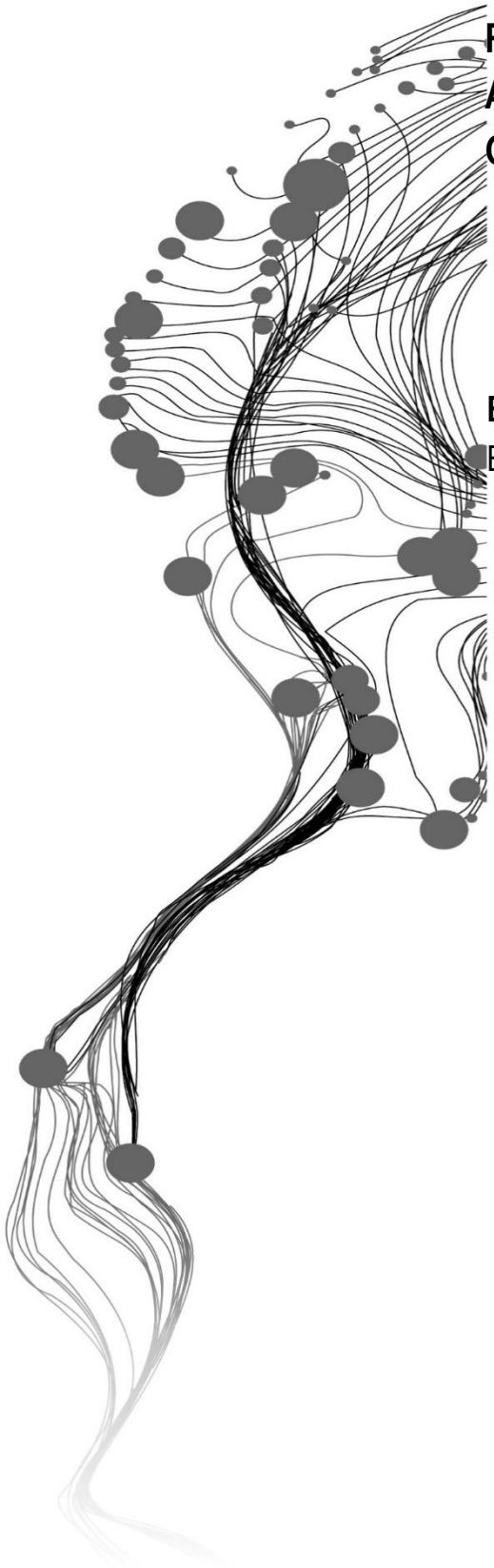
REGULATORY MAINSTREAMING CLIMATE CHANGE ADAPTATION INTO URBAN PLANNING IN THE GLOBAL SOUTH. A CASE OF KIGALI CITY.

EMMANUEL MWENJE

February 2019

SUPERVISORS:
Dr. Diana Reckien
Dr. Johannes Flacke



REGULATORY MAINSTREAMING CLIMATE CHANGE ADAPTATION INTO URBAN PLANNING IN THE GLOBAL SOUTH. A CASE OF KIGALI CITY.

EMMANUEL MWENJE

Enschede, The Netherlands, February 2019

Thesis submitted to the Faculty of Geo-Information Science and Earth Observation of the University of Twente in partial fulfilment of the requirements for the degree of Master of Science in Geo-information Science and Earth Observation.

Specialization: Urban Planning and Management

SUPERVISORS:

Dr. Diana Reckien

Dr. Johannes Flacke

THESIS ASSESSMENT BOARD:

Prof. Dr. P.Y. GEORGIADOU (Chairperson)

Dr. G. OZEROL (External Examiner, University of Twente)

Dr Diana Reckien (1st Supervisor)

Dr Johannes Flacke (2nd Supervisor)

ABSTRACT

Mainstreaming climate change adaptation into urban planning has been necessitated by the realities of climate change impacts in the Global South. Conventional urban planning that mostly focuses on urban housing, economy, environment, and infrastructure, has always hindered Global South cities from addressing the emerging and uncertain dynamics of climate change. Thus, a paradigm shift towards mainstreaming adaptation is inevitable so that urban planning can holistically address climate change. This calls for the reformation of regulatory frameworks to incorporate, in this case, flood risks (vulnerability, exposure, flood hazards intensity, and adaptive capacity) in the planning process. The results of mainstreaming may include potential reduction in policy redundancy, capacity needs (funds and experts), conflicts of interest and possibly promote effectiveness and coherence of risk-informed planning and implementation.

This study aimed at determining the efficacy of regulatory mainstreaming of flood risk adaptation into urban planning, and the contextual challenges to the same in Kigali city. A mixed method was used for data collection and analysis for credible results. Both secondary and primary data were acquired through literature and regulatory document reviews, and in-depth key informant interviews respectively. Data analysis was conducted using the thematic content analysis, 3As framework, Logframe evaluation and a Regulatory mainstreaming framework. The data analysis tools employed included ATLAS.ti 8, SPSS and Excel (descriptive statistics). Innovatively, the effectiveness of regulatory mainstreaming was determined through frequency standardization approach. The results were presented both qualitatively and quantitatively.

The results of this study brought to light critical insights about regulatory mainstreaming flood risk adaptation in Kigali. Firstly, there is an overall influence of top-down approach to planning and adaptation with the limitations of national frameworks to address climate change explicitly being reflected in all the lower level planning jurisdictions including Kigali city. Secondly, the planning process wasn't fit enough to integrate flood risks. Form the analysis, no component of the 3As had a score of above 50%. Of the 3As, the Action criteria scored about 42.92%, followed by Analysis at 28.98% and lastly Awareness at 23.43%. Thirdly, adaptation strategies in Kigali were found to be mostly dedicated and disintegrated for they were proposed by various programs and institutions at the national level. This brought about the challenges of conflicts of interest, lack of accountability and responsibility, and poor coherence. Moreover, the only spatially-oriented adaptation project, "Nyabugogo Transit hub and Market development project" wasn't explicit enough to elicit the expected outcomes. From the Logframe indicators evaluated, there was almost an equal distribution of the missing, implicitly and explicitly addressed indicators, leaving room for action in future. This challenge was brought about by limited cognitive ability by both the experts and the EIA guidelines to address CCA.

The effectiveness of Regulatory Mainstreaming in explicitly addressing flood risk adaptation was found wanting. On a scale of 0-1, the agenda setting dimension managed an effectiveness score of 0.75, context analysis had an explicit score of 0.16, risk-informed planning 0.53, and finally implementation, M &E had 0.25. This indicates how ineffective regulatory mainstreaming was in Kigali. Last but not least, factors limiting regulatory mainstreaming in Kigali were found to include political challenges such as directed adaptation programs that are not in line with city priorities, capacity challenges of funding and experts, cognitive limitations of accurate, relevant data and risk planning methods, and problem framing concerns where floods have never been defined as a derivative of climate change impacts.

To conclude, future research can be focused on the other facets of mainstreaming like managerial, directed and programmatic. This study made recommendations cutting across the need to improve capacity, coordination and use scientific climate data in urban planning. The most critical recommendation to the way forward is the need to adapt and operationalize an effective urban planning Regulatory Flood Risk Mainstreaming Framework that includes climatological risks, adaptive capacity and resilience assessments.

Key words: Mainstreaming, Regulatory Mainstreaming, Climate change Adaptation, Flood risks, Risk-informed Planning, urban Planning.

ACKNOWLEDGEMENTS

To GOD be the glory. He has consistently and unwaveringly been by my side even during moments I least felt qualified to warrant His mercies and Grace.

My family, especially Rebecca and Jackline, your silent and distant prayers kept me hopeful. May God bless you.

My field work would not have sailed through without the aid of these selfless Rwandese: Mr Mugisha, Mr Mafinyika, Ms Mupende, Mr Gasore, Mr Vital, Mr Fidelle and Mr Musonera. Thank you all.

Special thanks to Dr Mbathi Musyimi. Your mentorship , encouragement and faith in me has been impressive. You pushed me even when I was literally resigning. I am truly indebted to you.

I am grateful to the University of Twente, Faculty of ITC for the admission to the course and academic guidance which has enabled my dream to further my education in Geo-Information Science and Earth Observation.

I wouldn't have managed to follow through this rigorous thesis process without the professional and apt guidance of my supervisors. Indeed, Dr Reckien and Dr Flacke will resonate in my mind for years to come for the role they played in shaping my academic and research ability. Thank you.

My fellow students and friends. It was a lifelong memory that I will cherish years to come. I appreciate you all in every context we interacted, both academically or otherwise. Dr Kumar and Dr Kibuye, thank you.

Finally, the Netherlands Fellowship program for granting me surprising double opportunities to study in the Netherlands. May God bless those responsible for the fellowship's existence so they may impact on others in future.

TABLE OF CONTENTS

LIST OF ANNEXES

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS AND GLOSSARY

Abbreviations

ABBREVIATION	Details
AU	African Union
CCA	Climate Change Adaptation
DDP	District Development Plans
EMI	Earthquakes and Megacities Initiative
GGGI	Global Green Growth Institute
GGCRS	Green Growth and Climate Resilience Strategy
GoK	Government of Kenya
GoR	Government of Rwanda
IPCC	Intercontinental Panel for Climate Change
KCMP	Kigali City Master Plan
NFP	Netherlands Fellowship Program
NLUDMP	
SPCR	Strategic Program for Climate Resilience
GGGI	Global Green Growth Institute
RBC	Rwanda Building Code
UNFCCC	United Nations Framework Convention on Climate Change
URT	United Republic of Tanzania
NLUDM	National Land Use and Development Master Plan
DLUP	District Land Use Plan
IDDP	Integrated District Development Plan
MININFRA	
OSM	Open Street Map

Glossary

Terminology	Definition	Sources
Adaptation	"The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects"	IPCC (2014, p.1758)
Adaptive capacity	"The ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences".	IPCC(2014, p. 1758)
Strategy	"A climate change adaptation strategy refers to a general plan of action for addressing the impacts of climate change, including climate variability and extremes. It may include a mix of policies and measures, selected to meet the overarching objective of reducing vulnerability".	Levina & Tirpak, (2006)
Regulatory framework	A general guide for the preparation or formulation of an urban plan. Also called planning process or methodology.	Albrechts, (2004) Schmidt-thome, (2017)
Risk	"The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur. Risk results from the interaction of vulnerability, exposure, and hazard. In this report, the term *risk* is used primarily to refer to the risks of climate-change impacts".	IPCC(2014, p. 1768)

1. INTRODUCTION

1.1 Background and Justification

Climate change is among the most complex 21st century challenges globally. Almost all cities are vulnerable or exposed in one way or another to climatic hazards, disasters, and risks (Bierbaum and Zoellick, 2009). Climate change impacts have been consistent in the recent decades. It is expected that climate impacts such as increased precipitation, flooding, cyclones, rising sea levels, storms and urban heat waves will be manifested. Resulting from such hazards are impacts such as food insecurity, unavailability of fresh water, loss of property and climate refugees with their associated humanitarian needs (Bierbaum and Zoellick, 2009; IPCC, 2014).

Climate change impacts can result into disasters especially when there is a combination of hazards, exposure, and vulnerability (IPCC, 2007; IPCC, 2014). This is particularly true for Global South where rapid urbanization has led to increased susceptibility to climatological hazards (Bierbaum and Zoellick, 2009). Vulnerabilities to hazards such as floods are mostly pre-existing in Global South cities as a result of factors like lack of regulatory frameworks that promote Risk-Informed urban planning. Also, due to inadequate supply of urban services like housing and existing poor infrastructure, marginalized city dwellers are more exposed to both natural and climatological hazardous conditions. To exemplify, poor housing sprawling in flood prone areas, mostly informal/slums, are very vulnerable to flooding and destruction. Moreover, climate change impacts are exacerbated because the affected urban marginalized happen to have little or no adaptive and coping capacities (Tobergte and Curtis, 2013).

Consequently, Global South cities have embarked on developing Climate Change Policies, plans and programs to aid minimize vulnerabilities and risks (Tobergte Curtis, 2013; African Union, 2014; Mburia, 2015; Filho, 2017). For instance, Ethiopia promotes water adaptation projects in response to the reducing precipitation; Luanda in Angola developed an ambitious eco-town that caters for green growth, flood management, urban agriculture for food security among other salient features (Filho, 2017). Furthermore, Malawi has an elaborate ecosystem management plan of the Shire river basin towards riverine flooding and natural resources management (Butterfield, 2018). These measures are an indication of the emerging awareness of the realities of climate impacts to the built environment and economic developments (Few, 2003; O' Brien, Leichenko, and Vogel, 2008; and Metternicht, 2017).

Besides the drive to address Climate Change Adaptation (CCA), Global South cities have been undertaking Urban planning to promote harmonious developments (GoK, 2014; Cantada, 2017; African Union, 2017). One key challenge is most of the urban adaptation plans, programs and projects are not in the built environment domain per se. This is a critical issue putting in mind that cities have the largest concentrations of vulnerable populations due to inadequate infrastructure and informal settlements. Indeed, very few cities in Africa like Cape town and Johannesburg have explicitly dedicated urban adaptation plans (Filho, 2017). As identified by Tobergte and Curtis, (2013), the current urban plans and planning frameworks do not factor-in climate change impacts explicitly. This has been identified to be due to lack of expertise, risk management frameworks, limited inclusion of relevant climate change actors in urban planning and financial limitations among others (Uittenbroek, 2016a). to demonstrate this limitations, on identifying key urban challenges like housing demand, the planning processes only address alternatives to providing adequate housing but do not conduct risk assessments relative to vulnerabilities and exposure to hazards. This calls for new approaches to urban planning that are inclusive of climate change risks to protect the social, environmental and economic gains made over time. However, very little knowledge exists on factors that may be limiting urban municipalities from mainstreaming climate change adaptation into urban planning (UNFCC, 2005; Uittenbroek, 2016; Araos et al., 2016).

To possibly mainstream climate change adaptation (CCA) into urban planning (UP), literature proposes mechanisms that promote regulatory frameworks for adaptation mainstreaming. Mainstreaming CCA can be defined as, "..incorporation of the challenges posed by climate change into the work of city authorities/municipalities by formulating effective responses to it, which—to become sustainable—then need to

be anchored in existing planning processes and frameworks, and policy across all sectors and levels" (Wamsler & Ing, 2007.p4) . Mainstreaming is informed by the fact that the current adaptation strategies have always been identified and structured as dedicated approaches (Klein et al., 2007), which implies that climate change adaptation has its own planning processes backed with additional relevant resources (financial and human), institutional, legal and regulatory frameworks (Moser & Ekstrom, 2010). Scholars allude that, for urban adaptation to be successful, it shouldn't be handled in seclusion but addressed in the wider urban contexts (Uittenbroek et al., 2013; Claudia, 2016). This requirement of integration is due to the fact that CCA operates within the urban systems and realities of demographic, social, infrastructural, technological orientations (Claudia, 2016). Thus, an integrated and collaborative approach across relevant urban planning and climate change actors and policy underpinnings is necessary (Butterfield, 2018; Uittenbroek, 2016b)

Despite mainstreaming being a new dimension in handling climate change realities, possible gains from the approach include enhanced inter-policy cohesion, efficiency, regulatory effectiveness and integration, joint budgeting, avoiding policy redundancy in terms of content and jurisdictions, and a chance to benefit from the synergies between urban and adaptation policy provisions (Uittenbroek et al., 2013; Runhaar, Wilk, Persson, Uittenbroek, & Wamsler, 2018). Even with the anticipated gains, some factors that may limit the effectiveness of climate change adaptation mainstreaming include but are not limited to political influence, institutional capacities, coordination and cognitive issues among others (Uittenbroek, 2016b; Runhaar et al. 2018).

Even though it's a promising move in urban systems, mainstreaming climate change adaptation into urban planning is not an easy process (Rahman, 2017). This is because it entails in-depth policy and planning reviews, capacity demands(funds and experts)„ and above all, a very engaging multi-agency process covering both the governmental and non-governmental sectors (Claudia, 2016; Uittenbroek, 2016a; Runhaar et al., 2018). Key to these demands is the determination and sharing of responsibilities, meeting urban land market and societal needs and above all, winning the political will (Rauken, Mydske, & Winsvold, 2015). Furthermore, different sectors of the urban system have varying perceptions and priorities which may contradict the urban planning and adaptation aspirations, and may pose the challenge of maladaptation (UNFCCC, 2017). Thus, there exist knowledge gaps about regulatory mainstreaming, in particular in Global South Cities**.** That said, no studies have been undertaken to unravel both the efficacy and what may be influencing adaptation mainstreaming in Kigali city (Rwanda)—the selected case study city. Unearthing the contextual factors influencing regulatory mainstreaming flood risk adaptation into urban planning in Kigali is the main topic of this thesis.

1.2 Problem Statement

The impacts of climate change have led Global South cities to develop stand-alone (dedicated) adaptation strategies and projects to help reduce vulnerability and risks (Lwasa, 2010; African Union, 2014; Filho, 2017; Butterfield, 2018b). However, Chang, Wilkinson, Potangaroa, & Seville (2010), claim spatial planning has a critical role in addressing climate change adaptation. According to Klein et al., (2007), risk sensitive planning and flood proofing guidelines (e.g. building codes), land use zoning that controls developments in vulnerable areas have a great potential of reducing exposure and vulnerability. These measures may be possible if cities would have prepared and fully implemented risk-informed spatial plans that include vulnerability and risk assessments. Studies suggest that CCA integration into urban planning may call for regulatory mainstreaming that entails: risk-oriented planning frameworks, adequate awareness and knowledge sharing, relations and coordination in planning processes, adequate capacity in terms of climate experts and budgetary allocations and spatially-oriented adaptation strategies (Wamsler, 2014; Rauken, Mydske, & Winsvold, 2015; Di Gregorio et al., 2017)

In the light of the prevailing flood risk challenges, the City of Kigali made attempts to respond by including flood considerations in its urban plans and development regulations. However, flooding has persistently affected the city in last couple of years with projections anticipating even more floods in future. To effectively mainstream flooding adaptation into urban planning, there is an urgent need to review urban planning frameworks, make budgetary allocations and enhanced collaboration in spatial planning (Runhaar et al., 2018). Moreover, there is a need for understanding the potential challenges facing the process of mainstreaming (Uittenbroek et al., 2013a). Currently, a knowledge gap exists about the effectiveness of urban planning to mainstream flood risks in Kigali. Besides, the actual challenges influencing the potential of mainstreaming flood risk adaptation in Kigali are not well known.

