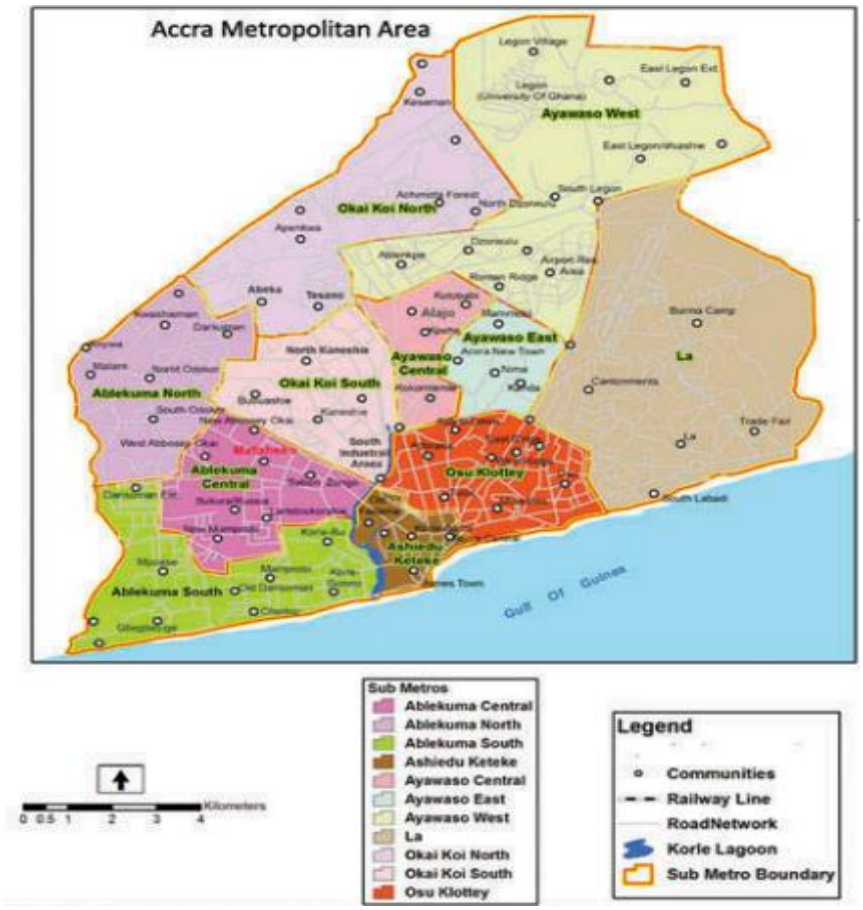

Figure 7: A map of the Accra Metropolitan Area (Amoako and Boamah, 2014)

The Twin disaster of 2015 which happened in Adabraka resulted from cascading effects and is till this day the worst flood disaster in Ghana's history (Daily Graphic, 2015). A dropped cigarette into flood water containing fuel caused an explosion of a gasoline station. The end result was that the lives of 152 people were claimed and properties damaged were in the region of millions of dollars (Quarshie et al., 2018). Those were the numbers reported by the media but there is the possibility that more lives were lost as some bodies were burnt beyond recognition and not identified.

5.1 Vulnerability and exposure to flood hazards in Accra (extent of flooding)

Adding to the above stated points, building on waterways, defective structures, and lack of drainage maintenance have had repercussions on Accra and contributed to persistent flooding (Okyere et al, 2013). Most of the communities that have been affected as a result of flooding are informal settlements in the capital of Ghana. Ad hoc engineering structures and facilities and choked gutters have aggravated the problems of flooding (Douglas et al., 2008).

5.2 Flood-prone communities in the Accra Metropolitan Area

Agbogbloshie, Old Fadama, Alajo, Weija and Adabraka are five settlements (Figure 8) in Accra that are vulnerable to perennial flood hazards. Moreover, Agbogbloshie and Old Fadama are the largest informal and slum communities in the city. The two communities are on about 146 ha of land (Owusu-Ansah et al 2016). An official of the AMA interviewed estimated the current population of the two communities to be over 80,000 inhabitants in total. There is no exact knowledge of the number of people residing there.

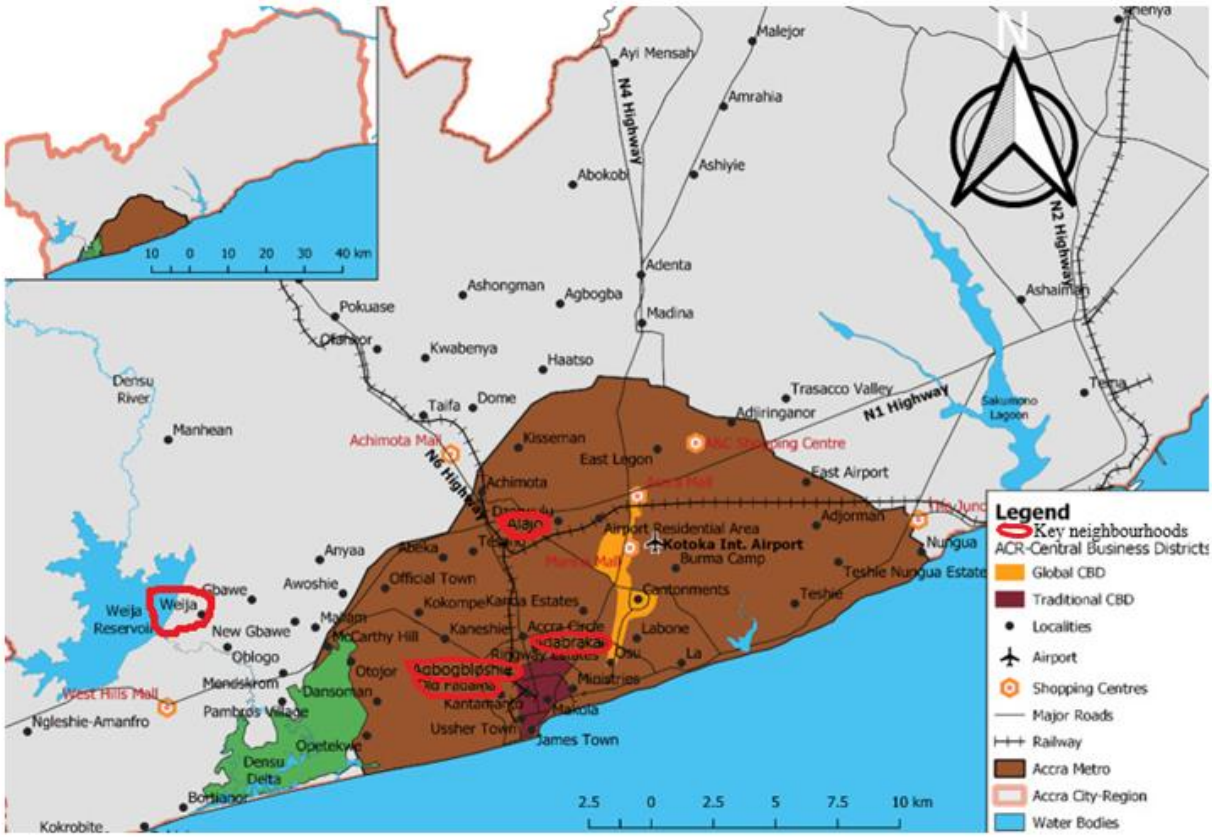

Figure 8: Location of the five communities in Accra (Adapted from Gaisie et al., 2019)

5.2.1 Alajo

Alajo is a suburb of Accra which is located within the Ayawaso Central submetropolitan area of the Accra Metropolitan District (Ayawaso Central Municipal Assembly, 2019). The map of Alajo and its surrounding neighbourhoods can be seen in Figure 9. Alajo is located north of the Kwame Nkrumah Interchange (formerly the Kwame Nkrumah Circle), and is about 6 km from the Central Business District (CBD) of Accra. The suburb is located in a flood-prone area at the confluence of the Odaw River and the Onyasia River which are the major cause of perennial flood in Ajajo. One of its tributaries is about a distance of 8 km from the Korle Lagoon, where the river empties into the Gulf of Guinea (Atuguba & Amuzu 2006; Aboagye 2012; Attipoe 2015).

Alajo was a high-income, low population density community before being overtaken by rapid urbanization in recent years. The community's infrastructures have not been able to support the influx of new inhabitants who include migrants from the northern part of Ghana and neighbouring West African countries (Atuguba & Amuzu 2006). Although Christianity is the dominant religion in Accra, Alajo has a large Muslim community. As of 2010, Alajo had 80,000 inhabitants in an area approximately 1 km^2 (Ghana Statistical Service, 2010).

Alajo experiences fluvial flooding and during storms, water levels rise along the Onyasia River. Buildings, homes and structures along the riverbanks get flooded. In June 2001, five hours of rain caused flash floods that killed six people and drove tens of thousands from their homes in Alajo. In total, it led to the death of 20 people in Accra (The Daily Graphic 2001).

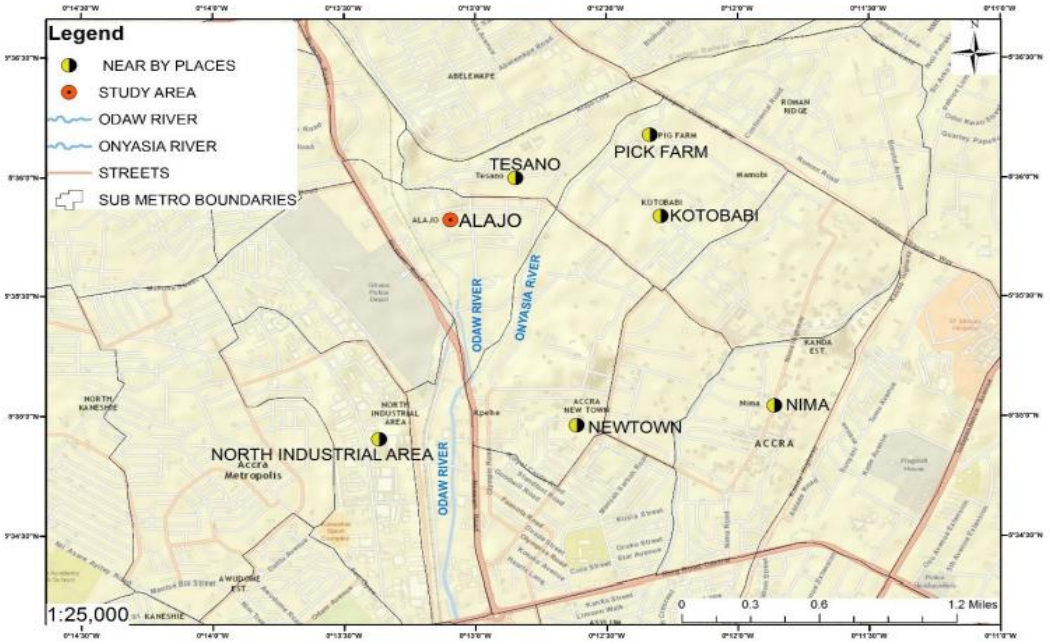

Figure 9: Map of Alajo and its environs (Kusimi & Yeboah, 2019)

5.2.2 Agbogbloshie

Agbogbloshie is a settlement located in the heart of Accra and situated about 1 km from the central business district of the city. The settlement is located in a low-lying area, where most of Accra's major drainage networks are located (Oppong et al. 2020). Agbogbloshie's location is already a trigger for flood-related incidents. Agbogbloshie traces its existence before the 1960s when it was a wetland (Codjoe et al. 2014). The community covers about 115 hectares of land. It is bordered by the Abossey Okai - Graphic Road, to the west by the Korle Lagoon and the Odaw River and to the east by the Accra terminal of the Ghana Railway Corporation. Agbogbloshie has experienced settlement in open spaces along major highways and railway lines. Houses are mostly wooden shacks called kiosks that lack water and sanitation. Agbogbloshie is not just the home to thousands of people; it is also a scrapyard and a site for dumping and burning electrical waste. The burning of electrical waste and cables takes place in open spaces. All the open spaces have been occupied by scrap activities (COHRE, 2004). The map of Agbogbloshie and its surroundings can be seen in Figure 10.

During the 1980s illegal settlement was on the rise after migrants from the northern part of Ghana sought refuge in Accra as a result of tribal wars in the region. Agbogbloshie was one of the settlements that experienced various waves of migration from the northern part of Ghana. Squatters and settlers have gradually claimed the community illegally without any proper form of documentation. As is common with migration, settlers rarely return to their original homes and claim lands through illegal appropriation (Gillespie 2016). The community has therefore developed into a slum community over the years.

Agbogbloshie mostly experiences pluvial flooding (Codjoe et al. 2014). The inhabitants of the settlement are also vulnerable to perennial flood hazards from the overflow of the Korle Lagoon and the Odaw River.

With the construction of the Agbogbloshie market, a regional market, the settlement has been transformed into a heterogeneous, densely populated community with a combination of wooden and permanent structures. The market has also suffered from flooding and other disasters.

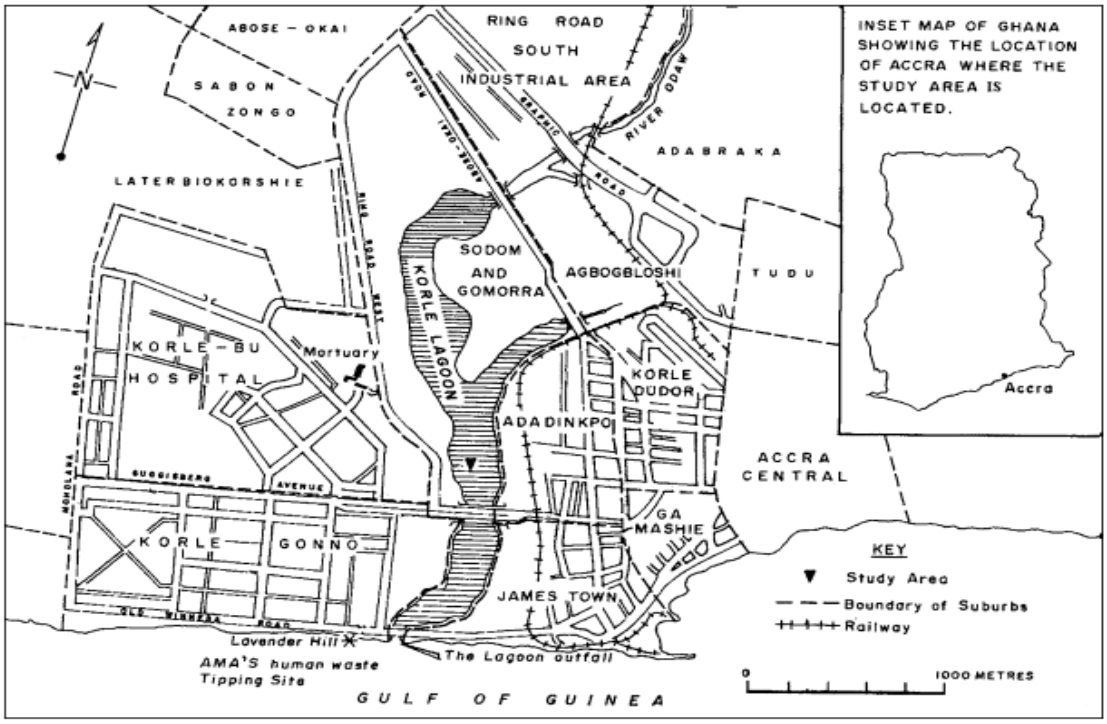

Figure 10: Map of Agbogbloshie, Adabraka and Old Fadama (Source: Survey Department of Ghana, Accra).

5.2.3 Old Fadama

Old Fadama, a squatter community popularly referred to as Sodom and Gomorrah, is a spillover settlement from Agbogbloshie. It is located south of Agbogbloshie and regarded as an illegal settlement by both traditional land owners and the state (Codjoe et al. 2014, COHRE, 2004). Old Fadama is 31 hectares in size and situated beside the Odaw River and near the Korle Lagoon. Most of the land has been reclaimed from the lagoon and river. This has been gradually filled in by residents using any materials they come across, mostly wood from the Agbogbloshie market. These practices make the settlement prone to flooding (Farouk and Owusu, 2012).

The informal settlement of Old Fadama emerged in the city of Accra in the 1980s as a result of migration from other parts of Ghana. This wave of migration saw a lot of traders moving to the settlement from Osu - a suburb of Accra. In 1994, there was another wave of migration to Old Fadama, particularly from the northern part of the country, due to tribal conflicts in that region. This wave of migration also resulted in people settling in Agbogbloshie (Oppong et al. 2020).

Bounded by the Odaw River and Korle Lagoon, Old Fadama is vulnerable to perennial flood hazards from the overflow of the two water bodies. Agbogbloshie and Old Fadama are exposed to similar flood hazards.

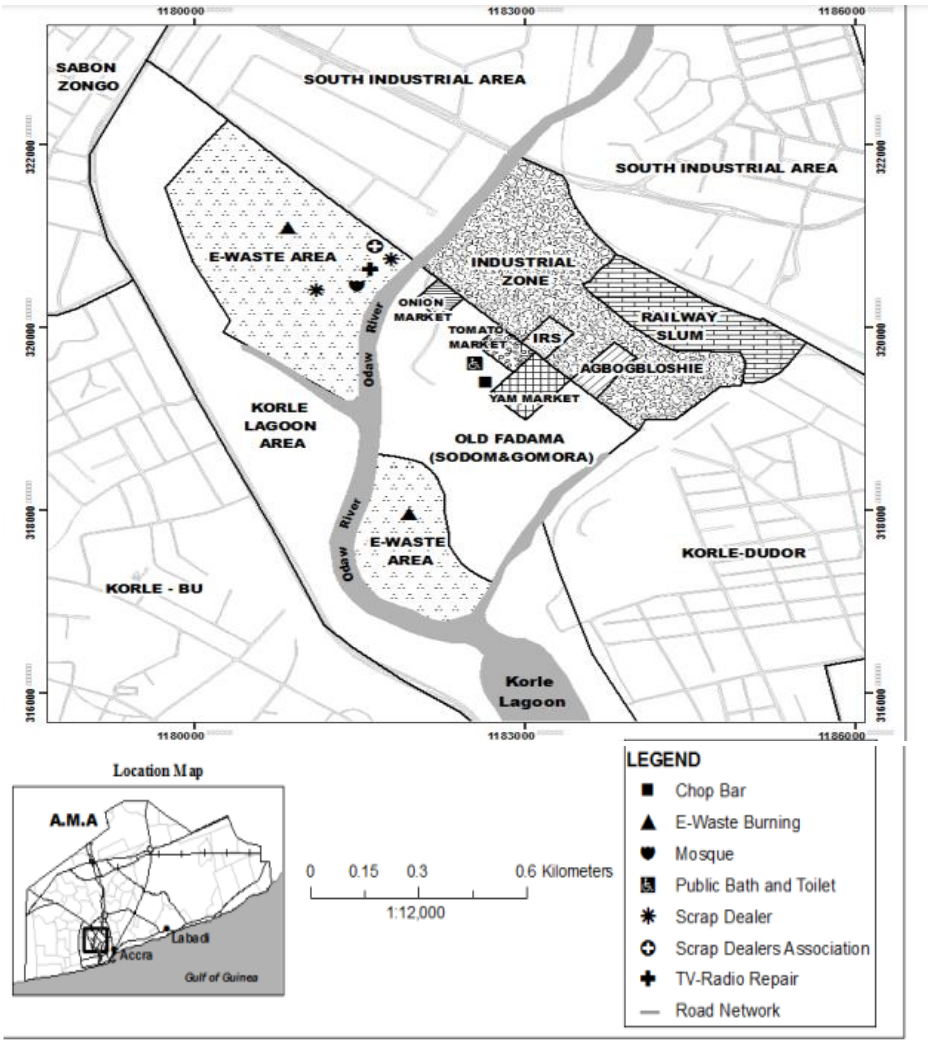

Figure 11: Map of AMA Showing Agbogbloshie and Old Fadama (Oteng-Ababio, 2012)

5.2.4 Weija

Weija lies at the south western part of Accra and is located in the Greater Accra Metropolitan Area. However, the community has undergone administrative changes over the years. Part of Weija was located in the Ga South Municipal which was carved out from the Ga West district in November 2007. Later, a small portion of the district was also split off to create Ga Central Municipal District on 28 June 2012; retaining the remaining part as Ga South Municipal District (Ghana Statistical Service 2014). However on 15 March 2018, the northern part of the district was split off to create a new Ga South Municipal District and the remaining part has been renamed as Weija-Gbawe Municipal District (Weija Gbawe Municipal Assembly)

Weija occupies a total land area of about 341,838 km^2 with about 95 settlements (Ghana Statistical Service 2014) The Weija Dam, situated in the west part of the Accra metropolitan area, is a major source of water supply to eight municipalities in the Greater Accra Metropolitan Area (Figure 12). The dam is operated by the Ghana Water Company Limited. More than 40

years ago, the Weija dam was constructed on the Densu River and it creates a reservoir in the Densu River. The Densu delta wetland lies 11km west of Accra in the river valley between the Aplaku-Takuse and Weija McCarthy hills (Kuma and Ashley 2008). When the dam was completed in 1978, Weija was a remote rural settlement. The Government of Ghana declared the Densu Delta wetland as a Ramsar site. A Ramsar site is a wetland site designated to be of international importance under the Ramsar Convention on Wetlands. This requires the wise use of wetlands for bird habitat, the conservation of wetlands and wise sustainable use of their resources (Willoughby et al. 2001).