1.3 Research Objective

The main aim of the study was to determine the efficacy of regulatory mainstreaming flood risk adaptation into urban planning, and the main factors influencing this integration in Kigali city.

1.4 Specific Objectives

This research was guided by the following specific objectives

1. To assess the fitness of urban planning in integrating flood risk adaptation in Kigali city.
2. To analyze how flood risk concerns are translated into urban adaptation in Kigali city.
3. To identify the main factors influencing regulatory mainstreaming flood risk in Kigali city.

1.5 Research Questions

1. To assess the fitness of urban planning in integrating flood risk adaptation in Kigali city.
    i) What policies and urban plans influence development in Kigali city?
    ii) To what extent has urban planning integrated flood risk adaptation in Kigali city?
2. To analyze how flood risk concerns are translated into urban adaptation in Kigali city.
    i) What are the flood risk adaptation strategies in Kigali city?
    ii) How explicit have spatial adaptation projects integrated flood risk in Kigali city?
3. To identify the main factors influencing regulatory mainstreaming flood risk adaptation in Kigali city.
    i) How can the effectiveness of regulatory mainstreaming of flood risk adaptation be evaluated in the context of Kigali city?
    ii) What are the main drivers and barriers to the mainstreaming of flood risk adaptation into urban plans in Kigali city?

1.6 Study Scope

There are many facets of mainstreaming, such as organizational, programmatic, directed etc. This study was limited to the regulatory mainstreaming, and the challenges influencing the integration of flood risk adaptation into urban planning in Kigali city. On the same note, climate change impacts are diverse and manifest in many ways in Kigali e.g. droughts, heat waves, rising temperature and floods. This thesis was focused on flood risk adaptation which is the current urgent impact being addressed in Kigali. Besides looking at overall adaptation strategies, the thesis narrowed down on the only spatial adaptation strategy in Kigali, "Nyabugogo Transit Hub and Market Redevelopment project" which integrated flooding, urban planning and transport infrastructure.

1.7 Thesis Structure

This thesis report is organized as shown in table 1-1 below.

Table 1-1: Thesis Structure

Chapter	Details
Chapter 1	The chapter covered the introduction, background and justification, related literature, problem statement, research objectives and questions. Additionally, it contained the scope, study relevance and report organization.
Chapter 2	Discusses the main concepts, theoretical backing, regulatory mainstreaming operationalization and conceptual framework.
Chapter 3	A profile of the study areas, research design, methods and research tools
Chapter 4	It detailed out all the results of the research according to the research questions
Chapter 5	The chapter provided a discussion and reflection of the results in chapter 4
Chapter 6	In relation to the research objectives and questions, chapters 2,3 and 4, this chapter wrapped up the research with conclusions and propose possible recommendations and areas for future research.

2. LITERATURE REVIEW

This chapter discusses the main concepts of interest in the spatial planning and mainstreaming of climate change adaptation debate. It looks into spatial planning in the Global South context, climate change dynamic in the least developed cities, the current dedicated adaptation approaches and the need for an integrated spatial planning that encompasses adaptation. An operationalization of regulatory mainstreaming of climate change adaptation into spatial planning has been discussed. Lastly, a conceptual framework that demonstrates hypothetical mainstreaming workflow is provided.

2.1 Urban Planning in the Global South Context

Urban planning (also referred to as land use planning) entails a methodological approach in which a determination is made as far as the appropriate use of a particular geographical location is concerned (EMI, 2015; Schmidt-Thome, 2017). Thus, through an iterating process led by urban planners, and involving relevant stakeholders, different alternatives to the use of land are discussed before decision-making. Ideally, urban planning in most Global South cities adopted planning methodologies from their colonial masters. The original master planning approach has been consistently used even with its apparent ineffectiveness in handling climate change impacts. The master plan approach has never given room for adjustments in the land uses to cater for uncertainties. To exemplify this, the space standards for drainage systems and wayleaves could not be flexibly changed to pave way for flood management (Albrechts, 2004). Sequentially, urban planning in Global South has steps that reflect the following: i) problem identification, ii) problem analysis iii) objective setting, iv) identification of intervention alternatives, v) evaluation of alternatives, vi) selection of the best alternative(s), vii) implementation of the best alternative, and viii) monitoring and evaluations (Schmidt-Thome et al., 2017). The process is repeated for subsequent urban land use needs. (Figure 2-1 summarises the spatial planning process). Even the evolution of urban planning into the recent approaches like strategic urban planning, integrated urban development among others, the methodology is still the same, only the name of the outputs did change (Albrechts, 2004).

According to UNISDR, (2004.p5), risk-informed urban planning entails "Land-use planning that involves studies and mapping, analysis of environmental and hazard data, formulation of alternative land-use decisions and design of a long-range plan for different geographical and administrative scales". Therefore, urban planning has the potential to minimize incidents of climatological risk by prohibiting developments and infrastructural installations into hazardous land by first conducting risks and suitability analyses, besides formulating regulations for flood-proofing cities such as building codes (EMI, 2015). Risk-informed planning aims at averting the business as usual planning approach that has been the norm in the Global South cities

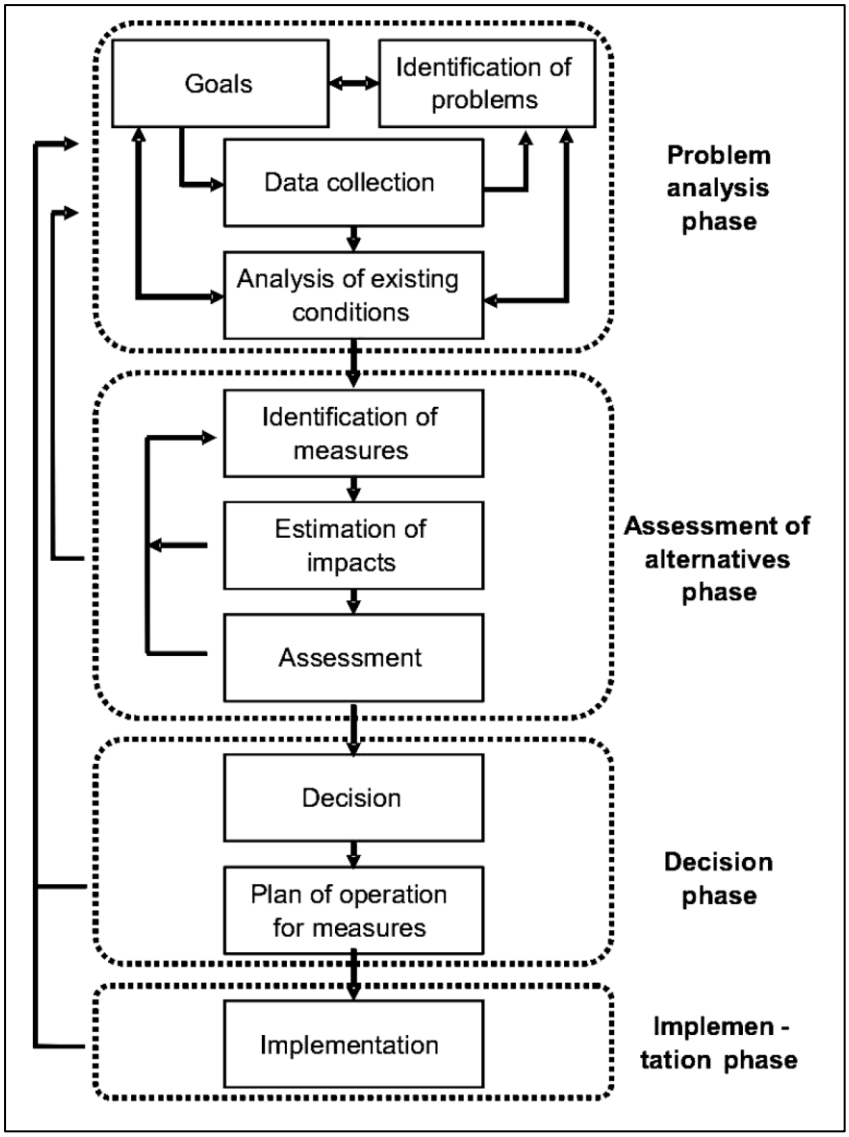


Figure 2-1: Conventional Urban Planning Process (Schmidt Thome et al., 2017)

2.2 Climate Change, Hazards, Vulnerability and Risks

"Climate Change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcing such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use" (IPCC, 2014,p 120)

"Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological and biological) or induced by human processes (environmental degradation and technological hazards). Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterized by its location, intensity, frequency and probability". (UNISDR, 2004.p4). In this context, hazards shall be used to refer to those natural incidents with a potential detrimental impact that can be associated with climate change e.g. flooding, rising sea level, and storm surges.

Vulnerability to climate change impacts refers to the susceptibility of urban dwellers and developments to hazards (It refers to the likeliness to be adversely affected) (UNISDR, 2014). It is ideally, a derivative of the

capacity to adapt in the event of a climate change impact like floods. Different urban regions have varying vulnerabilities based on the prevalent hazard exposures. Coastal cities may be vulnerable to rising sea level and storm surges whereas inland cities face urban heat islands, heat waves, flooding and potential landslides (UN-HABITAT, 2011). For instance, about 17% of Mombasa city may be submerged up to a height of 0.4 m due to rising sea level. Frequent cases of flooding have been reported in the city affecting critical infrastructure including the port of Mombasa. Similar cases are evident in other African cities such as rising sea level in Luanda, Angola, flooding in Kigali, Dar es salaam, Kampala and Nairobi, and droughts in northern Nigeria. In this study, vulnerability shall be intended to refer to the physical exposure to hazards of a population, its socio-economic elements and the built-up environment to the damaging effects of flood hazards.

Lastly, risks refer to the actual or anticipated losses (property, deaths, damages to infrastructure etc.) as a result of a hazard to exposed elements at risk like people, houses etc. Risk is always considered as a derivative of both Hazards and Vulnerability (***Risk=Hazards*Vulnerability***) (UNISDR, 2004). In urban planning dimension, risks may be reduced by preventing the elements at risk from exposure to potential hazards. Thus, urban regulations that limit/prohibit or protect settlements in flood prone areas, unstable land among others, may ameliorate climate change impacts. With respect to flood risks, a combination of exposure, vulnerability, and intensity will influence the actual level of risk and losses incurred. Figure 2-2 depicts the derivatives and drivers of flood risks in most contexts.

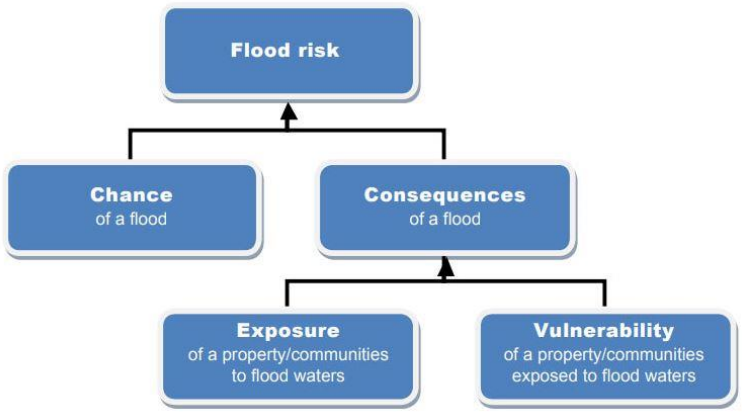


Figure 2-2: Flood risk dynamics (Earthquake and Megacities Inititative, 2015).

2.3 Climate Change in Africa

The most common climate related hazards in Africa are floods and drought. Most countries in the sub-Saharan Africa are vulnerable to flooding with the Southern, Eastern and Central regions having the most rampant flood disasters, followed by Western regions (Ngoran et al., 2015). East African countries including Kenya, Uganda, Rwanda, Ethiopia and Sudan among others are the worst hit by flooding within the continent. In early 2018 alone, around 270, 000 were displaced due to flooding in East Africa and large farmland areas were destroyed in Kenya (NASA, 2018). Associated long term risks include food insecurity, following the destruction of farmlands, agricultural interferences, and destruction of local ecosystems. Economic impacts also prevail since agriculture is a major contributor to the economy.

Drought is prevalent in northern Africa and parts of East Africa. Countries such as Sudan, Somalia, Ethiopia and Kenya are prone to periods of low or no precipitation that result in prolonged drought conditions. Droughts also have direct impacts on food crops, and other farming activities that communities depend on for their livelihoods. These climate issues not only threaten livelihoods through food insecurity, but also create devastating economic and infrastructure losses. Additionally, the presence of these disasters increases vulnerabilities from tribal and inter-communal clashes due to limited resources that can disrupt peace in these conflict prone areas.
Specifically, African cities have been experiencing consistent flooding in the past few decades due to increasing precipitation and rainfall intensities. According to Cluva, (2012), African cities experience four

types of flooding that include coastal floods, localized floods, flash floods and riverain floods. Due to limited drainage capacities, cases of localized flooding are prevalent which affect local contexts eg neighborhoods or urban areas. Most cities have streams cutting through them which experience flash floods during short rain periods from surface run off. This has been a perennial challenge in cities like Nairobi where streams cut through slums and during floods, the urban poor with low adaptive capacities pay the price. Similar to this type of flooding but of major impact are riverine floods caused by major rivers cutting through cities. During intense precipitation and encroachments into the riparian reserves, riparian floods have been registered to impact negatively to the urban population. This is more severe because these encroachments into riparian reserves are by poorly designed and poor quality units by mostly the urban poor. Lastly is the coastal flooding that is influenced by the low elevations of coastal cities. Most coastal cities like Abuja, Mombasa and Dar es salaam, may sometimes be within deltas or river confluences which experience intense water from upstream (Niang et al., 2014). In Kigali for instance, the flooding hotspot of Nyabugogo happens to lie at the confluence of two rivers (River Mpanzi and river Nyabugogo) (Asumadu-Sarkodie, 2015).

2.4 Climate Change Adaptation

Climate change adaptation entails a myriad of actions/strategies or adjustments in the natural and built environment to minimize the impacts of hazards. In practice, adaptation can be implemented at varying spatial scales ranging from the national, regional, city, community and even individual levels. Thus, at the national scale, broad policy guidelines are proposed to be implemented by both the regional and city levels. To achieve effective results, studies show that adaptation at the local level is more impactful since it is at this scale the real developments occur, vulnerability can be determined, and appropriate measures taken (Chmutina & Bosher, 2015)

In the literature of climate change, there exists several types of adaptations whose understanding is key to effective hazard management. Being contextual in nature, adaptations vary in objectives, goals and implementation approaches. Thus, we may have reactive and or anticipatory adaptation, planned or autonomous among others (Preston, Westaway, & Yuen, (2011); Runhaar, Mees, Wardekker, van der Sluijs, & Driessen, (2012); and Runhaar et al., (2016). The main categories of adaptation identified include but not limited to:

i) Reactive versus Anticipatory Adaptation

Adaptation strategies that are employed once the climatic impacts have taken place constitute reactive adaptation. Reactive adaptations are normally focused on improving the coping abilities of the elements at risk, be it humane or natural systems. For instance, relocating of elements at risk from flood prone areas eg people and land uses is a form of reactive adaptation commonly used in the Global South, Kigali included. On the other hand, it involves pro-hazard measures that are put in place before the hazard happens. Anticipatory adaptations aim at preventing the severity of the impacts and potential losses. Promoting public awareness on the possibility and impacts of flooding, enlargement of drainage channels before rain seasons, supplying food stuff and medical equipment to potential risk areas before the hazard happens will most likely alleviate the impacts (Preston, Westaway, & Yuen, 2011).

ii) Private versus Public Adaptation

The distinction between the two is simply identified by the key actors involved in the adaptation process. Private adaptation strategies include measures taken by an individual, a household or maybe a company in relation to the climatic change. For instance, urban dwellers in flood prone areas may decide to have their houses built with elevated foundations, or pool resources and dredge drainage systems. This approach in most cases is limited by the level of awareness, willingness to participate and capacity limitations. Public adaptation are the measures taken by the government, central or local, at the interest of its subjects. Public strategies of adaptation may include government subsidies to flood management approaches like purchase of rain water harvesting tanks, reducing cost of construction materials for every climate-proof project or directly investing in eco-system based or structural adaptation like urban forestry and dams respectively.

iii) Planned versus Autonomous Adaptation

Planned adaptation is the result of reviewed development guidelines in line with the foreseen impacts of climatic change. This measure aims at retaining the status quo (current equilibrium) should a hazard occurs in vulnerable areas. Planned adaptation is almost similar to anticipatory adaptation discussed above. Therefore, the city may create hazard scenarios eg flood intensity and extent and make measures towards avoiding flood damage when it occurs by say relocating people or developing flood-resilient regulations like building codes. On the other hand, autonomous adaptation entails those measures that may be individual-driven without any directives/guidelines and or awareness of the expected future scenarios.

iv) Sectoral and Cross Sectoral Adaptations

Sectoral adaptation focus on single or individual sectors that could be affected by the climatic change. For instance, in the agricultural sector, increase in global warming and droughts would adversely affect that sector thus calling for the use of irrigation in crop production, planting drought resistant crops and other efficient water utilization systems. Cross sectoral adaptation involves linking of the several climatic changes to various management options to ease or hasten the work done by the management to reduce the effects of climatic changes. Cross sectoral adaptation may call for effective and coherent adaptation frameworks that include all the affected sectors.