The population of Weija was less than 5000 in 2000 and was therefore classified as rural by the Ghana Statistical Service (Ghana Statistical Service 2005). However, over the last 22 years, the settlement has grown rapidly due to urbanization and rising to a population of 15,892 in 2010 (Ghana Statistical Service 2014) as can be seen in Table 7.

Weija has experienced perennial flooding over the years. Excess flow from the Weija reservoir discharges into the Densu River. The Densu Delta wetland around Weija has been targeted and encroached for commercial and residential development. Due to the continuous rainfall, the spillways of the Weija dam have been opened for months, causing flooding in the Weija-Densu valley downstream. The Densu River has flooded homes and businesses along the river banks. The residents have not heeded to the advice of government officials to evacuate the flood-prone area (Ntiamoa-Baidu & Gordon, 1991; Willoughby et al. 2001).

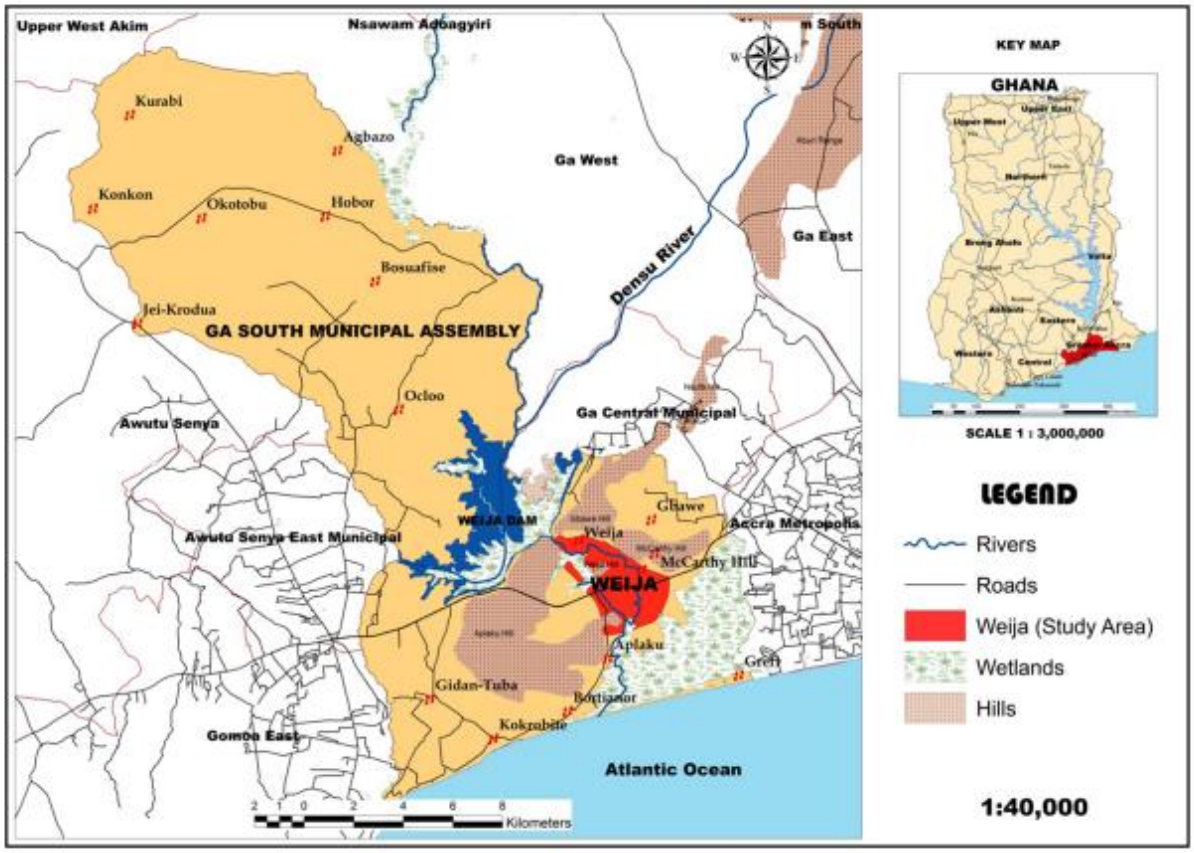

Figure 12: Map showing the location of Weija (Ga South Municipal Assembly)

5.2.5 Adabraka

Adabraka is centrally located within the Korley Kottey district and 2 km from Accra's central business district. Adabraka, as can be seen in Figure 13, is also located in the Osu Klottey submetropolitan area which also has neighbourhoods like Asylum Down and the Kwame Nkrumah Circle (Korley Klottey Municipal Assembly, Grant, 2009). Adabraka is one of the most densely populated suburbs within the submetropolitan area and one of the busiest business districts. Adabraka houses one of the biggest media houses in Accra, which include radio and television stations. Joy FM and Citi FM are located in the neighbourhood. As of 2010 the total population was 36,510 (Ghana Statistical Service, 2010).

The Osu Klottey submetropolitan area is known to be a haven for low income people living in illegal structures. According to Douglas et al. (2008), residents of low-income informal settlements are known to be more susceptible to flooding hazards in Accra. This is also the case in certain parts of Adabraka and its environs as there is a high daily migration of people to the sub metro from various parts of Ghana. These people include petty traders, illegal immigrants, prostitutes, armed robbers and other social misfits (Daily Graphic: Issue 19562 September 12, 2014)

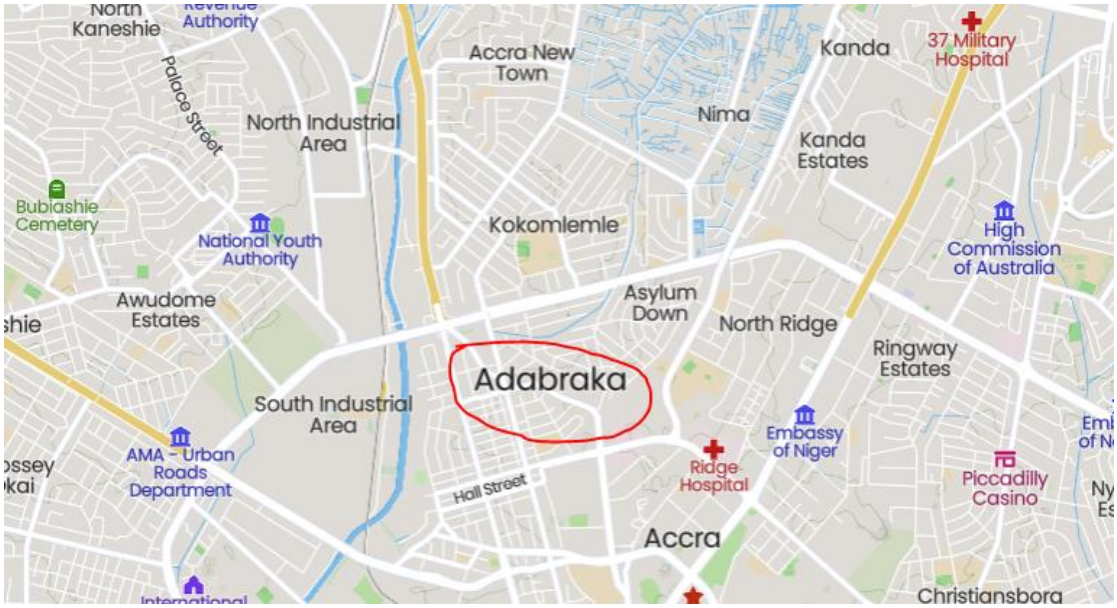

Figure 13: Map showing Adabraka's proximity to the central business district of Accra (Mapcarta)

However, Adabraka is a planned neighbourhood comprising a planned network of streets and houses, functional drainage systems and municipal services (Yankson, 2012). Despite, the planned nature of the neighbourhood, Adabraka is noted for flooding and suffers from frequent flooding along the banks of the Odaw River (Tengan and Aigbavboa, 2016). One of such flooding occurrences is the 'Twin disaster' that took place on Wednesday June 3. Kwame Nkrumah Circle, which is a major junction of local buses, close to Adabraka was flooded after 6 hours of torrential rainfall (Daily Graphic, 2015). Traders and passengers fled Kwame Nkrumah Circle and sought refuge at a Goil fuel station in Adabraka. However, their source of hope became their deathtrap as the flooding extended to Adabraka. The electricity went off as a result of heavy flooding, a generator was started to return the light, a spark came in contact with fuel in combination with a dropped cigarette that had spread in the floodwaters and set the station on fire. The explosion cost an estimated number of 152 lives and injured approximately 60 others (UNCT Ghana, 2015).

5.3 Main drivers of flooding in Accra

The drivers that pave the way for flooding in Accra are numerous. As discussed below they include inadequate drainage systems and waste management, population growth, rapid urbanization, indiscipline, religion, poor spatial/physical planning and high rainfall intensified by climate change to name a few.