2.5 Evaluation Frameworks

— Urban Planning Fitness Evaluation Framework

According to Kruse & Putz, (2014), fitness of urban planning in integrating climate change adaptation refers to the capacity of urban planning process or frameworks to be modified to respond to both development and climate change impacts and demands. As such, the planning should have the ability to reduce vulnerability and exposure, capitalize on synergies of urban development and climate change needs (co-benefits), and adequately respond to uncertainties of climate change and urban growth. Specifically, Kruse & Putz, (2014) ascribe the extent of urban planning fitness is thus identified by its ability to enhance awareness and willingness to include adaptation, flexible in addressing emergent development challenges like climate change impacts and include both short and long term visions towards climate change. This perspective is also held affirmatively by Moser and (2010), Preston, Westaway, & Yuen, (2011) and Kumar & Geneletti (2015).

The 3As framework by Moser & Luers, (2008), which entails Awareness, Analysis, and Action components has been identified as an effective framework for assessing and quantifying CCA integration at the local planning contexts. Though originally applied in California to assess the capacity and preparedness of urban managers to address the challenges of climate change, this framework has equally been used in the global south to evaluate how urban plans are fit in integrating climate change challenges in Indian cities Kumar (2015). Application of the 3As framework in the review of spatial plans requires the development of relevant indicators of each 3As sub component as reflected in the spatial plans. Indicator development should adopt a climate adaptation lens in identifying weather or not Awareness, Analysis and Action stages of the planning process and the outputs reflect the climate change impacts and how they have been addressed. The indicators prioritized should primarily focus on climate adaptation if not, then sensitizing terms and concepts should be factored (Moser & Luers, 2008). For example, Awareness sub-component examines the extent to which the plan indicates a comprehension of major drivers of local climate change impacts (Moser & Luers, 2008).This may include hazards and vulnerability assessments or profiling. The Analysis sub-component looks into the presence or lack of the ability to do an analysis, conduct quantification and synthesis of data on the local climate change impacts to aid in decision-making. The Action component evaluates structural and non-structural climate change adaptation strategies proposed in the plan. Although the 3As framework used by Kumar (2015) combined both mitigation and adaptation strategies/indicators, this study focused categorically on the adaptation indicators for evaluating the planning process. Thus, a modification was done by dropping all the mitigation-oriented indicators. Table 3-3 shows the 3As indicators used for evaluation as adopted and modified from Kumar (2015)

— **Spatial Adaptation Project Evaluation Framework**

In order to determine whether or not spatial adaptation has explicitly factored climatic hazards, impacts and potential risks, a systematic evaluation is fundamental. Various frameworks exist that are applicable in project evaluations. Some of the frameworks include Logical Frameworks Approach, Project Cycle Management (PCM) and System concepts evaluation approach (Fujita, 2010). PCM provides a simple approach to project Planning and evaluation that includes establishing the project purpose, an analysis of the project background issues, the relevant interventions based on cost benefit analysis, making feasible and logical assumptions that may influence the realization of the project in question. Moreover, the process includes an implementation framework, provisions for considering sustainability needs of the project, and finally and a monitoring system. This PCM approach is argued to be an improvement of the LFA as it abolishes the rigid nature and simplicity of the LFA. However, it is alluded that PCM is effective only in a situation where the project in question has been implemented. The spatial adaptation project in Kigali is still a proposal, though fully planned. This state limits the application of the PCM in analyzing the adaptation project in context.

Besides the PCM, Fujita, (2010) ascribes to an even advanced approach to project evaluation, the Systems Concepts in Evaluation. This approach gives life to the project evaluation by including the social aspect. Thus, an evaluator makes efforts to interact with all the relevant actors ranging from planners, experts, the local community in trying to understand the effectiveness and success of the project in question. Much as this approach elicits all the relevant facts, it is time consuming and also, just like the PCM, it is only useful when the project has already been implemented. This fact limits its use in Kigali context where what is available is the documentation of the project, with time being a limiting factor for comprehensive interviews. All these facts have made LFA the most suitable approach in this case despite its limitations. This is because even in the absence of both the actors involved in the planning, and the project not having been implemented, it is still possible to conduct an evaluation and arrive at an almost logical conclusion, though subject to validation. Moreover, for an effective evaluation, there is need to use a framework that is synonymous to the urban planning processes in global south for ease of integration of the logical steps.

Thus, this study adopted the Logical and Result-based framework (Logframes) developed by Benson & Twigg (2007) for the International Federation of Red Cross and Red Crescent Societies. Logical frameworks Approach provides a chronology of steps/sequence and indicators that ought to be observed if any spatial adaptation planning process was to adequately mainstream climate change concerns. Systematically, the Logframes commence with an analysis of the contextual issues/problems, setting of objectives, identifying alternative interventions and development of measurement indicators for the project in question.

Sequentially, the Spatial-adaptation planning process should include, within its logical steps: analyzing the hazards and urban vulnerability, constitute the relevant actors both in the spatial planning and adaptation domains; critically analyze the problem at hand including risk factors; set SMART objectives both in the spatial and adaptation domains; realistically analyses spatial alternatives together with adaptation options relative to the existing or anticipated hazards and risks; make an appropriate selection of indicators and options that maximize on both land use and vulnerability reduction; make risk informed assumptions in the spatial plan management structure; implement the risk-informed spatial plan by monitoring risk trends and making relevant adjustments; and finally conduct timely and routine evaluations of the performance of the project (Benson & Twigg, 2007)

— **Regulatory Mainstreaming Evaluation Framework(s)**

Regulatory mainstreaming of climatic risks refers to the explicit measures to make climate change one of the foci of any urban plan and planning framework. Numerous frameworks exist that tend to guide this process of evaluation as literature indicates (Stead & Meijers, 2009; Brouwer, Rayner, & Huitema, 2013; Iglesias, 2014; Wamsler & Brink, 2014; Lin, 2018). However, three of these frameworks may qualify in aiding the integration of flood risks into urban planning. These include Tearfund Mainstreaming Evaluation Framework by Trobe (2005), OECD (2016) framework and the EMI (2015) regulatory mainstreaming frameworks. A keen review of these three frameworks reveals their suitability. For instance, the Tearfund

framework has the potential of mainstreaming flood risks into urban planning, but it approaches the process from a governance and institutional perspective. Thus, urban planning, or rather geographical planning becomes a component of the entire process. Moreover, the framework does not follow the planning process in the global south for ease of application. Annex 21 provides the details of this framework.

In 2016, the OECD developed a very ambitious framework for integrating sustainable Development goals into sectoral policies. According to the author, this framework can be improved an modified for other purposes based on contexts, such integrating flood risk regulations into urban planning. Thus, the OECD (2016) framework calls for an analysis of the relevant actors, policy interlinkages and financial issues; institutional re-orientation to promote coordination and collaborations; and finally, a monitoring and evaluation framework with clear evaluation indictors (see Annex 20). one main limitation of this framework is it has never been applied in the global south context to justify its credibility. Moreover, the framework focuses more on national level mainstreaming approach unlike the local level approach needed for flood risk integration at local planning scales. Just like the framework by Tearfund, the OECD (2016) framework is not synonymous to the planning process thus limiting its usability in this context.

Finally, this thesis adopted a framework of mainstreaming evaluation by Earthquakes and Megacities Initiatives, (2015). This framework was adapted because it is almost synonymous with the planning process for cities. Thus, "It follows the urban development planning process to ensure that flood Risk aligns with the broader aims of urban development. This way, development efforts are reinforced to withstand severe shocks from disasters that can derail a city's development trajectory. It is also anchored on the laws, regulations, policies and procedures that define how cities are governed, the mandates of each institution, and how policy and decisions are made on a day to day basis" (EMI, 2015, p. 4). Furthermore, it has been applied in evaluating and formulating effective risk-sensitive urban plans in Palo Municipality and Metro Manila (Philippines), and Dhaka (Bangladesh)

2.6 Why Mainstream Flood Risk Adaptation into Urban Planning?

2.6.1 Conventional Approaches to Flood Risk Adaptation

Flood Risk adaptation involves alternating the probability of the floods to affect the community or rather reduction of vulnerability of floods to the community as a whole. The methods employed in the reduction of risk are most often specific to locations and there is no method that fits all flooding challenges. Literature alludes that management of flood risk should be a partnership between the community and the government that uses a range of measures/methods to help reduce the vulnerability of the people, infrastructure and crops/plants. In the preparation of a floodplain management plan the factors that are key include insuring all buildings are above a certain level of floodplain it also includes the study of flood behaviors as mentioned earlier this helps to counter attack the floods when they are about to occur hence reducing the level of vulnerability to people and plants not forgetting infrastructure (Smit & Wandel, 2006).

Both structural and non-structural measures may be used to respond to flood hazards (Smit & Wandel, 2006) However, it is worth noting that structural measures have been criticized due to their financial demand, impacts to both environmental and social systems. The use of non-structural nature-based (ecosystem services) in adaptation have been found to have co-benefits of promoting flooding resilience and GHG mitigation in cities. Land use regulations have as well been employed in flood management through measures like zoning and development control measures through stringent enforcement (Earthquake and Megacities Inititative, 2015). Besides these measures, increased awareness of risk perception makes it easier for locals to respond to hazards and increases their adaptive capacities.

To aid minimize risks and vulnerabilities due to climate change hazards, both community-based and governmental responses are necessary. In the African context, a study by Mulligan et al. (2016) in Kibera Slums, the largest informal settlement in Nairobi city characterized by high economic poverty and an annual flooding risk, there was a high prevalence of autonomous household and community level adaptation

measures. Autonomous adaptation responses consisted of short-term coping mechanisms such as refining housing structural integrity and improving drainage systems of flood water in the area. However, both market-driven responses including micro-financing and government-based public policy responses were limited (Mulligan et al., 2016). Nguimalet, (2018) found that adaptation strategies for climate change hazards including drought and floods in Kenya and Central African Republic were commonly temporary relocation and a change in livelihood activities. The relocation of affected residents is however cited as a challenge by government stakeholders (Mulligan et al., 2016). In Ethiopia, water adaptation projects have been implemented as a response to drought and in Luanda, Angola an eco-town catering for flood management, and urban agriculture has been developed (Filho, 2017). An ecosystem management of the shire river basin in Malawi to alleviate riverine flooding and natural resources management (Butterfield, 2018).

2.6.2 The Concept of Mainstreaming

Studies indicate that there exists no single definition of mainstreaming. Several scholars have endeavoured to conceptualize and operationalize mainstreaming differently. Some of the definitions include: …

> i)…….“The mainstreaming approach aims to integrate climate adaptation as an objective in existing policy domains. This means that synergies between existing policy objectives and climate adaptation are established and that existing resources are used to address climate adaptation. As opposed to the dedicated approach, mainstreaming focuses on performance- based decision-making - i.e. actors focus on to what extent climate adaptation is required and feasible within the given context” (Runhaar et al., 2016)
>
> ii)…..“..incorporation of the challenges posed by climate change into the work of city authorities/municipalities by formulating effective responses to it, which—to become sustainable—then need to be anchored in existing planning processes and frameworks, and policy across all sectors and levels” (Wamsler & Ing, 2007.p4)

Thus, any deliberate measures to integrate climate change adaptation objectives in other sectoral policies (in this case urban planning) may constitute mainstreaming. Thus, the general manifestations of mainstreaming into urban planning may be associated with the characteristics in table 2-1 by Runhaar et al., (2018)

Table 2-1: Characteristics of Mainstreaming

Focus	The plan should explicitly indicate its intention to mainstream climate change adaptation within its objectives. The perceptions of the key informants should also be precise on the status and direction of mainstreaming climate adaptation.
Defining mainstreaming	A precise terminology used to imply the definition of mainstreaming
Operationalizing mainstreaming	Was the concept of mainstreaming operationalized?
Mainstreaming types/strategies	Did the plans demonstrate the nature of mainstreaming to be
Sectoral focus	What is the main focus of the plans?
Climatic risks addressed	The plan should adequately indicate the types of risks it is tackling or adapting to
Plans’ outputs (proposals)	Evidence of frameworks or procedures for planning and or institutional re-organization to implement the proposed mainstreaming strategies
Quality of plans’ mainstreaming proposals	The plan should demonstrate the proposed procedure for re-organizing the planning process or institutional setup for effective mainstreaming of adaptation.
Plans’ actual adaptation mainstreaming projects	The mainstreaming should lead to actual implemented projects on the ground)
Quality of the actual mainstreaming projects	The plans should describe comprehensively the mainstreaming projects on the ground.

2.6.3 The Need for Mainstreaming Flood Risk Adaptation in Kigali

The inability of Global South cities to afford separate programs for urban planning and climate adaptation makes mainstreaming CCA inevitable (Wamsler, 2014). There is an apparent need to re-organize spatial planning at city level to deliberately factor climate change. Integration may entail the adjustments of planning methodologies and regulations to accommodate climate adaptation (Runhaar et al., 2016). An effective mainstreaming of CCA into the built environment is a potential tool to achieving urban resilience (Dovers & Hezri 2010). This is informed by the fact the most vulnerable populations depend on climate sensitive livelihood sources like urban agriculture, live-in disaster-prone areas such as informal settlements in flood plains and unstable landscapes and have limited adaptive capacities. Besides in spatial (land use) planning, climate adaptation can be mainstreamed into other sectors such as infrastructure (climate proof and green infrastructure); agriculture (use of drought resistant crops and efficient technology); educational systems (curriculum reviews to increase risk perception and adaptation responses) and water management in the light of drought hazards as well as excessive precipitation (UNEP-UNDP, 2011; Wamsler, 2014) On the same note, a nexus exists between spatial planning and other concerns of natural resources and ecology, infrastructure and economy which are all vulnerable or exposed to climate hazards and disasters. Fortunately, spatial planning can as well play a critical role in promoting Climate Change Adaptation (Sutanta, Rajabifard, & Bishop, 2013;Araos et al., 2016)

2.7 Types of Mainstreaming Climate change Adaptation

According to Wamsler et al., (2014), Persson, Eckerberg, & Nilsson (2016), Runhaar et al., (2016), and Runhaar et al., (2018) the main categorizations of mainstreaming include but not limited to:

- Programmatic mainstreaming: simply the modification of the body that implements by the integrating aspects related to the climate adaptation.
- Managerial mainstreaming: this entails modifying the managerial structures and the working structures that include internal formal and informal norms towards climate adaptation inclusion.
- Intra- and inter-organizational mainstreaming: this calls for linking or rather networking of different departments, individual sections and or different stakeholders for example the government might link up with different non-governmental bodies or the government bodies with the public/private sector. The purpose of this mainstreaming is to create or generate a shared understanding between the departments and thus enhancing positive coherence.
- Regulatory mainstreaming: this is the modification of formal and informal procedures that include putting plan, regulations and legislation in place, this enables in the linking of the procedures to policy to facilitate the generation of adaptation approaches that confide within the laws, plans and regulations.
- Directed mainstreaming refers to top-down support to mainstreaming adaptation at the local planning levels. Directed mainstreaming also facilitates distribution of responsibilities.

2.8 Regulatory Mainstreaming

In order to achieve effective regulatory mainstreaming, it is significant to have an in-depth comprehension of its theoretical underpinnings. Thus, a review of what regulatory mainstreaming entails has been provided in the sections below from the definitional, content and methodological perspectives.

2.8.1 Definition of Regulatory Mainstreaming:

According to Runhaar et al., (2018), Regulatory mainstreaming refers to "The modification of formal and informal planning procedures, including planning strategies and frameworks, regulations, policies and legislation, and related instruments that lead to the integration of adaptation". However, this definition is quite broad and not operationable within this research scope and timeframe. Thus, the operational definition of Regulatory Mainstreaming adapted this study was:

"*The modification of formal urban planning process (planning methodology) and urban plans (development guidelines) to incorporate flood risk adaptation.*"

In the same light as Runhaar et al., (2018), the components of regulatory mainstreaming framework will include:

- Climate adaptation mentioned as objective or vision in plans / sectoral regulations
- Plans describe actions aimed at climate adaptation
- Plans / strategic documents contain implementation provisions with relation to climate adaptation measures
- Adoption / uptake of regulations that facilitate climate adaptation action and planning practices
- Operationalize regulatory mainstreaming process
- Revision and creation of plans, regulations, and instruments that include climate adaptation.

2.8.2 Operationalizing Regulatory Mainstreaming

Runhaar et al., (2018) made great advances in demystifying the categories and contents of climate change mainstreaming as identified above. Even though this was a big leap in simplifying about what works and what doesn't in the attempt to achieve mainstreaming, it fell short on the process of how mainstreaming may be addressed from a planning perspective without limiting one to the contents of existing policies and plans. Thus, this study goes a step further by articulating a methodological process through which regulatory mainstreaming can be achieved and or assessed, paying attention to the adopted definition above. One critical point to note is that, there exists no universal approach for regulatory mainstreaming, both in the global north and Global South. However, EMI, (2015 and Schmidt-thome (2017) allude to a possible modification of the conventional spatial planning process to include adaptation to hazards, both natural and climatological. This regulatory mainstreaming framework has been used in similar Global South countries like the Philippines is as discussed in the section below.