5.3.1 Population Growth and Urbanization

Capital cities of countries have experienced a massive influx of people from other regions over a period of time. The city of Accra has also experienced this trend of people migrating to the city and this is a recipe for the increase in flood risk and impacts (Yankson & Grant, 2003) Accra's perennial flooding issues have been attributed to this trend of population growth and rapid

urbanization over the years, as mentioned in Chapter 3 (Karley 2009). This rapid growth rate of Accra has resulted in many impervious surfaces as a result of most neighbourhoods being occupied due to improper spatial land-use. Drainage networks have become undersized and unconnected from the river basins as a result. Thus, there is an increase in discharge when it rains, causing an overflow of the drainage channels and gutters. The current infrastructure in Accra is inadequate to contain all these loads and discharges. Accra also has a high number of slums and informal settlements with a lot of land-use regulation challenges (Rain et al. 2011).

For instance Alajo's main road, has been occupied by small businesses and kiosks crowded next to each other. It is also congested by vehicular traffic and pedestrians traveling and transporting goods. There is little open space, and this is a gateway and a recipe for disaster if flooding occurs. In Weija, the rapid population growth rate can be attributed to the influx of urban residents from Accra and its environs searching for cheaper lands and living conditions. The Densu delta wetland close to Weija is being targeted because almost every open space has been encroached. This is as a result of the indiscriminate allocation of building permits by government authorities.

Uncontrolled development occurring in risky areas exacerbates the impact of flooding. The relatively high population serves as a market for investors but at the same time it also poses problems for sanitation and waste management. Solid waste is disposed of in the Metropolis through the house-to-house collection system and by public dump. Liquid waste is mostly disposed into gutters through a drainage system and then through a sewerage system into waterbodies. There is also illegal disposal of solid waste into gutters and drains posing health hazards in the metropolis.

Table 7: Population growth in Weija (Compiled from GSS (2005, 2014)

Year	Total	Growth rate
1960	1551	-
1970	1909	2.08
1984	2464	1.82
2000	4862	4.25
2010	15,892	11.84

5.3.2 Inadequate drainage systems and waste management

There is a lack of drainage systems and facilities to collect effluent and stormwater for safe disposal in most communities like Old Fadama, Agbogbloshie, parts of Adabraka and Alajo. As cities begin expanding, the drainage capacity becomes inadequate to accommodate the accompanying runoff unless it is upgraded or expanded. This is one of the causes of flooding according to Karley (2009). Natural drains and open drains, commonly referred to as gutters in Ghana, are a common sight in Accra. Gutters function as storm water drains and also convey domestic effluent. The drains are often poorly designed or constructed by experts and poorly managed by the communities. Most of the gutters do not have the capacity to contain large volumes of water during heavy rainfall. Most of the drains are unconnected or characterized by improper connectivity to discharge points (Rain et al. 2011)

To add insult to injury, the open nature of the gutters in the surroundings of Accra has created an avenue for easy dumping sites by citizens. It has become common practice to illegally throw garbage into gutters and drains, waterbodies and on the streets due to indiscipline and inadequate waste management systems. For instance, the open drains at Agbogbloshie have been blocked and choked as a result of inadequate waste management practices. These factors pose health hazards in the metropolis and increase the impact of flooding as waste products are either carried away with floods or block the pathway of flow. Inadequate drainage systems and poor waste management practices in Accra are consequences of rapid and unplanned urbanization (Karley 2009). Traders at the Agbogbloshie market have urged A.M.A to put their taxes to good use, but one of the unresolved issues is that the traders are also contributing to the flooding problem by using the drains as dumping sites as can be seen from Figure 14 in Joy News AM Show on May, 20, 2022.

Figure 14: Choked drains at Agbogbloshie market (AM News on Joy News (20-5-22))

Due to Accra's inadequate drainage and sanitation infrastructure and the indiscriminate disposal of waste by inhabitants, Old Fadama and Agbogbloshie have become the source of pollution to the nearby Korle Lagoon. Storm water gutters are either missing or under capacity while gutters around the houses and shelters are unconnected or choked and blocked by solid waste as can be seen in Figure 14. The lagoon receives a huge amount of waste through the Agbogbloshie drain and Odaw River (Farouk and Owusu 2012).

Electronic and faecal products are dominant waste products in the lagoon and over time the Korle Lagoon has become shallow due to excess siltation. The Korle lagoon serves as a central drainage system in Accra emptying its content into the sea. However, due to the lagoon being heavily silted, the outlet is blocked most of the time and the water is unable to flow into the sea at a rate sufficient to avoid stagnation. This situation has led to periodic flooding when it rains in Accra (Boadi and Kuitunen, 2002).

Figure 15 shows the Korle Lagoon being polluted with debris from Agbogbloshie. Some innovative inhabitants have made a pathway from old televisions and computers that have landed in the Korle Lagoon.

Figure 15: Korle Lagoon showing electronic waste from Agbogbloshie being used as Bridges (The Guardian, 2014)

On 5th July, 2022, major streets were submerged following hours of rain, further cementing Accra's reputation as a flood-prone city. The neighbourhoods that were flooded include the streets of Dansoman, Odorkor, Kaneshie, the Kwame Nkrumah Interchange and Adabraka. According to the Daily Graphic, poor drainage in Adabraka and surrounding neighbourhoods was the catalyst for the two-hour flooding event. The inadequate gutters were overwhelmed by the volumes of water which caused an overflow of the drains and covered road surfaces, thereby obstructing pedestrian and vehicular movement. The extent of flooding can be seen in Figure 16.

5.3.3 Poor physical planning

Accra has undergone a period of drastic growth over the years without a proper planning of the city. (Korah and Cobbinah 2017) Poor physical planning of Accra has resulted in an unstructured city with streets and buildings arranged in a haphazard manner. This has not been helped by informal settlements near waterbodies, with poor infrastructure an avenue for periodic flooding. Flood-prone areas like Old Fadama and Agbogbloshie lack the requisite infrastructure to prevent the occurrence of flooding. The growth of these slums and informal settlements in floodplains is a sign of poor urban planning (Karley 2009)

Poor planning and lack of regulation of development have significantly contributed to flooding in Adabraka. A particular house in Adabraka was affected by the flooding event of 5th July 2022. The house has experienced identical flooding situations over the past years ranging between 2019 and 2022. Pictures from recent events were shared by Ghanaian journalist Godwin Asediba on his twitter page. This represents the reality of how serious Accra's flooding problem is even if it feels like part of daily activities to most citizens (Asediba, 2022).

Figure 16: Photos of same house in Adabraka that gets flooded annually. Photo credit: @godwinasediba Source: Twitter

5.3.4 Informal urbanisation

Accra's flooding issues have been attributed to uncontrolled informal urbanisation and occupation in flood plains. These could indirectly be attributed to the ineffective planning of the city which makes room for the illegal erection of buildings and other structures on hazardous floodplains, and the uncontrolled dumping of wastes in the usually open channel drainage systems (Afeku 2005; Karley 2009). Solid waste is disposed of illegally in these informal neighbourhoods as can be seen for Agbogbloshie (Figure 17). Moreover, a great part of land at Old Fadama was reclaimed from the Korle lagoon using saw dust, chippings and materials such as plastic bags. This serves as an impetus for flooding to occur at Old Fadama (Poku-Boansi et al. 2020).

Figure 17: Agbogbloshie as a dumping ground for old computers and electronic waste (Andrew McConnell)

Informal settlements are built up with little room for expansion. Housing infrastructures, roads and drains are poorly developed. Agbogbloshie and Old Fadama have expanded along the Korle Lagoon and in open spaces, reclaimed wetlands and unused government land. Wetlands are unstable and are not suitable to build on as the soil is waterlogged, often acidic or saline and has a high clay content (Grant 2006; Afenah 2009).

5.3.5 High rainfall

Over the past 25 years, Accra has experienced some of the worst flood events. The flooding events in Accra have been attributed to the increased frequency and severity of rainfall events. The rainfall patterns in Accra have been unstable and this is a major cause of urban flooding in the city (Asumadu-Sarkodie, et al., 2015). The most extreme flooding events reported in recent years have occurred after episodes of heavy rainfall. (Amoako and Frimpong Boamah, 2015) Climate change increases the likelihood of extreme rainfall and since most parts of Accra lack the proper storm management infrastructure to convey rainwater and surface-runoff water, the risk of flooding becomes higher after a rainfall event. Hettiarachchi et al. (2018) found this to be a threat to human life and property in neighbourhoods where the existing infrastructure has not been designed to cope with these flood risks.

Old Fadama and Agbogbloshie are some of these neighbourhoods that have been exposed to floods, especially during the rainy season due to their location along the banks of the Odaw River and Korle Lagoon. Afeku (2005) also acknowledges that rainfall triggers flood events in the absence of proper infrastructure.

Accra's rainfall patterns have changed over the years and this has led to increased precipitation. Amoako and Inkoom (2018) states that Accra has recorded average monthly precipitation from 160 mm (1991–2010) to 200mm (2011–2020) over the last 30 years. Rainfall in Accra occurs in the form of intensive storm events, which cause local flooding (Masiyandima et al., 2003). The monthly distribution of rainfall (Figure 18) shows bimodal seasonality in the rainfall distribution, with June being the rainiest month, on average, and January, February and December being the driest months.