The applicability of this approach is informed by the fact it is almost synonymous with the planning process for cities. Thus, "It follows the urban development planning process to ensure that flood Risk aligns with the broader aims of urban development. This way, development efforts are reinforced to withstand severe shocks from disasters that can derail a city's development trajectory. It is also anchored on the laws, regulations, policies and procedures that define how cities are governed, the mandates of each institution, and how policy and decisions are made on a day to day basis" (EMI, 2015, p. 4). Hence operationalizing regulatory mainstreaming may be composed of four critical phases that include: organizational and preliminary setting of the planning process; conducting a diagnostic and situational analysis; developing the plan; and finally, measures to implement, monitor and evaluate the plan proposals and final results respectively.

Operationalizing Regulatory Mainstreaming evaluation as prescribed by Earthquake and Megacities Inititative, (2015) may include four main dimensions as presented below:

i) **Agenda setting** entails the initial preparations to jump start the risk-informed urban planning process. This dimension calls for activities that include but not limited to: Stakeholder mapping, formation of the planning management team, identification of climate change knowledge gaps among the key actors, and efforts towards data needs identification more so on the risk-planning perspective. Table 2-1 depicts some of the data needs relevant to the flood risk mainstreaming.

ii) **Situational Analysis** (also called context evaluation) endeavours to enable an adequate understanding of the status quo of the planning area and systems for effective decision making. Thus, mainstreaming will call for an analysis of the land uses, socio-economic and environmental dynamics; and evaluation of urban flood risk levels, geographical distribution of risks, and resilience of urban systems, and validation of the final results of the context evaluation. Thus, reviews of relevant literature, flood risk mapping and multi-agency validation of the findings are key to ensure flood risks are well integrated into the planning process.

Table 2-2: Sample Data needs

Data Requirement	Scale
• Geospatial references, such as geo-political boundaries, digital elevation data, land-use land-cover data, surface elevation data,	City level
• Built Environment, such as land use plans and detailed area plans, building data, transportation, public facilities, and informal settlements , etc.)	District and City Levels
• Emergency Support Functions (such as police and fire stations, evacuation centers, hospitals and health centers	District/neighborhood levels
• Socio-economic data (such as census by district, property tax reporting and household demographics)	District and City Levels

iii) **Risk-sensitive Plan Making**: The third dimension of the regulatory mainstreaming entails ensuring that the relevant urban development and flood resilience visions, strategies and projects are derived in a participatory way. Moreover, the planning should distribute roles and responsibilities to concerned actors in order to promote a sense of ownership and accountability. Thus, the focus of the development proposals and budgetary allocations should address both built environment dynamics and climate change uncertainties.

iv) **Implementation Monitoring and Evaluation:** Finally, the implementation, monitoring and evaluation stage should ensure the expected results are met. Therefore, the planning project team should propose feasible timelines, realistic mainstreaming indicators and mainstreaming evaluation frameworks during the reviews of the plans at the end of the plan cycle.

In conclusion, the process of regulatory mainstreaming is continuous/Cyclic since a number of reassessments should be carried out whenever they are required. Furthermore, the process of reassessment must also consider the possibility of multiple or chain hazards. Systemic vulnerability assessment is encouraged because it takes into consideration direct and indirect impacts that can be caused by flood risks at different spatial scales from the local to regional scales. Urban planners ought to follow appropriate mainstreaming valuation methodologies to aid inform the preparation of risk-sensitive urban plans. Clearly the proposed evaluation approach does not offer an ultimate and straight forward answer, but it does give a structure of the regulatory evaluation framework towards better mainstreaming of flood risks into planning. According to EMI, (2015), this process may take a period of between 12 to 24 months based on the scope of work, city size and development and vulnerability dynamics. Figure 2-3 summarizes the mainstreaming process.

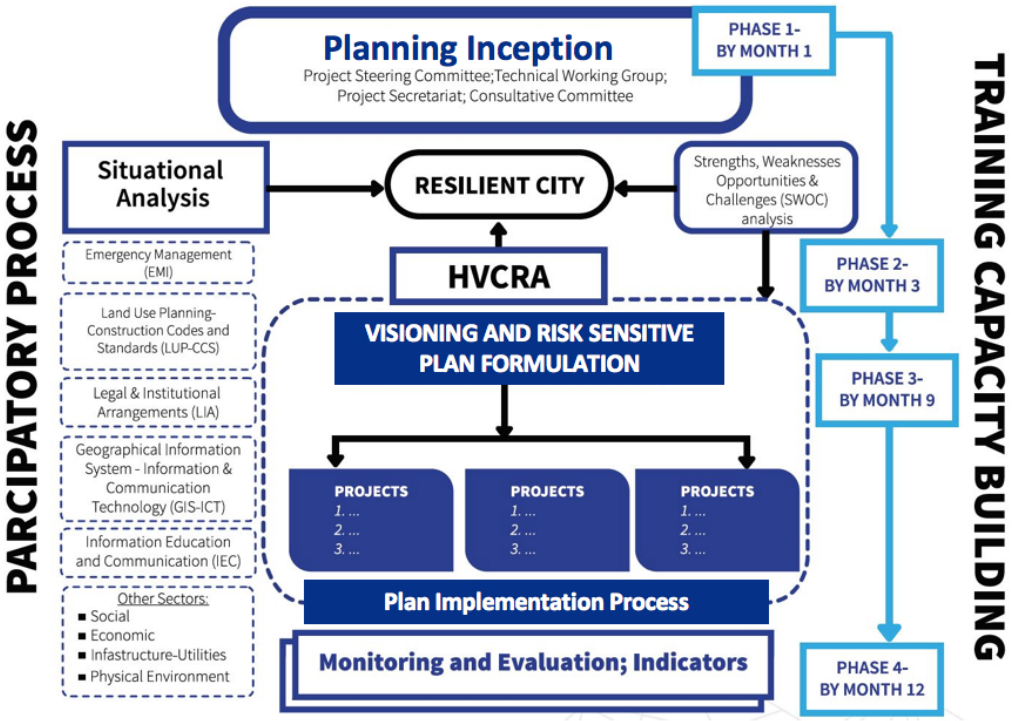


Figure 2-3: Summary of regulatory mainstreaming (Adapted from EMI,2015)

2.9 Regulatory Mainstreaming Drivers And Barriers

According to Uittenbroek, (2016a), climate adaptation interests align with the political environment and thus sometimes the level of public awareness or the consistency to fulfill those goals in some cases fall short due to bad governance but in rare cases it has a positive effect due to good governance. Unless the political environment is committed to promote mainstreaming, changes of success are normally limited. On the same front, Wamsler (2014) alludes that factors within organizations have a major influence in the adaptation mainstreaming. For instance, if the inter organizational objectives are not coherent, accepted across the board, and are not well developed achieving mainstreaming may be suffocated. One other critical factor that may enable or bar effective mainstreaming if the Cognitive ability of the actors involved (Wamsler & Pauleit, 2016). This implies, the level of uncertainty, awareness the sense urgency and also the degree of social learning are critical in appropriate mainstreaming solution finding. The capacity to identify, analyze and urgently address climate change challenges may determine the ultimate outcomes of any mainstreaming agenda.

In the same breadth, Stead & Meijers, (2009) allude that resource capacity of any urban planning and management entity has a significant impacts on the success or failure of mainstreaming. Thus, the availability of staff, financial resources, information and guidance provided, subsidies offered by the government and the availability and expertise of knowledge are basic requirements towards realizing mainstreaming objectives. The need for experts, public awareness and necessary technology all call for financial and material inputs. Equally important is the framing of the problem at hand. According to Runhaar et al., (2018), wrong diagnosis and characterization of climate problems may lead to inappropriate solutions and results in the end. They allude it is critical to address every challenge directly and distinguish as such. Last but not least, the time of addressing the mainstreaming challenge will determine its overall inception and implementation. Wamsler (2015) claims that if adaptation is brought in focus when flooding challenges are eminent, chances of all responsible actors participation are high. On the same note, aligning city's climate objectives with the national climate strategies makes it possible to gain funding during budgetary allocations. Figure 2-4 below denotes the influencing factors that lie between theory and practice in most urban systems

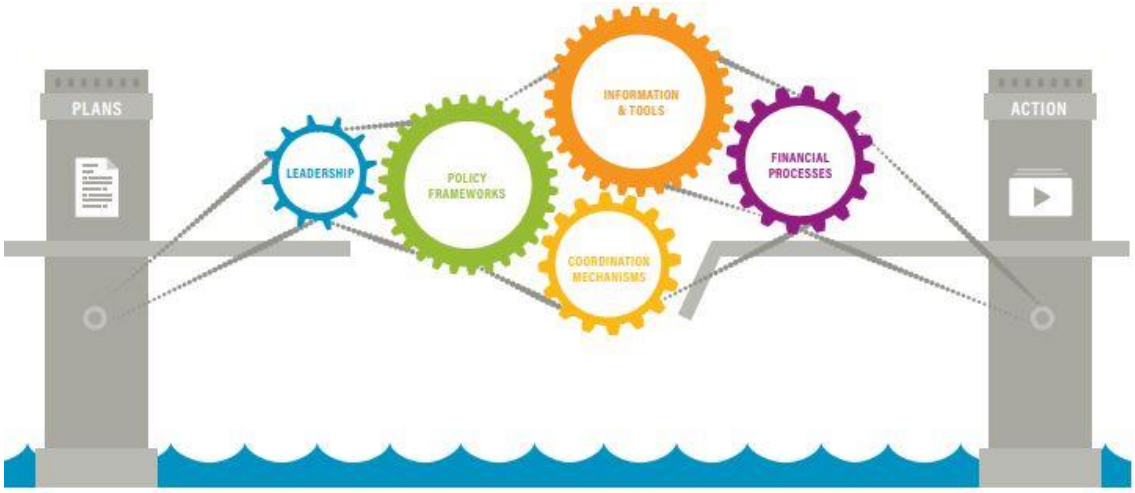


Figure 2-4: Factors influencing Mainstreaming (Galderisi & Menoni, 2015)

2.10 Conceptual Framework

The conceptual framework in figure 2-5 below denotes the urban planning and adaptation nexus for effective mainstreaming. If urban planning as a process leads to plans and projects that are not risk-sensitive, both the built and natural environment may be subjected to change vulnerabilities (EMI,2015; Galderisi & Menoni, 2015). These vulnerabilities will be exuberated by the levels of exposure and hazard intensities. To avoid disasters and risks, therefore, there is the need for adaptation measures at the local urban scale. These measures may be either planned, unplanned or both. Global South cities tend to employ dedicated adaptation strategies that bring about additional expenses and expertise to the already fiscally constraint urban municipalities. To curb this, possible mainstreaming of CCA into urban planning may result in climate-proof urban plans. It's the factors that may limit organizational ability to achieve mainstreaming that this thesis aims to unravel. Any land use planning process ought to recognize possible hazards and vulnerabilities. This calls for climatic risk assessment in order to determine the relevant adaptation measures based on an area's suitability level. Thus, a risk-informed urban planning may aid in reducing exposure to hazards and the potential risks.

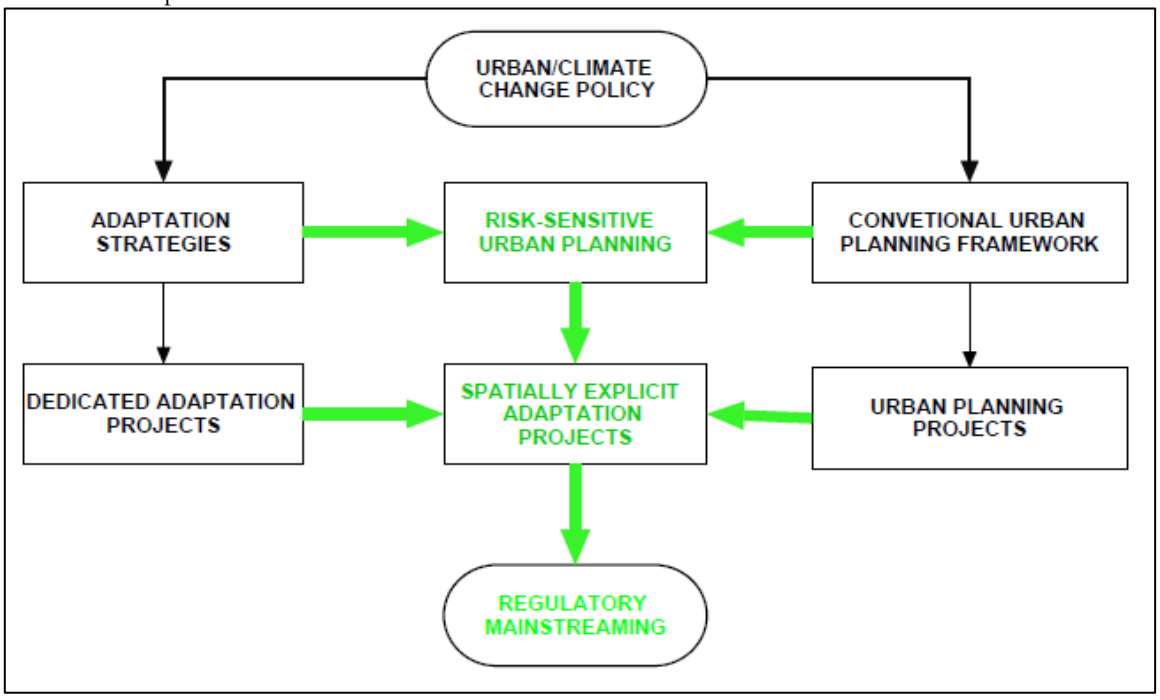


Figure 2-5: Regulatory Mainstreaming Conceptual Framework. (Author, 2018)

3. STUDY AREA AND METHODS

3.1 Overview

This chapter explains the research methodology used in conducting this study. It addresses the research mixed method design, a case study strategy and how the case study was selected. The study employed both purposive and snow-ball sampling to select the key informants to be interviewed were applied. A combination of Qualitative, quantitative and content analysis methods was used. Progressively, Objective one looked into the fitness of urban planning in integrating flood risk adaptation with respect to the 3As framework (Awareness, Analysis and Action). Objective two focused on the strategies and programs employed in addressing flood risk responses, and how explicit spatial adaptation projects were in relation to the Logframe indicators. Since the first two segregated objectives did not offer an overall and holistic understating of the effectiveness of regulatory mainstreaming and the critical factors influencing the process, objective 3 focused on addressing this missing link by critically and in-depth evaluating the plans and analyzing the key informant interviews results with an explicit mainstreaming lens.

3.2 Study Area

The city of Kigali owes it origins to the early 1900s colonial influence. The city is located within longitude 29^0 43'0"E and 29^044'0"S and latitude 2^035'0"S and 2^037'0"S. Kigali spans across a mountainous landscape and comprises one of the five provinces of Rwanda others being the Northern province to its North, Eastern Province on its East, and southern province to the south. Due to the prevalent of flood plains, swamps and steep slopes, the city development has been limited to the gentle slopes and flat hilltops. Demographically, the city has seen its population grow from a mere 337 people in 1907 to about 1,140,000 in 2012, with its area also growing from 0.08 Km^2 to 730 Km^2 over the same period (Joshi, Damani, Ng, Lauwa, & Joshi, 2013). With a total of 3 districts of Gasabo,Kicukior and Nyarugenege (figure 3-1), Kigali is a mixed-use city comprising of major urban land uses that include: agriculture, commercial, residential, public facilities, forests, infrastructure, recreational and rivers/lakes (KCMP, 2013).

Besides experiencing rapid urbanization, the city of Kigali has had consistent climate change hazards and impacts. Cases of floods and landslides have been responsible for infrastructural and physical development damages and losses in the past decades. This scenario is aggravated by the encroachments into flooding vulnerable and exposed areas (REMA, 2013). Besides, the urban development and management policies and plans have never factored in the realities of climate change. The average annual temperatures have been rising between 1970 and 2008 from 19^0C to about 20.5^0C. This is a disturbing trend putting in mind that the global mean temperature has risen by only 0.8^0C since 1850 (IPCC, 2014b). Cases of rainfall variability have been noted leading to among other ills flooding and flash floods in urban and rural areas. These have detrimental impacts on fresh water availability, agro-production and sustainable development. Other contributing factors to this challenge are indeed non-climatic such as poor management of watersheds.

According to REMA (2015), the economic implications of climate change indicate that flooding costs Rwanda about 1% of its GDP annually in two of its districts alone. Direct economic losses are as a result of destroyed livelihoods, agricultural land and crops, infrastructural damages, destruction of buildings (Residential, commercial and even industrial) contamination of water sources that leads to waterborne diseases. All these incidents burden the economy by investing in dedicated adaptation. These adaptation costs are expected to raise in future if nothing is done to an annual average of about 400 Million USD all the way to 2030 (REMA, 2015).

Figure 3-1 : Study Area (Author , 2018; OSM, 2018)

3.3 Case Study Strategy

In order to operationalize the research sub-objectives adequately, a case study approach was adopted for this research (Yin,2009; Bryman,2012; Yin 2013). A case study according to Yin (2009) is characterized by five main components that include: well framed research questions which anchor the purpose of the study, the case study selection process, data collection methods, data interpretation and reporting. All these components have been articulated in this methodology chapter. The use of case study provides a better avenue for an in-depth analysis since the research ought to unearth the critical factors that influence mainstreaming of CCA into urban planning. The research focused on a few units of analysis (1 Global South city) to determine the effectiveness and factors limiting regulatory mainstreaming. Furthermore, the study was location specific thus ruling out generalization possibilities due to contextual issues in climate change impacts and the requisite mainstreaming strategies.

3.4 Case Study Selection

The identification of the case study was done systematically. The key factors considered included countries whose capital cities had a population greater than 1 Million, a member of IPCC that have National Adaptation Program of Actions (NAPAs) and a city level or municipal adaptation plan, programs, projects or strategies. One unique requirement was that the city should be in the process of reviewing its urban master plan(s) as a potential entry point to mainstreaming. The full details of the case study selection strategy are in Table 3-1. From the search, it emerged that south African cities had advanced in adaptation mainstreaming as compared to all other African cities. Due to its level of development, this study finds it logical to select emerging cities in adaptation so as to generate more knowledge on the dynamics they experience. Thus, this study focused on the city of Kigali for detailed analyses. Kigali city has made initial steps towards mainstreaming climate change adaptation into urban planning. This move is informed by nationally determined contributors as documented by various policy and strategic frameworks (East African Community, 2010; REMA, 2010; Metternicht, 2017). This is an indication of the awareness of the realities of climate change vulnerabilities and impacts to the built environment, food and water security and economic developments. Furthermore, the adoption of the Sendai Framework for Disaster Risk Reduction

formulated in 2015 makes Kigali and Rwanda a potential study unit to enable unravel the bottlenecks impeding full realization of the mainstreaming objective.

Table 3-1 Case Study Selection Criteria

DIMENSIONS	CRITERIA	RATIONALE
City size	At least 1,000,000	According to UN definition of urban agglomerates
Language	English	
Country Plans (UNFCCC Members)	NAPAs	Some NAPAs are the entry points of municipal/city adaptation
Search Concepts/Terms	(city name) Climate change adaptation OR Risk Reduction OR climate change strategy OR climate change action plan OR Municipal Adaptation plan (science direct)	Due to uncertainty of data/plan specific naming, any relevant term is necessary to get results.
Global Climate Risk Index	Number of appearances in up to 2016 report (Sönke, Eckstein, Dorsch, & Fischer, 2016)	The level of risk frequencies informs a state of urgency
Global Vulnerability Index	Number of appearances up to the latest 2014 report	The higher the vulnerability and frequency, the higher the urgency
Sources	Municipal websites, city websites, government websites, climate body websites	A wider range of search increased the chances of getting data
Timing	The city should be in the process of reviewing its Urban master plans and also vulnerable to floods. (Runhaar et al., 2018)	This provides an opportune entry point for introducing flood risk mainstreaming into urban planning.

3.5 Research Design and Approach

This study used a Mixed-Method approach. According to Bryman, (2012), Mixed-method enables multiple data collection methods from various sources for purposes of triangulation and data corroboration in order to ensure both internal validity and reliability (Bryman, 2012). Furthermore, multiple data collection method promotes complementarity and completeness in data which makes it possible to unravel the actual contemporary issues.

3.6 Field work

A number of activities conspired during the field work phase of the research. These included: a reconnaissance at the city of Kigali and lead agencies to establish rapport and make initial contacts. This also included confirmations to the initially requested appointments. The second activity entailed testing the interview guide. Although the interview guide was adopted meaning it had already been tested, re-testing was aimed at making sure that it fits well in the current context and yields the expected results. After a few interviews, the instrument was revised, and a copy shared with the supervisors for observations. Interviews were then conducted between 6th October to 26th October as shown in ANNEX 3 On completion, the researcher made a round of courtesy calls to the interviewed key informants to bid them goodbye and thank them for their willingness to be interviewed and the internal documents shared.

3.6.1 Sampling Approach and Sample Size

The identification and selection of key informants was done through purposive sampling and snowballing. This was due to the fact that, this research sought specific data from actors involved in both urban planning and climate change adaptation. The key informants included urban planning officials and experts, climate change officials/experts, urban development professionals and environmentalists and the academia. In the end a total of 18 key informant interviews were conducted. The selection of the key informants focused on representativeness across all the city planning departments. As such, all the key urban planning departmental

heads at the city of Kigali were targeted. Besides the city of Kigali officials, the sampling of key informants also included the immediate ministries and lead agencies in urban planning in Kigali. This was necessitated by the fact that their exists a very high influence of higher authorities in the activities of the city. Moreover, the city of Kigali despite being autonomous, it doesn't operate in isolation since planning is a socio-political and participatory process. Thus, key informants from the ministries of Infrastructure (urban planning and development department) Environment, local government and lead agencies that included Rwanda housing authority, and REMA. For a complete understanding of the contemporary flood planning in Kigali, both the academia and private experts were interviewed in order to gain insights into the real issue from various perspectives for credible conclusions. The interviews were concluded on reaching saturation since it came a moment when no new information was forthcoming. Most of the key informants were accessed through both purposive sampling and snowballing. The interviewed key informants are as shown in ANNEX 3.

3.6.2 Data Collection

This study collected data using literature/document reviews and key informant interviews. For the KII, data was collected through semi-structured in-depth interviews with open ended questions that enable follow up inquiries were used to gain more information from respondents.

Both primary and secondary data types were collected for analysis. Secondary data was collected from literature urban plans and internal documents from both the city of Kigali and lead agencies. These secondary data included both urban land use policies, urban master plans and zoning plans, adaptation project documents and EIA/ Building codes guidelines to unravel any form of mainstreaming. The sources of secondary data included relevant national and city government offices such as the departments of urban planning, environment, disaster management, infrastructure, urban development and housing. Primary data was collected through semi-structured key informants interviews. The key informants interviewed at Kigali city authority included the director of urban planning and one stop Centre, heads to departments of development control, environment, infrastructure, settlement planning, GIS, Master plan review and implementation and environment. National agencies interviewed during the field study were Rwanda Housing Authority, REMA, MIDIMAR, MINALOC, and MININFRA. Additionally, other key informants from Non-governmental organizations were interviewed that included private experts in risk management, GGGI and University of Rwanda. ANNEX 3 details the key informants interviewed.

3.7 Data Analysis and Tools

Data analysis was conducted using the thematic content analysis, 3As framework, Logframe evaluation and a Regulatory mainstreaming framework. The data analysis tools employed included ATLAS.ti 8, SPSS IBM version 24 and Excel (descriptive statistics). Innovatively, the effectiveness of regulatory mainstreaming was determined through frequency standardization approach. The initial stage of the Qualitative Data Analysis (QDA) process entailed the transcription of all the interviews conducted. Afterwards, the transcripts were analyzed using a mixed method through inductive and deductive thematic content analyses in two phases. The first phase involved a directed approach to determine preliminary codes based on the analytical framework adapted. This was followed by coding of the interview transcripts, categorizing the codes into themes and pattern identification. To avoid potential bias, open coding was done using *Atlas.ti 8* so that the information emerges from the data. The second phase of the analysis focused on identifying the barriers and drivers to climate change integration from both the urban plans and interviews. This was done inductively from the results of the open coding done. Thus, the prevailing constraints to adaptation integration were analyzed as shown in the findings chapter. Besides coding, this study used talking time as an indicator of emphasis by the key informants as far as flood risk adaptation is concerned. This approach has not been extensively used in qualitative data analysis, more so in the Global South.

3.7.1 Rationale for Evaluation Frameworks

This study employed three evaluation frameworks of which each had a different relevance but complimented each other in order to provide a holistic understanding of regulatory mainstreaming in the context of Kigali. The 3As framework was used to evaluate the fitness (adaptive capacity) of overall urban planning in integrating flood risks both at the city and district levels. This framework has been applied before by Kumar & Geneletti (2015) to analyse the capability of urban planning to integrate climate change

concerns into urban planning in Indian cities. Besides, there exist no other frameworks applied in the Global South before for purposes of empirical considerations. The Logframe framework enabled the evaluation of how explicit spatial adaptation project was in Kigali. Logframes enable objective project planning that also promotes efficiency, participation and effectiveness (Benson & Twigg, 2007). On the same note, Logframes structure is synonymous to the project planning process which enables its applicability besides having been used in the global south mostly by door agencies. Once the fitness of urban planning and explicitness (or lack of it) of spatial adaptation projects were determined, the EMI (2015) regulatory mainstreaming framework made it possible to evaluate the overall mainstreaming effectiveness. Thus, regulatory mainstreaming integrated urban planning, spatial adaptation and dedicated adaptation measures as identified in the evaluated plans for purposes of demystifying mainstreaming efficacy. These three frameworks therefore provided an integrated and holistic approach to regulatory mainstreaming evaluation in Kigali at the various spatial scales of action.

3.8 Objective 1: Fitness of Urban Planning in Integrating Flood Risk Adaptation

3.8.1 Policies and Plans Influencing Development in Kigali City

To analyze and have an in-depth understanding of the main plans that have a major influence in urban development in Kigali, thematic content analysis of the relevant literature was used. This gave room for bringing out the main facts in a detailed without the limitations of what predetermined frameworks may pose. Urban policies and plans were thus analyzed with the main focus addressed to what they provide for or prescribe with respect to development and adaptation in Kigali without necessary measuring the magnitude of the influence. These findings were then backed up with the key informants interviews as a way of triangulating and validating the facts.

3.8.2 Extent of Urban Planning in Integrating Flood Risk Adaptation

To determine the extent of urban planning in integrating flood risks in Kigali, a 3As approach was used. This 3As approach (framework) by Moser & Luers, (2008), which entails three dimensions: Awareness, Analysis, and Action has been identified as an appropriate framework for assessing and quantifying climate change adaptation integration at the local urban planning contexts. Though originally applied in California to assess the capacity and preparedness of urban managers to address the challenges of climate change, this framework has equally been used in the Global South to evaluate how urban planning is fit in integrating climate change challenges in Indian cities Kumar & Geneletti (2015). The frameworks aims at finding the extent to which urban planning has explicitly addressed the Awareness, Analysis and Action dimensions. Table 3-2 shows the 3As indicators used for evaluation of the fitness of urban planning in integrating flood risks.

Table 3-2: 3As Framework for Planning Process Evaluation

Components	**CRITERIA**	**Evaluation criteria**		
Awareness		Missing (score 0)	Implicit (Score 1)	Explicit (Score 2)
	Explicitly Defining the Concept of climate change			
	Well defined Climate scenarios and anticipated impacts			
	Very clear Climate focused Visions (long-term)			
Analysis	Adequate Vulnerability assessments			
	Comprehensive and strategic Land suitability assessments based on climate change scenarios			
	Flood risks Impact assessment on the urban biophysical			
	Socio-economic impact of climate change assessment			
	Deliberately addressing climate change refugees and displacements			
	Evaluation of climate impacts on job access and livelihoods in general			
	Evaluation of economic impacts by climate in the planning areas			

	Estimating the cost of climate change risks			
Action	Explicit observance of coherence and synergies cross planning levels and policies			
	Risk-focused development standards			
	Stringent measures for Conservation of parks, forest and natural and protected area			
	Well defined Infill developments and reuse of remediated brown field sites			
	Explicit Green infrastructure standards.			
	Determining Low ecological footprint design for impervious surface			
	Explicit Climate proofing of transport infrastructure			
	Suggested policies and programs to provide health facilities, insurance, food security and education relative to climate impacts			
	Explicit Financial / budget commitment			
	Identify role and responsibility among sectors and stakeholders			
	Public awareness and education about the climate change issues			
	Waste water control and treatment measures			
Adapted from: Moser & Luers, (2008) ; Kumar & Geneletti, (2015).				

Selection of Plans for Evaluation:

The selection of the respective plans for evaluation was informed by a number of factors that included

i) The urban plans must have been completed, implemented or being implemented, and in the public domain.
ii) A convenience sampling approach in which the documents should be easily made available by the relevant authorities.
iii) Not older than 2010 and due for reviewing
iv) Geographical representation: the plans must cut across the planning scales of Kigali city, and both master plans, zoning plans and action plans.
v) Similar studies have selected plans for evaluation based on contexts. (eg if evaluating urban planning, then makes sense to select urban plans. On the other hand, national level evaluations would call for national policies and strategies)

Scoring Criteria

Criteria	Description	Remark
0	Missing	If the indicator/criterion or its proxies are completely not available in the planning process
1	Implicit	If the indicator/criterion or its proxies are just mentioned and not detailed out in the planning process. For instance, if the planning process acknowledges that the people and land uses in flood prone areas will be identified for effective measures, but does not detail out "HOW" it will be done, by "WHO", and "WHEN", then it may be identified as an implicit approach.
2	Explicit	When the indicator/criterion is well acknowledged and a framework of addressing it is provided. For instance, for an indicator proposed to address flood risks, the process will conduct a risk and vulnerability assessment before making development proposals.

Urban Planning Quality Analysis

The planning fitness was analyzed in three main stages. Firstly, there was rudimentary summations of the indicator scores of each component of the 3A framework. Secondly, the level of integrating climate adaptation into urban planning was determined through a standardization on a scale of zero to one (0-1) of total actual scores of the 3As indicators. The Standardization entailed dividing the total actual scores of each indicator by the maximum possible score. A determination of the 3As performance was arrived at using descriptive statistics. Lastly, a quality analysis was performed based on depth and breadth score (Tang, Brody, Quinn, & Chang, 2010; Kumar & Geneletti, (2015) as shown below:

- **Depth scores**: The **importance** given to each indicator in the urban planning process was analyzed using the "**depth percentage scores"** as shown in ***Equation 1***. Depth scores focus on how explicit an indicator was addressed across all the planning levels. Thus, it looks at only explicitly addressed indicators.
- **Breadth scores:** The **representativeness/distribution** of fitness across all the planning levels was analyzed using "**breadth percentage scores"** as shown in ***Equation 2.*** As such, breadth scores look at how many planning levels addressed a particular indicator, whether implicitly or explicitly.
- The **higher** the depth and breadth percentage scores, the higher the quality of planning in integrating flood risks. This approach was key in determining the fitness or capability of planning to integrate which is not possible by using descriptive statistics.

$$\boldsymbol{Depth\ Score\ (DS)_j = \left(\sum_{j=1}^{P_j} \frac{I_j}{2P_j}\right) * 100} \text{.....} \textit{Equation 1}$$

$$\boldsymbol{Breadth\ Score\ (BS)_j = (P_j/N) * 100} \text{ .....} \textit{Equation 2}$$

P_j is number of plans that address the j^{th} indicator. N is the total number of spatial plans in the study and I_j is the j^{th} indicator receiving scores on the 0–2 scale.

3.9 Objective 2: Translation of Flood Risk Concerns into Urban Adaptation

3.9.1 Adaptation Strategies and Programs in Kigali City

The analysis of adaptation strategies and programs in Kigali city was done using a content analysis approach as discussed in section **3.8.1** above.

3.9.2 Explicit Spatial Adaptation Project Evaluation

To evaluate the extent of explicitness of spatial adaptation, this study adopted the Logical framework Approach developed by Benson & Twigg (2007) for the International Federation of Red Cross and Red Crescent Societies. Logical framework Approach provide a chronology of steps/sequence and indicators that ought to be observed if any spatial adaptation project planning process was to adequately mainstream flood risk concerns. The Logframe is as discussed in section **2.5.** Table 3-3 provides the Logframe Analysis Framework.

Table 3-3: Logframe Analysis Framework

Steps	Description
Situational analysis	Explicit background vulnerability and risk assessment and observation of the risks throughout the planning process
Stakeholder Analysis	Disaster focused stakeholder interest identification for realistic planning objectives
	Inclusion of risk experts/technical personnel
	Inclusion of local community
	Appropriate identification of focus areas based on risk-levels
Problem analysis (cause and effect analysis)	The planning process should identify risk factors affecting the planning issue at hand.
	The causes and effects of hazards be well defined and the affected identified
	Role and impact of previous hazards/disasters are considered
	Appropriate vulnerability assessment done
	Use of appropriate Geo-spatial Tools and relevant data
Objective Analysis	Risk-informed strategic planning objectives/goals (positive statements of step 3 above)
	Connection of planning objectives with nationally/regionally determined strategies/programs
	Well defined SMART risk-informed objectives(R: Manageable/delegation)
Analysis of Alternatives	Risk-focused determination of planning alternative interventions
	Possible current Hazards/risks and or environmental impacts are well identified/assessed
	Hazard proofing measures in place or proposed for each alternative
	Possible future Hazards/risks and or environmental impacts are well anticipated, and scenarios created
	Vulnerabilities due to intentional or unintentional activities are well considered (eg diversion of water ways and possible blockages or flooding due to human activities)
Targets and indicator selection	Appropriate monitoring and evaluation indicators and criteria established to measure progress
	Indicators should be: specific& tangible; measurable in quantity/quality, time and location; easy and cheap to collect; relevant and reliable
	Realistic targets(capacity and time)
	Measures to counter maladaptive indicators (eg land prices vs gentrification)
Risk analysis and assumptions	Flood risk Scenario development
	Risk-based urban growth assumptions
	Review framework for assumptions (post-disaster)
Plan Implementation	Performance Monitoring framework
	Well defined performance indicators
	Post disaster review of adaptation strategies (redesign objectives, targets etc)
	Measures for uncertainties
	Participatory monitoring framework
Evaluation	Accurate assessment of risks assumptions
	Appropriate and cost-effective risk management
	Benefits and achievements of flood adaptation strategies
	How direct and indirect disasters may have affected the plan outputs
	If the future of the plan/city is threatened by anticipated risks
	If the flooding impacts were managed well by the plan
Adapted from Benson & Twigg (2007)	

3.10 Objective 3: Factors Influencing Regulatory Mainstreaming Flood Risk Adaptation in Kigali City

3.10.1 Effectiveness of Regulatory Mainstreaming Flood Risk Adaptation

This thesis adopted a framework of mainstreaming evaluation by Earthquakes and Megacities Initiatives, (2015). This framework was adapted because it is synonymous with the planning process for cities in the global south. Thus, "It follows the urban development planning process to ensure that flood Risk aligns with the broader aims of urban development. This way, development efforts are reinforced to withstand severe shocks from disasters that can derail a city's development trajectory. It is also anchored on the laws, regulations, policies and procedures that define how cities are governed, the mandates of each institution, and how policy and decisions are made on a day to day basis" (EMI, 2015, p. 4). Table 3-4 provides the regulatory mainstreaming evaluation framework.