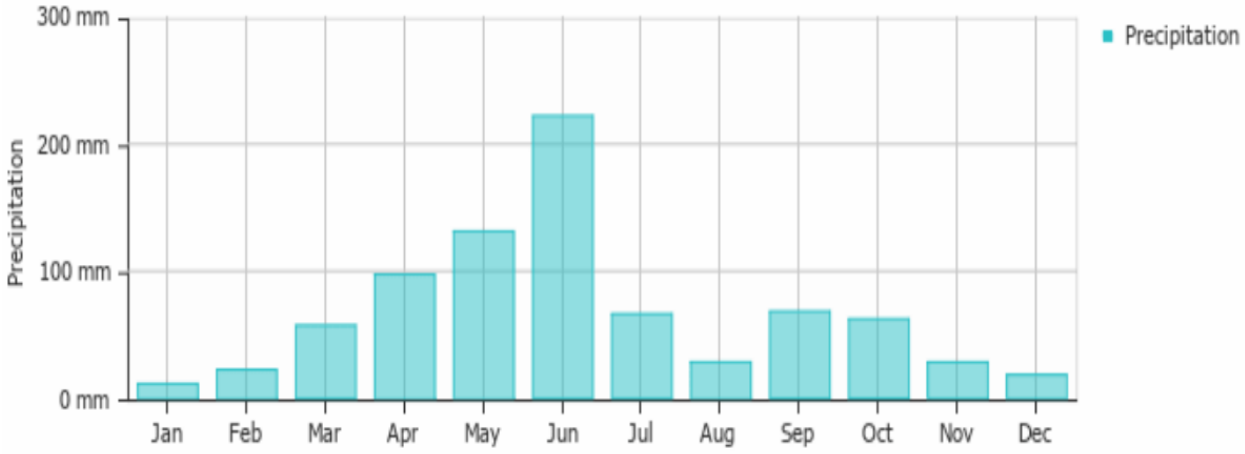

Figure 18: Average monthly rainfall in Accra (Ghana Meteorological Agency, 1971- 2022)

Extreme rainfall events such as the three-hour heavy rainfall in October 2011 caused flooding in many parts of Accra. This could be attributed to changing climatic conditions since it occurred not in the main rainy season. The top three highest rainfall events recorded in Accra are

243.9 mm, 212.3 mm, and 175.3 mm which occurred on the 4th of July 1995, 3rd of June 2015, and 22nd of June 1973 (Amoako and Frimpong Boamah, 2015; Ansah et al., 2020). Accra experienced serious damage to life and properties caused by floods in June 2001 which left 12 people dead and over 100,000 homeless, and seriously disrupted traffic in Accra. An early morning downpour submerged portions of the city, with many houses and structures at Madina, Achimota, Dzorwulu, Avenor, Santa Maria and Adabraka being affected. Residents of the affected areas who were trapped by the flood waters had to climb to safety in trees and rooftops until they were rescued or the flood waters subsided (Karley, 2009).

Twenty-one years later, major streets of Adabraka are submerged under floods again following hours of rainfall. The flood situation today, as can be seen in Figure 19, has been exacerbated by the aforementioned anthropogenic factors such as rapid urbanization, changes in urban land use, poor urban planning and inadequate drainage systems (Owusu-Ansah 2016).

Figure 19: Adabraka Official town flooded after two hours of rain. Source: Daily Graphic 2022

5.4 Current Flood Risk Management Practices in Accra

5.4.1 Stakeholders

Governance arrangement and how it works with respect to the impacts of flooding in Accra is a key component that influences the effective implementation of flood risk management and adaptation. As established from literature reviewed and the legal laws that back the interaction of organizations, agencies and institutional actors, it is evident that Ghana's disaster management system, which includes flood risk management, is structured into three levels. Reduction of flood vulnerability is done at national, regional, and metropolitan/municipal/district assemblies level (Amoako 2016).

Accra, which is the capital of Ghana and the seat of government, operates at the city and national level. Reducing and managing vulnerability and exposure to flood hazards is the focus of flood risk management in Accra. This involves identifying and mitigating the above mentioned drivers of a flood risk from occurring (Amoako, Cobbinah, & Mensah Darkwah, 2019). The Accra Metropolitan Assembly (AMA) is the city's highest institution responsible for flood response and flood risk management (Amoako and Frimpong Boamah, 2015).

Frameworks, national programmes, policies and plans such as the National Water Policy (2007) (NWP), the Ghana Water Vision 2025, the Water Sector Strategic Development Plan (WSSDP), the National Buffer Zone policy (2013) and the National Integrated Water Resources Management (IWRM) plan (2012) have all been formulated, designed and reviewed at the national governmental level to tackle the issue of flooding (Frimpong et al. 2021, Poku-Boansi et al. 2020).

Ghana's National Water Policy (2007) ensures the overall integration of water-resources management in Accra. The NWP is transposed via the Water Resources Commission Act 522 of 1996 which is derived from the 1992 Constitution of Ghana. With the enactment of the Constitution of Ghana in 1992, ownership, control and regulation of water resources was placed in the hands of the State, represented by the President of the Republic of Ghana, for and on behalf of the people of Ghana. Private ownership of water resources does not exist in Ghana (Frimpong et al., 2021, Water Resources Commission Act, 1996).

The NWP contains measures directed at mitigating floods via flood warning and enforcing buffer zones in consultation with affected communities. For instance, buffer zones are established using the Riparian Buffer Zone policy (2013) to prevent illegal settling along river banks by people (Almoradie et al. 2020). In 2010, in order to educate residents in slums and flood-prone neighbourhoods, the Ministry of Local Government and Rural Development, introduced The Blue Agenda policy. The Blue Agenda addresses flooding and its related threats by placing an emphasis on development control, public education, provision of drainage, flood-control measures and the enforcement of building regulations in urban communities (Danso and Addo 2017).

5.4.2 Flood management at different levels

5.4.2.1 Key stakeholders in flood risk management at the national level

Flood risk management is a national security issue and it involves organisations from national level. The National Disaster Management Organization (NADMO) of the Ministry of the Interior coordinates with institutions at all levels of flood management (National Disaster Management Plan of NADMO, 2010). The president appoints NADMO coordinators and he has the power to declare a state of emergency for a flood disaster. Parliament enacts and approves laws for Flood risk management. Decisions are taken in consultation with the National Security Council. The structure of the disaster management organization is shown in Figure 20 with top-down to bottom-up connection of the organization. A top-down connection means that the higher levels give orders to lower levels in the hierarchy on how things should be done. A bottom-up connection is a democratic and collaborative approach rather than a hierarchical one which involves the whole organization participating at all levels in the process of leading the organization (Stewart, Manges & Ward, 2015). This top-down to bottom-up connection of the organization is shown by vertical lines with double-edged arrows.

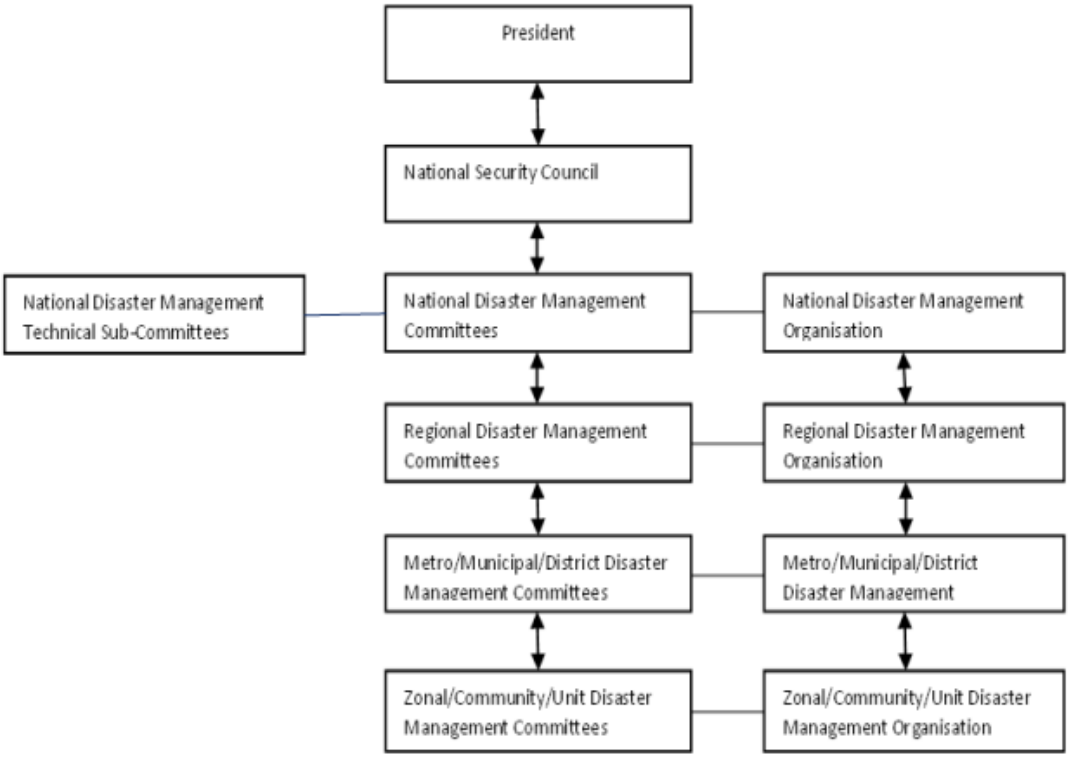

Figure 20: Structure of disaster management in Ghana. Source: National Disaster Management Plan (NADMO 2010: 26).

Reports from the National Disaster Management Committee of NADMO are used to inform the National Security Council of flooding and its related activities. The Regional Disaster Management Committee of the NADMO receives reports from metropolitan, municipal and district Disaster Management Committee. District level is decentralized to the Zonal/Community/Unit Disaster Management Committee. The committees of NADMO are linked at each level by horizontal lines. The National Disaster Management Committee is chaired by the Minister of the Interior and is driven by Technical Sub-Committees, dealing with specific issues. These include: Fires and Lightning, Pest and Insect Infestation, Disease Epidemics, Hydrometeorological, Geological, Man-Made, Relief and Reconstruction and Nuclear & Radiological disasters (NADMO 2010: 26).

5.4.2.2 Key stakeholders of flood risk management from Accra Metropolitan Assembly (AMA)

There are a wide range of plans, interventions and policies to deal with Accra's flooding problem. At regional level, government institutions coordinate the policies and plans of the Metropolitan/Municipal and District Assemblies. The Metropolitan/Municipal and District Assemblies are the local government institutions in charge of local planning, legislations and development implementation. The Accra Metropolitan Assembly functions as a local government that is decentralized into sub-metros and is directly involved in Flood risk management. Some of the national stakeholders are also part of Flood risk management in the Accra Metropolitan Assembly. Table 8 presents the institutional stakeholders and actors involved in flood management in Accra. The functions towards flood management are also described in the table.