Innovative Frequency Standardization Approach

In order to present the findings in a manner that enables easier decision making, this study found it necessary to support the qualitative findings with measurable results. Thus, quantifying the effectiveness of mainstreaming becomes important. Since this quantification of mainstreaming effectiveness has never been done before, this study applied a creative methodology. Due to the indicator based approach, the frequencies of each indicator under a given evaluation criterion (Missing=0, Implicit=1 or Explicit=2) were summed up, then standardized on a Min-Max scale of 0-1. Unlike the conventional approach of giving values to the performance of each indicator, which is normally subjective and sometimes unreliable, this study allowed all the representative figures to emanate from the data based on the actual existing context. To demonstrate, if an indicator, say Z, had a frequency of X across all the plans for the Missing score of 0, this indicator was standardized as shown in figure 3-3 This approach removes the bias that may arise due to subjective value allocation by a researcher. This limitation has been reported by the evaluation criteria in the 3As framework by Kumar & Geneletti, (2015). Tis is because the current plans in Kigali never made a deliberate effort to integrate flood risks for it to be evaluated on an actual value-based scale. Therefore, with this new approach, the final results are a true reflection of what the data analyzed could provide based on the indicator framework applied.

$$z = \frac{x - \min(x)}{\max(x) - \min(x)}$$

Figure 3-3.: Min_Max Frequency standardization

Where Z is the indicator whose frequency is being standardized,
X is the frequency of occurrence of Z for each of the evaluation criteria across the plans evaluated,
min(x) is the least possible frequency (which is zero in this study)
max (x) is the maximum possible frequency of occurrence (which is 8 in this study)

Table 3-4: Regulatory Mainstreaming Evaluation Framework

Dimensions	Description	Sub-dimensions	Indicators
Agenda setting	Overall preparations to jump start the planning and mainstreaming process.		-Stakeholder mapping -Project management team -Knowledge gaps identification -Data needs identification
Context Evaluation	The mainstreaming needs to have an adequate understanding of the	Socio-economic and environmental Analysis	-Review of literature (policies, previous plans..)

	status quo of the planning area and systems for effective decision making.		-Analysing emergency systems -Urban resilience analysis
		Urban flood analysis	-Flood mapping -Vulnerability assessment -Exposure assessment
		City flood risk profile	-Flood risk quantification -Flood risk matrices -Geographical risk levels and distribution -Flood risk maps
		Validation of situational analysis findings	-Multi-agency approach -Gaps identification -Analytical tools (problem trees, network analysis etc)
Risk-Informed Plan making	This entails a detailed process of the actual plan preparation and decisions made based on the findings of the situational analysis above.	Vision setting	-Urban development vision -Flood resilience vision
		Strategy prioritization	-Land use concepts -Urban flood resilience models -Funding identification
		Projects identification	-Urban development projects -Flood risk adaptation projects -Budgetary indications
		Role distribution	-Stakeholder per project -Timelines -Budgetary commitment
Implementation, monitoring and evaluation	Once the flood risk mainstreamed plan has been prepared, the actors in question should take due diligence to implement, monitor and evaluate the final outcomes relative to the set expectations.	Implementation	-Well defined timelines (e.g. 5years cycles)
		Monitoring and evaluation	-Well defined mainstreaming indicators -Assessment frameworks
Adapted from Earthquakes and Megacities Initiative, (2015)			

3.10.2 Barriers and Drivers to Regulatory Mainstreaming

To analyze the barriers and drivers to regulatory mainstreaming, a framework by Runhaar et al., (2018) was used. In this framework, Runhaar et al., (2018) conducted a systematic evaluation of over 140 urban plans, NAPAs, Municipal plans in an attempt to identify what constitutes effective mainstreaming of climate change adaptation. The relevance of this framework is informed by the fact that it addressed a good representation of policies and plans across the developed, developing and least developed countries. Furthermore, it focused on what was more realistic across board for purposes of arriving at legitimate conclusions. Countries like south Africa, Mozambique, Tanzania, Kenya and Malawi, all with similar flooding and other climate challenges like Kigali city (Rwanda), the case study of this thesis.

Worth noting is that, the framework by Runhaar et al., (2018) only analyzed secondary data in determining what works for effective mainstreaming. However, after reviewing the urban plans of Kigali, this study realized the plans were not strong in distinguishing the challenges to mainstreaming apart from just the conventional topographical and environmental issues. Therefore, in combining data from both the urban plans and key informant interviews, this study builds upon the adapted framework by Runhaar et al., (2018)

in providing a holistic understanding of both the extent of mainstreaming, and what the key informants perceive as the influencing factors (barriers and drivers). Table 3-5 provide the drivers and barriers evaluation framework.

Table 3-5: Barriers and Drivers Framework

Barriers and Drivers	Description	Indicators
Political factors	The process mainstreaming depends a lot on external support that is mostly pollical. Besides, planning itself is a political process that's highly participatory, calling for enabling political ambience. If the key decision makers/influencers aren't for the concept, the process and its outcomes may not meet the expected solutions to the contemporary climate challenges.	• Conflicting interests • Political commitment • Community awareness or support • Policy (in)consistency / (in)congruence across levels (local, national, EU) • Inflexible legislative and policy contexts • Political (in)stability, political patronages, corruption, political short-termism interrupting continuity in actions and strategies
Organisational factors	Mainstreaming climate change adaptation occurs within a system or organizations. The set-up and structuring of the organization determines the success and or failure of the mainstreaming process.	• Formal requirements to develop adaptation plans/ make arrangements (top-down) • Supportive regulative framework (i.e. supportive legislation, regulation) • Expanded mandates and statutes • Coordination and cooperation between departments within a policy sector and across policy domains • Coordination among policy levels • Cooperation with private actors and citizens • Clarity about responsibilities for adaptation / problem ownership • Institutional fragmentation / complexity • Organisational structures, routines and practices • Leadership / policy entrepreneurs
Cognitive factors	The plans and those responsible need a great level of intellectual ability on both current and foreseeable future climate change dynamics.	• Awareness • Uncertainty • Sense of urgency • Learning
Resources	Indeed the mainstreaming process needs inputs in terms of funds, experts, information, data among other factors.	• Availability of staff • Available financial resources • Subsidies from higher levels of government • Availability of and access to knowledge and expertise (i.e. insight into local impacts/difficulties in translating climate change to the local level, insight into possible adaptation

		measures; understanding climate change science and impacts) • Information and guidance
Characterisation of the adaptation problem at hand	The definition of the problem enables appropriate decision making. The projects to be mainstreamed need good planning and coherence with other projects too.	• Framing and linking to sectoral objectives • Conflicting timescales • Narrowly defined adaptation objectives
Timing	When preparedness meets opportunity, possible positive results can be expected. Does the plan and the institutions make timely decisions and at the most opportune time?	• Waiting and sustaining momentum for climate adaptation • Focussing events (i.e. extreme weather events) • Windows of opportunity
Adopted from: Runhaar et al., (2018)		

Table 3-6: Research Matrix

Sub-objectives & Questions	Data collection	Collection tools	Data analysis	Data source
Objective 1. To Assess the Fitness of Urban Planning in Integrating Flood Risk Adaptation in Kigali City.				
i)What policies and spatial plans influence development in Kigali city?	Literature Key informant interviews	Desktop research Internal documents Semi-structured interviews	Descriptive Analysis Content/thematic analysis	-Vulnerability/risk assessment reports -National or city plans -Relevant Policy documents(CCA plans/strategies/projects) -Key Informants
ii)To what extent has urban planning integrated flood risk adaptation in Kigali city?	Secondary sources	Semi-structured interviews Internal documents	Content/thematic analysis Qualitative analysis 3As framework	Spatial planning experts Environmental professionals Secondary sources (CCA plans/strategies/projects) Urban plans
Objective 2: To Analyze how Flood Risk Concerns are Translated Into Urban Adaptation In Kigali City.				
i) What are the flood risk adaptation strategies in Kigali city?	Key informant interviews Literature review	Semi-structured interviews Internal documents	Content/thematic analysis Qualitative analysis/ Descriptive Analysis	National Spatial Planning agencies City urbanl planning department and officials Urban planning experts Environmental professionals Secondary sources (urban plans/strategies/projects)
ii)How explicit have spatial adaptation projects integrated flood risk in Kigali city?	Key informant interviews Literature review	Semi-structured interviews Internal documents	Content/thematic analysis Logframe framework	City Spatial planning department and officials Spatial planning experts Environmental professionals Secondary sources (Spatial plans/strategies/projects) Vulnerability/risk assessments
Objective 3. To Identify Main Factors Influencing Regulatory Mainstreaming Flood Risk Adaptation In Kigali City				

i) How can the effectiveness of regulatory mainstreaming flood risk adaptation be evaluated in the context of Kigali city?	Key informant interviews Literature review	Semi-structured interviews Secondary data	-Content/thematic analysis - Descriptive analysis -Standardized frequencies	City Spatial planning department and officials Spatial planning experts Secondary sources (Spatial plans/strategies/projects)
ii) What are the main drivers and barriers to the mainstreaming of flood risk adaptation into urban plans in Kigali city?	Key informant interviews Literature review	Semi-structured interviews Secondary data	-Content/thematic analysis -Qualitative Analysis	Kigali City urban planning department and officials urbanl planning experts Secondary sources (urban plans/ projects)

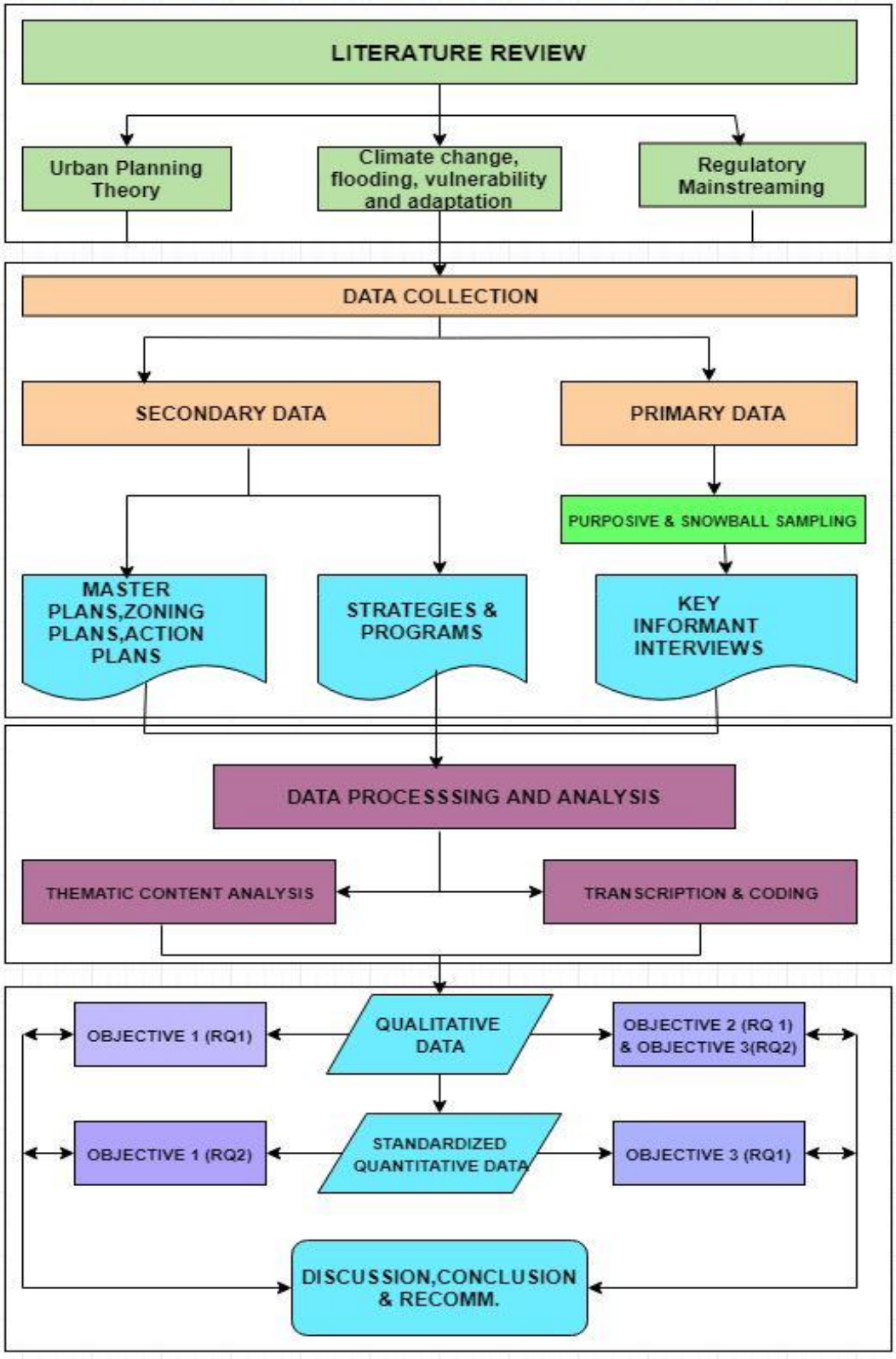


Figure 3-2: Methodological work flow (Author, 2018)

3.11 Ethical issues

The study sought the consent of the respondents before engaging them. Specifically, the researcher disclosed the purpose of the study as being academic and not for commercial use. Also, the respondent's anonymity was assured, and no recording done without the respondents' acceptance.

4 RESULTS

4.1 Overview

The main objective of this thesis was to determine both the efficacy of regulatory mainstreaming flood risk into urban planning and the factors influencing this process in terms of barriers and drivers. This chapter presents analytical findings of the study various research questions explored.

4.2 Objective 1: To Assess the Fitness of Urban Planning in Integrating Flood Risk Adaptation in Kigali City.

This objective analyses policies and urban plans influencing development in Kigali and urban planning fitness in integrating flood risk challenges. Characterizing the nature of urban planning processes is important because it enables us to understand whether climate change is an overarching theme or not. Absence of climate change and flood resilience in urban planning processes limits the final plan outcomes and outputs from addressing climate change adaptation issues.

4.2.1 Policies and Urban Plans Influencing Development in Kigali City

Urbanization is a new concept in Kigali city and Rwanda at large (MINIFRA, 2015). The 1994 genocide in Rwanda was followed by rapid rural-urban migration which led to indiscriminate yet haphazard informal development in Kigali city, thereby negatively impacting the quality and direction of planning/development. The national government therefore took several measures to control unsustainable urban growth. Since comprehensive development guidelines were lacking, several spatial policies proposing various urban development guidelines were formulated to be implemented by city and district authorities.

a) **Rwanda Vision 2020**

Rwanda's urban policy and plans have undergone various transformations since early 2000s. At the helm of this agenda was the Rwanda Vision 2020 that projected population growth of up to 30-35% by 2020. Rwanda vision 2020 provides the country's long-term development agenda focusing on poverty eradication, participatory development, and formulation of sectoral plans (including urban planning) to guide holistic development etc. The vision is anchored on six pillars cutting across governance, capacity building, infrastructure and private-sector focused economic development, agro-economics and regional development cohesion and integration. Of key interest is the focus on environmental and sustainable conservation that contributes to climate change adaptation and flood risk management through afforestation and ecosystem conservation initiatives. Rwanda vision 2020 provisions have influenced urban planning and development in Kigali for they are implicitly addressed in the KCMP 2013 and the district development zoning plans. On the contrary, key informants report negative impacts on flood risk adaptation through private-sector led economic development because varying investor priorities undermine coherent development goals in the city, expropriating private land for infrastructure development is costly, and investing in flood management is deemed uneconomical by private sectors and is not mandated.

b) Land Use Plans and Climate Change Adaptation.

Rwanda has land use and development plans at multiple scales across the country. Nationally, the Rwanda National Land Use and Development Master Plan (NLUDMP) (2010) determines large scale future plans, overlays and national level zoning. District level authorities have District Land Use Plans (DLUPs) and District Development Plans (DDPs) listing development goals for smaller areas across the city. Within more centralized areas, urban land use master plans are designed to guide the growth of urban areas and address common challenges facing them. At each level of planning, climate change adaptation measures are majorly implicitly evident, and their strength, implementation and ultimate objectives vary.

i) **The National Land Use and Development Master Plan and Adaptation**

The NLUDMP has identified climate change as a current and future threat to development, local livelihoods, plus investments in infrastructure, agriculture, and business. The plan even cites climate projections as a way of recognizing that current risks will pose larger threats in the near future. Recognizing these threats and citing floods, landslides and droughts as primary impacts, the plan prioritizes protecting water and energy access for rural and urban populations and calls on districts to incorporate climate change

adaptation measures in DDPs. The plan does not provide specific recommendations/guidelines to promote climate change adaptation in DDPs however, throughout the plan there are actions and provisions for land use, building and development with indirectly cited climate change adaptation implications.

Specifically, the NLUDMP provides maps identifying vulnerable areas, including areas prone to erosion and flooding and areas with settlements on steep slopes above 20% grade. For each map and environmental issue, the plan also provides narrative on interventions and guidelines to mitigate risks and requirements to implement the DDPs such as limiting development on steep slopes. The plan outlines land types, areas to prioritize reforestation programs and tree species appropriate for erosion and slope control. In terms of hazard events, the NLUDMP established the first call for an early warning system and disaster management elements within DDPs (but not adaptation).