Table 8: Key flood management institutions in Accra and their roles (Adapted from Poku-Boansi et al. 2020; Agyenim & Gupta (2010))

Institution	Spatial Level of operation	Laws backing for establishment	Functions towards flood management
Accra Metropolitan Assembly (AMA)	Local government institutions in charge of Accra	Local Government Act 1993 (Act 462)	Coordinate the activities of all the relevant decentralized departments in flood responses and management
Land Use and Spatial Planning Authority	Decentralized department under the AMA in charge of physical development of Accra	Land Use and Spatial Planning Act, 2016 (Act 925)	Land use planning and regulation Support NADMO by providing havens for flood victims Public education in flood-prone communities
National Disaster Management Organization (NADMO)	National but have local offices at the municipal level	Established under the National Disaster Management Organisation Act, 1996 (Act 517)	Preparation of National Disaster Management Plan Evacuation and provision of relief items for affected flood victims.

			Collaboration with other institutions in the dredging of drains. Community flood warning received from GMET. Community education and awareness creation on flooding
Ghana Meteorological Agency	National level	Ghana Meteorological Agency Act, 2004 (Act 682)	Weather monitoring and forecasting. Building early-warning mechanisms and systems
Hydrological Services Department	National level and Metropolitan level	-	Monitoring and evaluation of surface water bodies with respect to floods. Construction and maintenance of storm drains countrywide
Water Resources Commission	National	Water Resources Commission Act, 1996 (Act 522)	Managing and monitoring river bodies and their catchments
Environmental Protection Agency	National but have local offices at the regional level	The Environmental Protection Agency. Act 1994 (Act 490)	Mapping of environmentally sensitive areas Prevent encroachment and development on wetlands
Department of Urban Roads	National but have local offices at the municipal level	Ghana Highway Authority Act, 1997 (Act 540)	Construction of storm drains in line with road construction Maintenance of storm drains
Centre for Remote Sensing and Geographic Information Services	National and local level	-	Mapping of flood-prone areas for public institutions and researchers
Ghana Health Service	National but have local offices at the municipal level	Ghana Health Service Act, 1996 (Act 525)	Counselling and rehabilitation of flood victims
Red Cross Society	National level	Ghana Red Cross Act 10, 1958	Provision of emergency response to injured and affected victims

The Accra Metropolitan Assembly has administrative powers to prepare and implement Flood risk management plans. The mayor of Accra, who is the Chief Executive Officer of the AMA, chairs the Metropolitan Disaster Management Committee (MDMP AMA 2010). NADMO at metropolitan level collaborates with other institutions at national and community levels. NAMDO collaborates with institutions like the Ghana Meteorological Agency, Environmental Protection Agency, Ghana Health Service, Hydrological Services Department, the Red Cross Society and other religious and non-governmental organisations operating within the affected communities and neighbourhoods. The Ghana Meteorological Agency and the Environmental Protection Agency have advisory roles at metropolitan level. They provide technical and logistical support to the AMA, NADMO and other institutions. The Ghana Health Service provides evacuation and victims support services to affected flood victims (Poku-Boansi et al. 2020). All the key flood risk management institutions in Table 8 are actively involved in flood risk management in Accra.

5.4.3 Challenges of Flood Risk Management

The policies and plans formulated have not been able to achieve the best results of managing flood risks. For years, the focus of flood risk management in Accra has been more on a reactive approach than a proactive one. Flood risk management practices like demolition of affected buildings and forced eviction of flood victims are common practices in Accra (Almoradie et al. 2020). The government regulates flood risk management in Accra but is reluctant to invest in preventive measures of flooding and rather waits for a disaster to occur before taking action (Amoako, Cobbinah, & Mensah Darkwah, 2019).

An EPA official interviewed supported this claim by stating that most flood victims are also in favour of reactive measures rather than preventive measures. To them, preventive measures are expensive and a waste of time and resources because citizens of Accra lack discipline. The EPA official laid the blame on indiscipline on the part of community leaders and households who ignore building and zoning regulations and dump refuse into open drains, lagoons and in their neighbourhoods. Meanwhile the authorities fail to act even though there are bye-laws and regulations. The official also stated the somewhat negative role the city authorities had in the reduction of flood vulnerability in Accra. She admitted that fraudulent practices have taken place over the years. Profit is being made by some officials during the frequent reactive measures.

She was quoted saying: "*We all know that there is more money in maintenance than preventive measures. It is big business for some government officials. I hope this ends one day.*"

However, in many countries there is more money for construction than for maintenance, which leads to most infrastructures for flood protection being neglected and not to function properly. The official's claims support revelations made by (Amoako 2016) concerning the two main strategies of state institutions in Accra's floods. The officials are mostly indulged in creating avenues for people in informal urbanization. They involve themselves in the politics of land

management in flood-prone zones mostly for personal gain. Secondly, it was stated that they turn a blind eye to informal growth in flood-prone areas.

Moreover, there is either a weak coordination and/or lack of coordination between agencies and institutions in planning for and managing flood risks. For instance, NADMO's technical committees only meet after a disaster has occurred (Almoradie et al. 2020). This is totally incompatible with a resilient city but a normal happening in Accra.

On the issue of weak coordination among institutions, the AMA official stated that *"Several agencies and institutions at different ministries struggle to co-operate with one another in tackling flood disasters. This is because there are so many conflicting roles and job descriptions. New agencies are created every single day but some have become white elephants because they do not know their specific roles and just waste the nation's resources. Some agencies are also unnecessary as most roles and functions overlap or are duplicated. This has also resulted in miscommunication between the AMA, NADMO and other institutions at all levels."*

Poor record keeping and not maintaining a database on population characteristics and climate variability records of affected communities is a huge challenge in responding to flood risks. Some incidents are not reported. The lack of good record keeping has also contributed to the lack of planning in Accra. Even though there is a National Water Policy, there is a lack of a legal flood risk plan or framework at all levels of government. Institutions like NADMO are unable to give precise flood responses due to inadequate record keeping and archives (Poku-Boansi et al. 2020)

Another hindrance to Accra's management of floods is the issue of corruption, bureaucracy and political interference from citizens and government officials in the operation of AMA and NADMO. This affects and slows down the collaboration between institutions during flood responses as the process needs to go through several rounds. (Cobbinah P. B et al, 2015, Acheampong 2019). An infringement by a citizen, for example informal settlements or by building in floodplains, getting permits through dubious means or polluting water bodies, usually go unpunished. They usually need to pay bribes to officials to cover up their unlawful acts.

During an interview with an AMA official, he admitted that political considerations have played a huge role in the choice and implementation of flood responses. Flood-prone areas like Kwame Nkrumah Circle, Agbogbloshie and Old Fadama have resisted demolition attempts by city authorities by threatening successive governments in power with their votes during elections. The government therefore kowtows to the inhabitants as the neighbourhoods have become politically sensitive areas in terms of their voting patterns. The inhabitants do not avail themselves of education on the dangers of their current livelihood which could result in fatalities.

This is illustrated in a quote from an official:

"I just do what I am asked to do by my bosses, but in my opinion the Old Fadama and Agbogbloshie slums have handcuffed the incumbent government leading to their indecisiveness. Every vote counts and the slum community know they have the power. We need to put Ghana first and our political ambitions second. The right thing must be done before it is too late."

6 Cross-comparative Analysis in terms of the analytical framework

The flooding issues in the five suburbs within Accra are studied. To obtain an overview, the findings from each suburb are cross-compared using the elements from the analytical framework in Section 3.9. These are the 5R's and the two types of multi-level governance for flood management.

6.1 Comparing flood resilience per suburb

Using the five elements of Batica et al. (2013), flood resilience per suburb is cross-compared in Table 9 below.

Table 9: Cross-comparison of flood resilience per suburb

Suburbs in Accra	Alajo	Agbogbloshie	Old Fadama	Weija	Adabraka
Relief	Desilting and cleaning the Odaw River and the Onyasia River. Kiosks are built along roads (No proper structural relief)	Channel widening and deepening, adding chemicals to the cement and concrete. No fit for purpose houses are constructed	Re-directing the flow of the Korle Lagoon and river. No gutters are constructed	Construction and concrete lining along the banks of the Densu River. No long-term structural solutions	Raising the foundation, walls and entry points of buildings and houses. Do not take land use plan into consideration
Resist	Engagements with city authorities for the provision of relevant infrastructure and support.	Clearing silt materials from storm drains.	Putting sand bags and/or bamboo pegs in the expected pathways of the stormwater runoff.	Filling muddy and swampy areas with gravels and stones.	Engagements with authorities for the provision of infrastructure and support.

	No warning systems.	No flood warning systems.	No evacuation program.	No proper evacuation program.	No evacuation program.
Response	Reconstruction of destroyed infrastructure such as roads and pipelines. Distribution of relief items and rehabilitation of victims with the help of NADMO	Evacuation of affected households and victims and their valuable items. Engaging NADMO and AMA for the distribution of relief items	Organizing spraying exercises to reduce the spread of infectious diseases. Distribution of relief items by the Ghana Red Cross Society	Creating temporary channels for flood water to flow out. Engaging city authorities and other stakeholders on the provision of flood reduction infrastructure	Channelling flood/storm water from affected homes. The church or mission houses as a source of refuge and safety
Recovery	Re-building collapsed sections of infrastructures. No land use controls on flood-prone sites	Re-building collapsed sections of buildings. No fit for purpose houses are re-built.	Communal cleaning of inappropriate disposal of solid waste. No long-term structural solutions	Relocation to neighbouring suburbs like Gbawe and Mallam. No long-term evacuation plan.	Collaboration with the media to get the story of flooding across for support at all levels. No fit for purpose houses are re-built.
Reflect	Community education and campaigns by the Assemblyman and officials of NGOs. No learning curve	Community education and campaigns about outbreak of diseases and prevention. There is no learning curve	Engagement between Slum Union of Ghana and relevant stakeholders on reducing flood risks and vulnerability. There is no learning curve	Engagement with NGOs and other stakeholders to educate the public on the dangers of building in floodplains. There is no learning curve	Community education and campaigns on the dangers of flooding. There is no learning curve

The following findings are obtained from the cross-analysis:

- Relief in this case is what is structurally done in terms of exposure and susceptibility. It should not be confused with emergency response. All the five suburbs have a high degree of exposure to floods due to their location. In terms of susceptibility, the five suburbs have different means of becoming susceptible. There are no structural relief solutions in coping with flood hazards. Most solutions are ad hoc and temporary and there is a lack of provision of infrastructure.

- Non-structural resist elements are present in Alajo and Adabraka while structural resist elements are present in the more vulnerable suburbs like Weija, Old Fadama and Agbogbloshie. More structural mitigation measures are needed in the latter communities. However the measures taken mostly limit flood damage rather than curb it.