Finally, land use and/or tenure implications of climate change adaptation within the NLUDMP are focused on displacement and corresponding effects on land rights. It cites successes and opportunities emerging from the land sharing programs and settlement policies, seeing formation of grouped settlements as an opportunity to better provide services outside of disaster areas. Simultaneously, the NLUDMP emphasizes that sustainable land use planning should prioritize onsite physical improvement and mitigation efforts to minimize relocation. The NLUDMP tries to strike a balance between improvement and adaptation measures (when resources are available through public subsidy and incentives) and relocation to safer areas less vulnerable to climate change risks.

ii) District Level Land Use Plans (DLUPs) and Adaptation

Districts in Kigali city have been using District Development Plans to set goals and objectives in five-year plans. However, measures are in place to merge DLUPs with District Development Plans (DDPs) to form an Integrated District Development Plan (IDDP) laying out land use and development goals for each District. The IDDP provides a framework that informs urban master plans within each District. Finally, master plan implementation is further outlined in more detailed small area action plans. Sector specific plans, or target area plans, are developed as needed to address specific challenges within smaller areas. For example, Kigali developed small area informal settlement plans in low income neighborhoods to address specific issues identified by the community as priority concerns and to improve housing and service provision.

In the current DDPs, environmental and sustainability elements were included within each plan as part of a national directive within the MINIRENA "Five Year Strategic Plan for the Environment and Natural Resources (2014 - 2018)." Under the requirement, climate change, within a "Environment, Climate Change and Disaster Management" section, must be included in cross cutting issues to be addressed to promote long-term sustainable development. Few plans include actionable items to promote adaptation, including: increasing forest cover to prevent erosion against heavier rainfall or allocating budget to address environmental issues and prevent climate related disasters. Most plans have vague measures to mainstream climate change through non-specific activities. As a first attempt to include climate change adaptation, all DDPs are required to acknowledge climate change as a barrier to development, manifested through an increase in disaster events.

iii) Kigali City Master Plan and Adaptation

Kigali City Master Plan (KCMP) (2013) stands as the model of urban planning in Rwanda, providing an example by which to design master plans for six other secondary cities, a process started in late 2014. It doesn't explicitly mention climate change adaptation (or greenhouse gas mitigation), but includes objectives and actions indirectly addressing climate impacts, namely flooding, erosion, and landslides. KCMP also seeks to make Kigali a city of "enchanting nature and biodiversity." Through this, KCMP sets targets relating to climatic impacts, but climate change adaptation isn't cited as the rationale for their adoption.

Roughly, wetland cover about 14% in the Kigali City, with many low lying areas adjacent to or in wetland borders. Some high use areas are near enough to wetlands to be extremely vulnerable to flood events, including the Nyabugogo Bus Depot, for example. To address flooding, the KCMP sets a target of being flood free against a 50 year flood and plans to identify low and high risk areas within the floodplain, corresponding to 100 year and 20 year flood boundaries. The plan also sets buffer zones around wetlands and water bodies that correspond to buffers set in the Organic Law on the Environment (2005) with native vegetation in the buffer zone (20 meters around wetlands, 10 meters around rivers and 50 meters around

lakes). With Kigali City officials anxious to bring businesses and jobs to the city, there have been occasions when higher impact uses have been approved within the buffer zone and even within the wetland itself, resulting in lost revenue during floods, as well as the loss of ecologically valuable wetlands. Measures to reduce flood risks within the KCMP could be strengthened by strict adherence to rigid boundary delineations.

The plan also outlines limited use in protected areas, with regulatory control provided within the zoning code. The zoning code allows limited low impact use (10% of parcel area) within protected areas designated as 'P4' zones, which include wetlands, forests and rivers. Within these zones, conditional uses are allowed upon approval by the city's planning review panel in the One Stop Center. While protections do exist within the plan and the zoning code for wetlands and other flood vulnerable areas, unauthorized uses still occur within these areas, evident in the fact that the plan also includes actions to remove settlements from these areas. Enforcing limited use within these areas will reduce the number of livelihoods at risk from flood events. On the contrary, limiting use also reduces the number of livelihoods derived from the area, requiring public intervention and funds to resettle people in areas that are affordable and provide satisfactory livelihood opportunities.

While the KCMP has measures that protect against some of the primary climate-related impacts, it fails to acknowledge climate change as an increasing threat and cause of environmental issues and extreme disasters events. With climate projections indicating increasing frequency and intensity of disaster events and ongoing environmental issues, there is no evidence within the KCMP to suggest that the city is preparing for these increases in climate change impacts. With limited resources to enforce the plan and ensure land use is in accordance with zoning regulations, communities continue to reside and cultivate in vulnerable areas. Relocation of vulnerable communities may depend on when the next extreme event occurs or on slow public intervention as resources to compensate or resettle those expropriated come available. Figure 4-1 depicts the proposed urban development concepts for Kigali city.

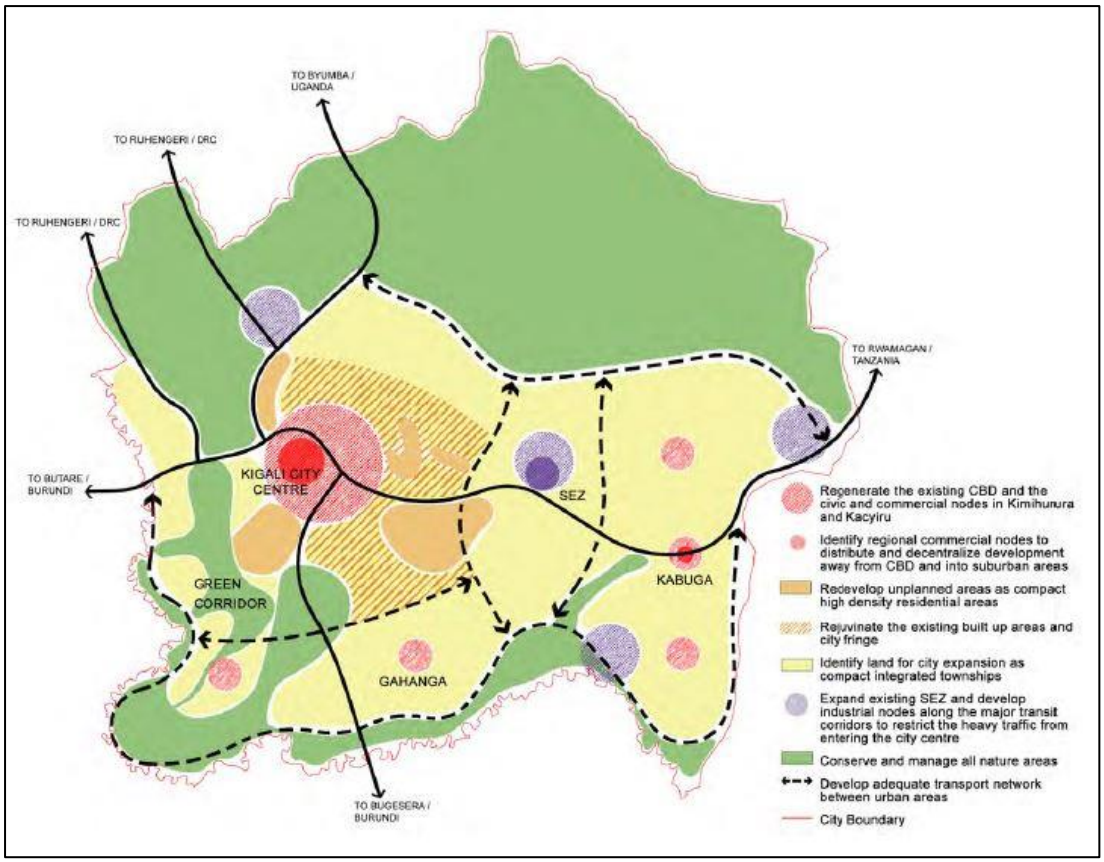


Figure 4-1: Kigali City Conceptual Design (source: KCMP 2013.)

Synthesis

Based on the findings, urban plans could benefit from incorporating climate change projections and related impacts into long term plans to guide land use, settlement, economic growth, infrastructure and environmental protection areas. By neglecting the use of climate data to inform the design of land use master plans, Kigali risks missing opportunities to match growth and land use objectives with climate change projections.

Urban plans in Rwanda are structured hierarchically with directives ranging from the national to district governments. This form of planning structure has its pros and cons when it comes to mainstreaming climate change adaptation. on the positive side, it becomes easy to develop a multi-sectoral mainstreaming framework in a multi-agency approach when formulating national land use guidelines to be implemented by the lower levels. This makes it possible to achieve coherence and harmonization of development agenda and adaptation targets. However, it is only achievable if the national planning framework makes evidence-based proposals informed by research and inventory of the local contextual challenges to planning with respect to climate change.

On the negative side, a rigid top-down planning directive can fail to explicitly address climate change at all levels. Since it is difficult for lower administrative units to change the proposed planning framework, if the national guidelines missed to focus on climate change, the same gap can trickle down to the neighbourhood level. As demonstrated in Kigali city, the evident lack of explicit integration of climate change concerns in the national and district plans can have negative impacts by increasing vulnerability, risks and reducing coping capacities of both urban land uses and urban dwellers.

4.2.2 Extent of Urban Planning in Integrating Flood Risk Adaptation in Kigali City.

Overall Performance Per Plan

According to the 3As evaluation criteria, all the plans can achieve scores ranging from 0-60 given a minimum and maximum score of 0 and 2 respectively, per indicator for the total 30 indicators in the evaluation framework. Scores were then standadized such that a maximum score of 60 equals a standardized score of 1. From the 3As components (Awareness, Analysis and Action) analysis, the plans scored between 0-0.67 (Figure 4-2). The maximum scores for the Awareness, Analysis, and Action components were 0.5, 0.59 and 0.67, respectively. Since the 3As component analysis was characetrizied per plan, the scores indicate a weak performance across the planning jurisdictions. Of the evaluated plans, P1 and P2 depicted the highest performance based on overall scores for the 3As components (Figure 4-2).

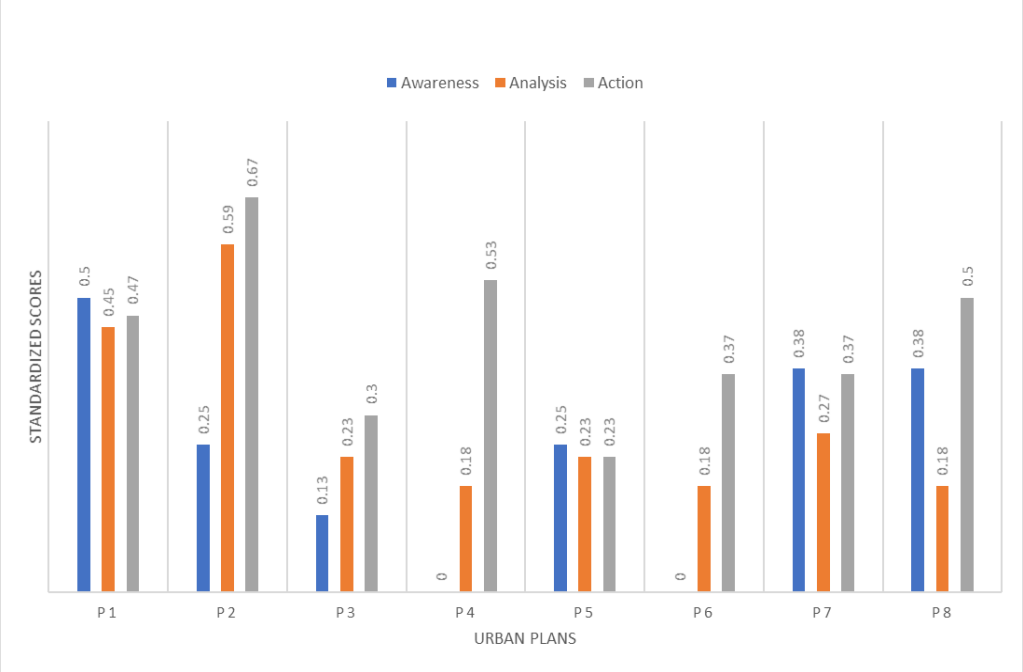


Figure 4-2 : Overall Performance of the Plans (Source: Author, 2018)

NOTE 1: P1:Kigali city Master Plan; **P2**:Kigali District Development plan; **P3**:Nyarugenge Master Plan; **P4**: Nyarugenge Zoning Plan; **P5**:Kicukiro Master Plan; **P6:** Kicukiro Zoning Plan; **P7:** Gasabo Master Plan; **P8:** Gasabo Zoning Plan

Despite the poor overall performance of the 3As components, Action component for the plans generally had a higher score (0.67) for P2 alluding to capable measures towards flood risk management in the city such as nature and biodiversity conservation, prohibiting development on steep slopes, storm water management and wetlands management strategies. Furthermore, across all the plans, indicators of flood management integrated into urban planning had high scores of 87%, 81% and 66% for conservation of parks, forest and natural and protected areas; infill developments; and green infrastructure and low impact developments, respectively. However, low scores in the Analysis components (0.18-0.59) confirms that the proposed flood risk management measures were not made based on real evidence from local assessments (see table 4-2).

Performance by Components Across all Plans

The overall performance of the 3As components indicators were calculated across all plans and Figure 4-3 summarizes the distribution of each component. Average indicator scores ranged between 24-43%, with the action component depicting the highest mean score. An overall 24% score indicates low awareness in tackling flood risk. Average indicator scores of above 75% demonstrates an excellent consideration of the Awareness component of the planning process (Preston, Westaway, & Yuen, 2011). Incidentally, the KCMP 2013 had the highest awareness score as compared to the other development plans yet they were prepared in the precursor of CoK vision and mission. A low Analysis component score (29%) across the plans indicates that analysis stage of the planning processes didn't consider flood risk challenges such as flood risk assessments and flood scenarios for effective decision making. Despite the highest average score of the action component (43%), about 50% of the analysed city level plans had scores below the mean. The KCMP 2013 has numerous proposed activities to address flooding in Kigali, however the lack of risk assessments makes the proposals remain hypothetical

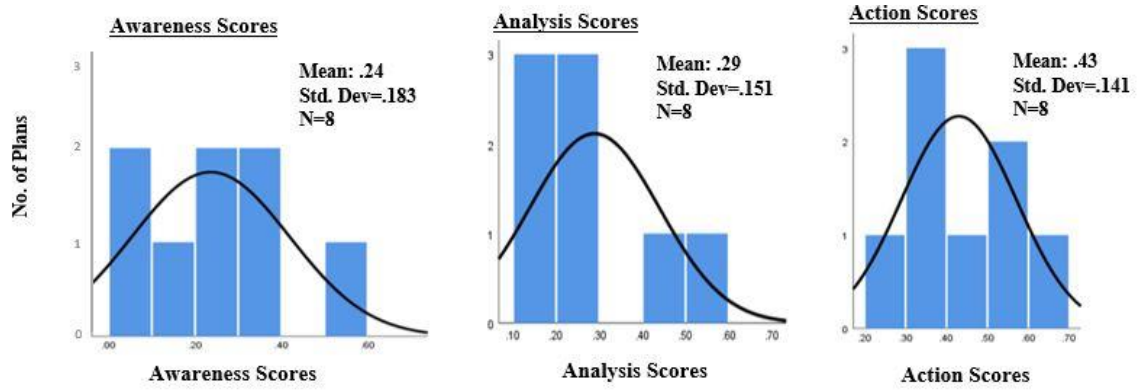


Figure 4-3: Distribution of overall performance of the 3As components indicators across all plans (Source: Author, 2018)

Planning Quality Evaluation: Breadth and Depth Scores

Breadth scores depict how all the plans considered a particular criterion in the planning process. If all the plans factored flood risk actions explicitly, a score of 100% would be achieved. On the other hand, the significance given to each indicator across the plans is depicted by high depth scores. Form the analysis, none of the indicators had maximum scores. For instance, the awareness component had breadth and depth score of 75% and 37.5% for the adaptation guidelines. Incidentally, nothing was done with reference to the prediction of climate impacts leading to breadth and depth scores of zero (Figure 4-4).

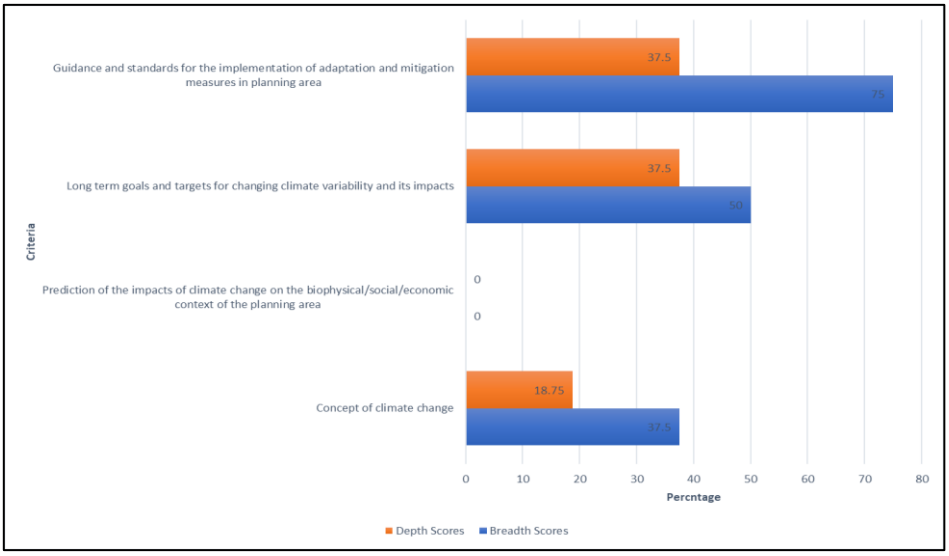


Figure 4-4: Awareness Component Breadth and Depth Scores (Source: Author, 2018)

The Analysis component is the most critical one after Awareness because it offers relevant contextual evidence to guide the Action component thereby keeping proposals in touch with reality. Despite having impressive breadth scores of 100% in the engagement of relevant stakeholders and definition of roles (Figure 4-5), most of the plans did not comprehensively address 75% of the indicators of evaluation. All the respondents alluded to lack of relevant data, experts and financial capacity to conduct the additional risk assessments when preparing the plans. Furthermore, the lack of a common sense of ownership may limit this aspect of criteria due to lack of commitment and prioritization.