- All the five suburbs initiate intangible and tangible emergency response actions. Tangible actions include channelling storm water from affected homes in Adabraka while intangible actions include evacuation practices in Agbogbloshie. The response is not long term.

- Structural initiatives are taken across all but one of the suburbs to recover from flooding events. Relocation and evacuation by inhabitants of Weija to neighbouring suburbs is common due to the extent of damage of infrastructures in Weija after flooding. There is a lot of collaboration with the media houses in Adabraka to create awareness and get the story of flooding and its seriousness to the public for support at all levels. Recovery is left to the community unless there is potential threat to life.

- Community education and campaigns on the dangers of flooding are done in the five suburbs by reflecting on flooding events. The reflect element has not led to structural change of infrastructures in the communities as a result of a lot of talk but no action.

6.2 Comparing multi-level governance per suburb

Using the two types of multi-level governance defined by Hooghe and Marks (2003), multi-level governance per suburb is cross-compared in Table 10. The connection between institutions, the availability of resources, infrastructural issues, regulatory issues and the flexibility for response to flooding are the criteria used to analyze the components of multi-level governance per suburb.

Table 10: Cross-comparison of multi-level governance per suburb

Suburbs in Accra (criteria)	Alajo	Agbogbloshie	Old Fadama	Weija	Adabraka
Coordination between institutions	Disconnect between administrative structure and NADMO	No clear authority structure within community exacerbates dealing with flooding.	Lack of coordination and little learning between inhabitants and NADMO	Traditional community interacts with traditional leader	No clear authority structure within the community
Availability of resources	NADMO lack resources	NADMO lack resources	NADMO lack resources	NADMO lack resources	NADMO lack resources
Infrastructural issues	No structural relief	No structural relief	No structural relief	No structural relief	No structural relief
Regulatory issues	Infringe laws and regulations	Infringe laws and regulations with the help of some officials	Infringe laws and regulations	Infringe laws and regulations	Infringe laws and regulations
Adaptability and Flexibility	Flexibility and room for response to local flood risk situation	Little flexibility for flood response	Little flexibility for flood response	Little flexibility for flood response	Institutional learning present

The following findings are obtained from the cross-analysis:

- For Type I multi-level governance, which refers to the delegation of hierarchical and sectoral authority, the administrative authorities are not managing to keep people out of exposed areas. They are failing to deliver effective and expensive infrastructure. There is a lot of lip service by the government and administrative authorities to flood risk management in Accra, but no action is taken.

- For Type II multi-level governance, which refers to network governance and the delegation of authority along functional lines, the flood risk management functional authority NADMO has been formed. However, NADMO lacks critical resources to tackle and respond to flooding. Moreover, there is little or no co-operation with the community and there is no alternative to tackle and cope with floods. There is miscommunication and no appropriate coordination mechanism between Type I and Type II multi-level governance due to different views and interests. There are trust issues in suburbs like Agbogbloshie, Old Fadama and the other suburbs.

- The GOIL Petrol filling stations in Adabraka was built in a residential area which violated the Land Use Plan. All the communities and suburbs bend the rules.

- There is much flexibility and room for response to local flood risk situation. Knowledge generation about flood risks and their management in Accra is shared and encouraged. This is typical of Type II multi-level governance. The National Water Policy needs to integrate more flexibility in the learning process.

Despite the differences in character between the different neighbourhoods, the flood risk management issues are very similar. That would suggest the findings can be generalized to the whole of Accra and perhaps even, to some extent, to other parts of Ghana.

6.3 Resilience in each suburb and in Accra as a whole

Resilience in each suburb is the outcome of flood resilience and multi-level governance in combination. The cross-comparison highlighted the following findings in relation to resilience:

- There is systematic exposure because Type I authorities are failing. The provision of structural solutions, such as effective infrastructure, are Type I responsibilities. However, the body accorded responsibility for flood risk management is Type II, a functional, network governance solution, that is leading to incompatibility and ineffectiveness in solutions.

- Type II multi-level governance works for the Relief element where the activities fall within the capability of NADMO. However, NADMO lacks critical resources for sophisticated responses and is unable to fulfill infrastructural and structural relief requirements.

- All the five suburbs do emergency response even though there is a mishap in coordination and communication across levels.

6.4 Discussion

The research was designed to obtain data that can be comprehensive to describe and find wayds in which Flood Risk Management can be organized to make Accra more resilient. The research started by identifying the need for a transition from a reactive response approach to a resilient Flood risk management approach in Accra. In addition to resilience, the research approach also helped to describe anticipation in Flood risk management approaches for responding to expected features of flood risks. It was further identified that multi-level governance could help in achieving resilient flood risk management. However, even though Accra has features of multi-level governance, the 2015 Accra floods and its impacts on the lives and properties of people highlighted the importance of dealing with the complexity of Flood risk management in Accra.

The study first identified the Flood risk management practices in Accra and then linked them to the issues pertaining to multi-level governance in Flood risk management. Multilevel governance is a useful analytical lens that examines the types of interactions, both formal and informal, amongst different actors (Hooghe and Marks, 2003). It gives a better understanding on the existing governance issues.

6.4.1 Limitations

This study provides practical, analytical and conceptual relevance for organizing Flood risk management. However, the study has limitations that cannot be ignored. The research design and objectives of the study were limited within a period of time due to limited resources and the COVID-19 pandemic. It was initially planned to have at least 16 interviews conducted instead of the five interviews that were later conducted.

The research design was limited to the Accra Metropolitan Area. Thus, the findings can have limited generalisability to Flood Risk Management in other cities. The results from the five neighbourhoods studied are similar, which gives some confidence as to their generalisability. However, analyzing even more neighbourhoods within the city might be more practical for generalization. This was not possible due to time constraints.

For the analytical framework, the initial intention was to quantify the findings. During the research, it became clear that the analytical framework shown in Chapter 4.9 was a qualitative model, which is how it was implemented in this study. The available data was not adequate to make it a quantitative analysis and therefore the analytical framework was used qualitatively.

6.4.2 Validation

Among the key findings of this study worth discussing is the analytical framework for resilience in Flood risk management. The framework was formulated from a review of literature on concepts and application of resilience in flood risk management. The five elements of Batica et al. (2013) and the two types of multi-level governance defined by Hooghe and Marks (2003) were employed to analyze and suggest improvements to the current approach to flood risk management in Accra. The results of the findings from the interviews conducted validated initial

thoughts of malpractices by officials and citizens. The use of interviews as the main primary data collection tool offered additional opportunity to increase access to relevant data for this study.

The validation of the analytical framework was performed by comparing the framework with the real-life situation in Accra. The institutions and stakeholders identified have been used to determine the kind of interactions and response at three levels of governance in the five neighbourhoods. The framework uses qualitative data from the real-life situation for events that occur and the choices and responses that are made. This to a large extent validates how realistic the framework is as it can be used to describe the real-life situation in Accra. However, there is no room for pluralism and traditional leadership in the framework.

6.4.3 Reflection on Analytical framework

The integration of flood risk management into governance across levels is considered critical to long term flood resilience. Regarding the multi-level governance context in Accra, the Type I multi-level governance is dominant. There is an overdependency on central authorities and leadership for decisions and allocations. National stakeholders and agencies contribute directly to flood risk management and infrastructural development in protecting formal and informal settlements. The Greater Accra Regional Minister and Mayor of Accra engage with Assemblymen and traditional leaders. The limited number of levels and the smaller size organisational structure at local level facilitates closer interactions between public officials and locals. This ensures citizen participation in flood risk management.

For Type II multi-level governance, a lack of financial support and the untimely release of funds and other resources within NADMO proves to be a critical barrier to their capacities to provide services and enable coordinated flood risk management. While NADMO operates under financial constraints, there is a concern that regional authorities delegate too many tasks and responsibilities to NADMO without being fully involved in the preparedness and response decision-making process of flooding.

Resilience in each suburb is the outcome of flood resilience and multi-level governance which are combined in the analytical framework. The findings from the framework resulted in formulating the conclusions and recommendations. Other frameworks for Flood Risk Management are possible but do not have a combination of the two aspects of flood resilience and multi-level governance. This framework could be more useful in making Accra more resilient There is a need for local level resilience framework using these international disaster resilience principles. There is a systematic problem because Type I and Type II multi-level governance have not been exploited to their full potential due to their complexity, wrong use and overlapping functions. This has led to delays, inefficiency and corruption. This framework for resilience disaster management would require a commitment from the city authorities for its implementation.

7 Conclusions and Recommendations

As presented in Chapter 1, this study aims to find ways in which Flood Risk Management could be organized to make Accra more resilient. To achieve this, a case study of Accra was conducted in Chapter 5. This involved a cross-case analysis of five neighbourhoods in Accra, supported by a literature review, interviews and the development of the analytical framework. The conclusions derived from the analysis and discussion are presented in Chapter 7.1

7.1 Conclusions

While Chapter 6.4 discusses the findings, the conclusions will lead to the answer to the main research question of this study. These conclusions will form the basis for the recommendations for the improvements envisaged in the main research question.

The study began with the main research question:

How can flood risk management be organized to increase flood resilience in Accra?

The main research question was split into four sub-research questions. Conclusions based on the answers of the research questions are stated below.

7.1.1 Research Question 1: What is resilience in the field of flood risk management and to what extent is it significant in the urban environment?

Resilience is the ability of a system to recover from a disturbance through response and recovery measures. The analytical framework explains the relation between resilience and flood risk management. Flood resilience combines spatial, structural, social, and risk management levels of flood preparedness and anticipation in the urban environment. Resilience helps to determine the levels of vulnerability, exposure and susceptibility of an urban environment to flooding. In Accra, five elements of flood risk management - Relief, Resist, Response, Recovery and Reflect measures - are employed to accept, resist, recover and learn from past and present flood events.

7.1.2 Research Question 2: What factors have shaped Accra's responses to flood events and what are the current socio-cultural and economic factors hindering flood resilience?

Social, political, environmental, cultural and economic factors have led to Accra's response to floods. These factors include rainfall patterns, urbanization trends and population growth, rural-to-urban migration and the topography of Accra. This growing population has led to pressure on the infrastructures and responding to floods. Houses are being built in floodplains which makes responding to floods a huge task. The government is made aware by citizens that they exercise their power during general elections and therefore response measures taken should be in their favour. Inadequate drainage, poor waste management, poor planning and maintenance of infrastructures hinder flood resilience.

7.1.3 Research Question 3: What are the actual effects of current flood management practices and what are current strategies for building flood resilience in Accra?

Flood risk management in Accra is done at national, regional, metropolitan, municipal, district and sub-metropolitan levels as well as non-governmental agencies and organizations. Reactive measures to flood risk management are more common than preventive measures due to ad hoc engineering solutions and the administrative authorities not prioritizing to solve the problem financially. Reactive measures taken include destruction and demolition of affected structures and buildings, flood pathways and eviction of affected victims of flooding. NADMO lacks critical resources to tackle and respond to flooding. There is lack of coordination between agencies and institutions in planning for and managing flood risks. Roles and responsibilities overlap resulting in poor coordination.

7.1.4 Research Question 4: What institutional arrangements and aspect of flood resilience can be strengthened in solving the flooding and waste management problem in a developing city like Accra?

The five elements of Batica et al. (2013)'s flood risk management cycle and the two types of multi-level governance defined by Hooghe and Marks (2003) are employed to improve the current approach to flood risk management in Accra. The five elements include Relief, Resist, Response, Recovery and Reflect. The two types of multi-level governance are Type I and Type II multi-level governance.

Turning to the overall research question, structural relief solutions need to be strengthened and financed to better cope with flood hazards. More structural mitigation measures are needed and the emphasis has to be on preventive measures rather than reactive measures. Community education and campaigns on the dangers of flooding should lead to structural changes. There is systematic exposure to floods in Accra because general-purpose authorities are ineffective. For Type I multi-level governance, the administrative authorities are not managing to keep citizens out of exposed areas. They are failing to deliver effective structural solutions. However, the body accorded responsibility for flood risk management is Type II, a functional, special-purpose, network governance solution. Type II multi-level governance works for the Relief element where the activities fall within the capability of NADMO. However, NADMO lacks critical resources for sophisticated responses and is unable to fulfill infrastructural and structural relief requirements.

A new paradigm of integrated flood risk management which actively involves traditional authorities in enacting policies is crucial to creating the foundation for effective multilevel governance integration in Ghana. Flood risk management should be embraced at local level and the appropriate institutions setup in order to exploit the benefits of the void that has existed between administrative regions and the national level, between neighbouring regions, districts and among local authorities within the same region. Traditional authorities have power and their active involvement in flood risk management will help to reduce flooding in Accra.

In conclusion, the analysis of the structure of governance and interaction among stakeholders in flood risk management shows that it is not just the formal function of an organization that matters, but rather how this function operates, and how organizations and agencies use the opportunities available to them to organize flood risk management. The success of flood risk management in Accra relies upon how the involved actors collaborate to achieve common goals. Moreover, the enforcement and implementation of laws is critical. Thus, flood risk management can be organized in Accra by including all the stakeholders to ensure proper coordination between functions at district and local levels because the problem is happening in these units in a cross-border fashion.

7.2 Recommendations

The following recommendations are made from the findings in Chapter 7.1 to make Accra more resilient to floods.

- Traditional leadership plays a limited role in enacting planning flood risk management in Accra even though they have the power to punish offenders within their communities. Coordination with flood-prone communities and local traditional authorities in the formulation and implementation of Flood risk management strategies would be useful for enforcement of land-use regulations and building codes for reduction of flood risk. Involving local traditional leaders more in flood risk management helps in the integration of the local communities into Flood risk management to prevent selling flood-prone lands to developers. Traditional leaders have blocking power and their involvement can reduce resistance to relocation and eviction of developments in flood-prone areas. For instance, president of the Ga traditional council of chiefs needs to have a representation in the Accra Metropolitan Disaster Management Committee to help in the integration of the local communities into flood risk management.

- Since the traditional beliefs and practices have slowly faded away and skewed towards Christianity, activating influential leaders could help bridge the gap between flood risks and managing floods. Stewardship could be used to make flood risk management effective, as it is the belief that humans are God's trustees and, as such, they are not only responsible for the care of the earth, but they are also accountable for the way they execute their roles as stewards. Religious leaders and pastors can educate their church members on practices and policies to prevent flooding. Culprits will be held accountable to God and posterity.

- Coordination dilemmas can be dealt with by assigning Functional Ministries responsibility of their sectors. They have to be held accountable for their actions and inactions. This in a way limits the number of autonomous actors.

- Accra is depleted of open spaces, which are most needed to erect temporal refuge and meeting points and other structures as shelters in times of flooding. Open spaces in Agbogbloshie and Old Fadama could be converted into markets and taxi ranks to keep people away and prevent them from settling there and acquiring lands illegally. This can be done in consultation with the lowest level of society like the taxi drivers and stall-owners. Open spaces like playgrounds, recreational parks and football pitches could also be developed. The government and local authorities need to collaborate with locals and interested parties in creating and keeping open spaces. This reduces the likelihood of the development of slums and informal settlements. If open spaces are not assigned a specific use, with stakeholders with an interest in it, they will remain open.

- City authorities and some members of the public need to change their attitude towards waste management and disposal. The authorities fail to act even when inhabitants of Accra pour waste into gutters, drains and backyards even though there are bye-laws and regulations.

- There is a need for effective implementation of Flood Risk Management measures through enforcement of land-use regulations and maintenance of drains. Empirical findings of this study revealed that spatial land-use plans and regulations in the city of Accra are flouted. Consequently, there is encroachment on waterways, flood-prone areas and on shoulders of drains causing floods. More involvement of traditional leaders could be useful in enforcing these land-use regulations. Plans for the enforcement of land-use plans and regulations could minimize encroachment on waterways to reduce flood risk. There is a need to operationalize resilience in Flood Risk Management plans in the city of Accra.

- The city of Accra has an infrastructural problem including inadequate road networks. This leads to traffic jams and delays in rapid response to flood scenes. It is recommended that establishment or designation of emergency response lanes in the road network could be helpful for timely response of flood disasters. More investment should be made in construction and structural relief solutions rather than investing in and making profit from maintenance.

- There is the need to guarantee and ensure public participation from the lower levels to strengthen and help the leadership at the district and local levels as these levels are the bane of the flooding challenge.

- Other neighbourhoods not mentioned in the thesis also need critical attention. For instance, Kaneshie, Odorkor and Kwashieman experience pluvial flooding whenever there is a rain event. The Kaneshie market, which is one of the biggest markets in Accra, can lead to loss of lives and valuables during such events.

7.3 Demand for future research

The lack of a common meaning of resilience and its application in science is a challenge for resilience in Flood Risk Management but it is also an opportunity to gain lessons from this study. Future research on resilience in flood risk management can consider a study with multiple case study sites to allow for a larger sample size and diverse research participants for in-depth understanding. The structure of the organizations is important, but the framework can include politics and cultural issues to tackle flooding. It is also recommended to have more interviews for a broader understanding and perspective of resilience in flood risk management. Testing the analytical framework of resilience in flood risk management in other cities could provide an opportunity to confirm its general application. Having more interviews could give better results after testing the analytical framework.

7.4 General concluding remarks

Accra as a city has the laws, policies and regulations for dealing with floods. However, there is the need for effective implementation of flood risk management measures through enforcement of land-use regulations and punishment of offenders. Sometimes it takes a natural disaster to reveal a social disaster.

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APPENDIX A: Interview Guide

Responses from the interview will help identify, evaluate, resolve and organize flood risk management issues in Accra.

A. NADMO official

1. What are your functions and duties at NADMO?
2. How does the organizational structure of NADMO look like?
3. How does NADMO keep track of the unexpected course of flood risks in Accra?
4. What type(s) of flooding have you tried to manage?
5. What was the extent and duration of flooding?
6. What does Flood risk management (FRM) mean to your organization?
7. Is your organization aware of resilience in FRM?
8. What flood response strategies are being used at NADMO?
9. What resources do you think NADMO has for managing flood risks in Accra?
10. Are these resources and equipment adequate to respond to floods and evacuation?
11. Can you recall specific dates of major flood events in Accra?
12. What, in your opinion, are the causes of Accra's floods?
13. What do you think is necessary to be done to reduce future impacts of floods? Is it the responsibility of the government or the residents of Accra as well?

B. AMA official

1. What are your functions at AMA?
2. Which flooding regulations are effective?
3. How do you respond to and prepare for floods?
4. In your experience so far, what type(s) of floods have you tried to manage in Accra?
5. What are the causes of flooding in Accra? What types of events led to these floods?
6. What is necessary to be done to reduce future impacts of floods?
7. What are the obstacles that your organization experiences in Flood risk management?
8. Through what means does AMA ensure that public is involved in FRM in Accra?
9. How is FRM in Accra coordinated between AMA and other organizations?
10. What lessons have your organization and other organizations learned from its performance in responding to previous flood events in the city of Accra?

C. EPA official

1. What is your job description at EPA?
2. Which flooding regulations are effective?
3. How do you respond to and prepare for floods?
4. In your experience so far, what type(s) of floods have you tried to manage in Accra?
5. What are the causes of flooding in Accra? What types of events led to these floods?
6. What is necessary to be done to reduce future impacts of floods?

7. What are the obstacles that your organization experiences in Flood risk management?
8. How do you deal with encroachment in wetlands?

D. Traditional leader

1. How do you exercise your power in Flood Risk Management?
2. What is your official role in Flood Risk Management in Accra?
3. How do you mobilize the community to embark on activities to prevent flooding?
4. What punishments and fines are meted out to offenders of the law?
5. How much are you involved in Flood Risk Management?
6. Do you have additional issues of FRM in Accra that you want to highlight for purposes of this research?

E. Flood victim

1. What is the size of your household?
2. What type(s) of flooding have you experienced?
3. Can you recall specific dates of major flood events in Accra?
4. What were the causes of the flooding?
5. Where did the flooding originate from? Are there any adjacent land features such as wetlands, lakes, ponds, roadway or adjacent properties which may have contributed to your flooding?
6. Did your neighbours experience flooding?
7. How did you respond to flooding events?
8. What do you think could be done to reduce future vulnerability and exposure to floods?