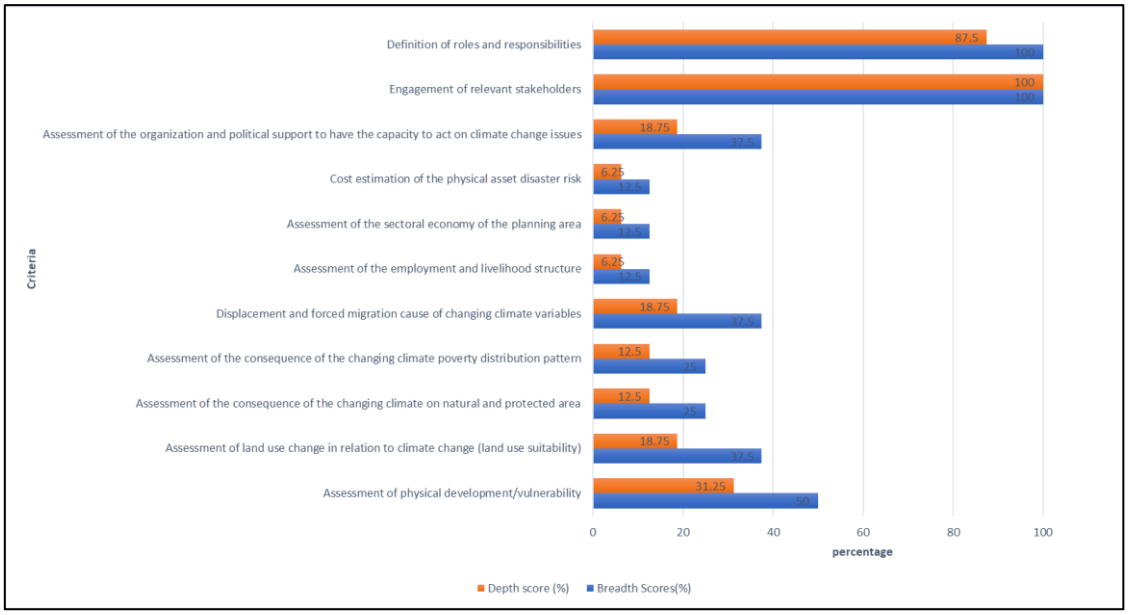


Figure 4-5: Analysis Component Breadth and Depth scores (Source: Author, 2018)

For the Action component, most of the plans had fairly good breadth and depth scores indicating how much planning tried to factor flood risk concerns. Above 50% of the evaluation criteria had breadth scores of 100% (Figure 4-6). This implies all the plans made efforts to propose actions towards flood risk adaptation such as infill development and conservation of nature and biodiversity. However, all the plans had depth scores below 50% an indication of how they didn't significantly consider flood risk adaptation in the planning process.

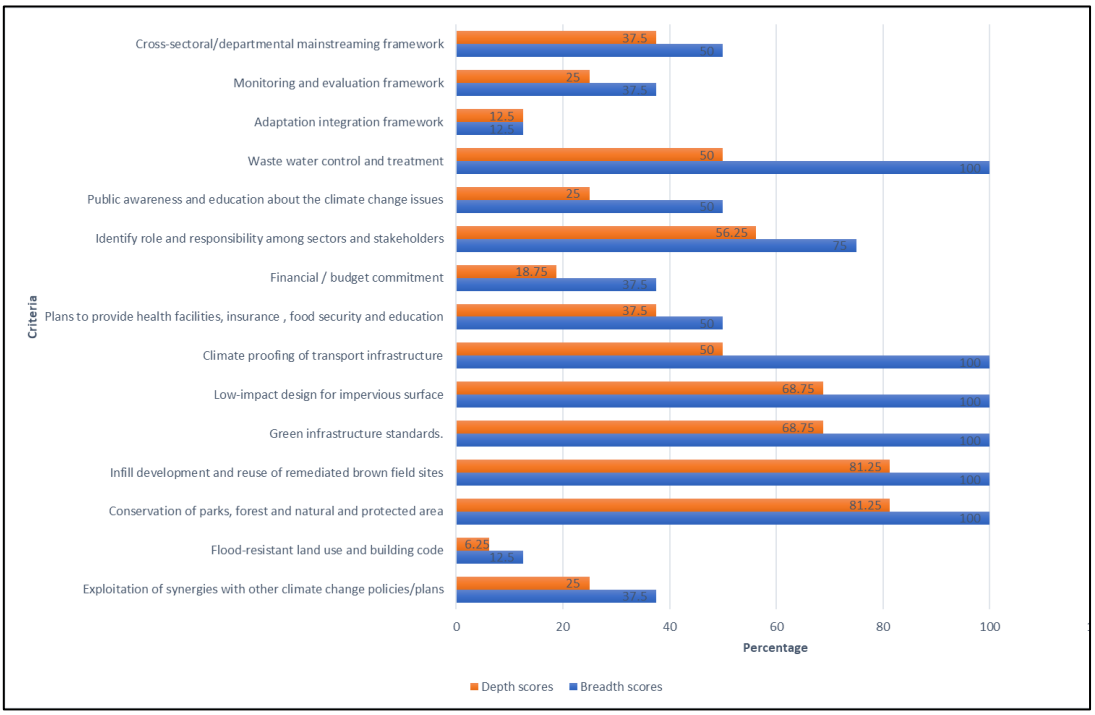


Figure 4-6 : Action Component Breadth and Depth Scores (Source: Author, 2018)

Summaries of Fitness Performances

— Summary of Criteria Performance Across the Urban Plans

Figure 4-7 depicts the overall standardized scores per indicator as per the evaluation criteria. Out of the possible score of 16 (equivalent of standardized score of 1), only criteria CAN14 had a maximum score. This implies not all the evaluation criteria were comprehensively addressed across all the evaluated plans. This limited inclusion of the evaluation criteria in the planning shows how climate change (flood risks) were never a major concern in Kigali. As per the key informants' responses, this dismal performance was informed by the fact that the actors in the planning process had limited cognitive ability about climate change issues. Furthermore, flood risks have never been identified as a component of climate change since most of the plans focus on storm water management. Moreover, the proposed adaptation measures like bioretention swales and buffers were never evidence based since neither flood risk assessment and flooding scenarios were developed to establish the potential vulnerability and risk levels for effective interventions.

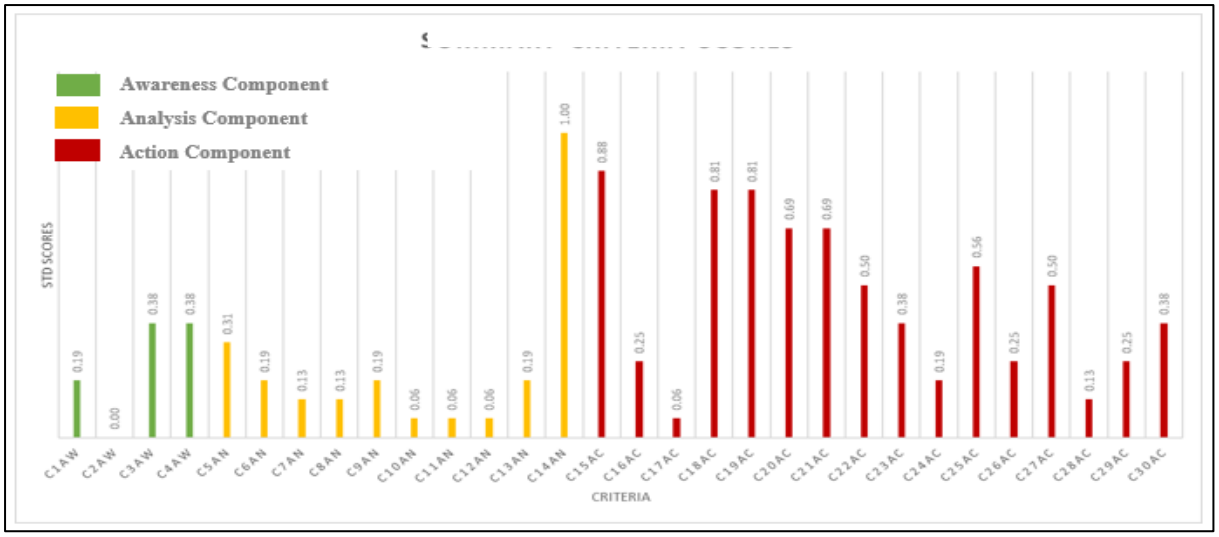


Figure 4-7: Performance Per Criteria (Source: Author, 2018).

— **Summary of the 3As Performance**

It is expected that good integration of climate change concerns should lead to maximum scores of the individual components of the 3As. That would mean the awareness, analysis and action were well addressed throughout the analyzed plans leading to a 100% score. However, from the analysis, no component of the 3As had a score of above 50%. Of the three, the Action criteria scored about 42.92%, followed by Analysis at 28.98% and lastly Awareness at 23.43% (Figure 4-3). This indicates by the time the plans were being prepared, perhaps the level of sensitivity towards climate impacts was low or the current flood risk challenges were not a major concern. The overall performance of all the plans analyzed stood at 35.21%.Table 4-1 summarizes the scores discussed.

Table 4-1: 3As Component Performance

Component (in all plans)	Std. Score
Awareness	0.23
Analysis	0.29
Action	0.43
Overall performance (all plans)	0.35

The Min-Max score was 0-1 after standardization (Source: Author, 2018)

Synthesis

The above results show how the urban plans of Kigali city have not given flood risk adaptation the focus it deserves. An overall score of 0.35 leaves a lot to be desired. This is even critical as the implementation of the proposed measures is not assured. Following the scores shown in Figure 4-3, there's need for improved awareness, analysis and action. Besides, the breadth and depth of considering climate change needs significant focus across all the plans. As observed by 80% of the key informants, perhaps an improvement in capacity building (experts), budgetary allocations and harmonization of regulations coupled with collective responsibility could aid alleviate the situation.

Much as urban planning has performed dismally in integrating flood risk adaptation, this scenario is contrary to what the key informants reported. All the key informants interviewed indicated some level of awareness of climate change impacts like flooding and the need to include them into urban planning. However, it may be suggested that this high level of awareness has been brought about by the increasing climate change impacts in the recent past, yet the plans were made earlier. As the key informants allude, future planning should be risk-informed, and measures are already in place as evident by the inclusion of aa climate change focused discussion group in the current master plan review process.

The most critical aspect of the above analysis is in its simple approach to demonstrate the state of planning in integrating climate change adaptation. The scores above are a representation of the findings from the evaluated plans thus, should not be ruled as ultimate judgement or conclusion. Other approaches may as well be used to do the evaluation and arrive at either similar or different results.

Table 4-2: Evaluating Fitness of Urban Planning in Integrating Flood Risk Adaptation

COMPONENT	CRITERIA/INDICATOR	SCORES										
		P1	P2	P3	P4	P5	P6	P7	P8	Std. score	Depth (%)	Breadth (%)
Awareness	Definition of and vision for climate change adaptation (C1AW)	1	1	0	0	0	0	1	0	**0.19**	18.75	0
	Prediction/projection of the impacts of climate change on biophysical/social/economic context of the planning area(C2AW)	0	0	0	0	0	0	0	0	**0.00**	0	0
	Long term goals and targets for changing climate variability and its impacts (C3AW)	2	0	0	0	1	0	1	2	**0.38**	37.5	25
	Guidance and standards for the implementation of adaptation and mitigation measures in planning area(C4AW)	1	1	1	0	1	0	1	1	**0.38**	37.5	0
Analysis	Assessment of physical development/vulnerability(C5AN)	1	1	2	0	1	0	0	0	**0.31**	31.25	12.5
	Assessment of land use change in relation to climate change (land use suitability) (C6AN)	1	1	0	0	0	0	1	0	**0.19**	18.75	0
	Assessment of the consequence of the changing climate on natural and protected area (C7AN)	1	1	0	0	0	0	0	0	**0.13**	12.5	0
	Assessment of the consequence of the changing climate poverty distribution pattern (C8AN)	1	1	0	0	0	0	0	0	**0.13**	12.5	0
	Displacement and forced migration cause of changing climate variables (C9AN)	1	1	0	0	0	0	1	0	**0.19**	18.75	0
	Assessment of the employment and livelihood structure(C10AN)	0	1	0	0	0	0	0	0	**0.06**	6.25	0
	Assessment of the sectoral economy of the planning area (C11AN)	0	1	0	0	0	0	0	0	**0.06**	6.25	0
	Cost estimation of the physical asset disaster risk (C12AN)	0	1	0	0	0	0	0	0	**0.06**	6.25	0
	Assessment of the organization and political support to have the capacity to act on climate change issues (C13AN)	1	1	0	0	0	0	1	0	**0.19**	18.75	0
	Engagement of relevant stakeholders (C14AN)	2	2	2	2	2	2	2	2	**1.00**	100	100
	Definition of roles and responsibilities (C15AN)	2	2	1	2	2	2	1	2	**0.88**	87.5	75

Action	Exploitation of synergies with other climate change policies (C16AC)	1	1	0	0	0	0	2	0	**0.25**	25	12.5
	Flood-resistant land use and building code (C17AC)	0	1	0	0	0	0	0	0	**0.06**	6.25	0
	Conservation of parks, forest and natural and protected area (C18AC)	1	2	1	2	1	2	2	2	**0.81**	81.25	62.5
	Infill development and reuse of remediated brown field sites (C19AC)	1	2	1	2	1	2	2	2	**0.81**	81.25	62.5
	Green infrastructure standards. (C20AC)	1	1	1	2	1	2	1	2	**0.69**	68.75	37.5
	Low-impact design for impervious surface (C21AC)	1	1	1	2	1	2	1	2	**0.69**	68.75	37.5
	Climate proofing of transport infrastructure (C22AC)	1	1	1	1	1	1	1	1	**0.50**	50	0
	Policies to provide health facilities, insurance, food security and education (C23AC)	2	2	0	1	0	0	0	1	**0.38**	37.5	25
	Financial / budget commitment (C24AC)	1	1	0	0	0	0	1	0	**0.19**	18.75	0
	Identify role and responsibility among sectors and stakeholders (C25AC)	1	2	0	2	1	1	0	2	**0.56**	56.25	37.5
	Public awareness and education about the climate change issues (C26AC)	0	1	1	1	0	0	0	1	**0.25**	25	0
	Waste water control and treatment (C27AC)	1	1	1	1	1	1	1	1	**0.50**	50	0
	Adaptation integration framework (C28AC)	2	0	0	0	0	0	0	0	**0.13**	12.5	12.5
	Monitoring and evaluation framework (C29AC)	1	2	1	0	0	0	0	0	**0.25**	25	12.5
	Cross-sectoral/departmental mainstreaming framework (C30AC)	0	2	1	2	0	0	0	1	**0.38**	37.5	25
Cumulative scores		28	35	15	20	14	15	20	22			
Standardized scores		**0.46**	**0.58**	**0.25**	**0.33**	**0.23**	**0.25**	**0.33**	**0.37**			

NOTE 1: P1:Kigali city Master Plan;**P2**:Kigali District Development plan;**P3**:Nyarugenge Master Plan;**P4**: Nyarugenge Zoning Plan;**P5**:Kicukiro Master Plan;**P6:** Kicukiro Zoning Plan;**P7:** Gasabo Master Plan; **P8:** Gasabo Zoning Plan

NOTE 2: 0=criteria Missing;1=Criterial Mentioned but not explained;2=Criteria Mentioned and discussed

NOTE 3: Standardised scores range from 0-1 with 0 denoting poor performance and 1 best performance of indicators and plans

4.3 Objective 2: To Analyze how Flood Risk Concerns are Translated into Urban Adaptation in Kigali City

This objective was addressed in two sections: First, an analysis of adaptation strategies/programs, and second, an evaluation of how explicit spatial-adaptation project was in Kigali city.

4.3.1 Climate Change (Flood Risk) Adaptation Strategies in Kigali City

As a result of the conventional planning methodologies, flood vulnerability and risks were not addressed as needed (Key Informant,2018). Thus, some dedicated adaptation strategies have been put in place, which although designed without climate change adaptation in mind can unintentionally help make Kigali more adapted to climate change.

Climate change adaptation strategies in Kigali fall under two main categories: those that are Nationally determined and city level strategies determined by the CoK itself. The adaptation strategies are depicted in the NAPA, Strategic Program for Climate Resilience (2017), Green Growth and Climate Resilience Strategy, (2011), Forest Investment Program (FIP) 2015, Building codes and sectoral laws identified below. Adaptation strategies are long-term in nature and some of them have been implicitly addressed in the urban plans.

i) Strategic Program for Climate Resilience (2017)

The Strategic Program for Climate Resilience (SPCR) is the latest ambitious strategy aiming at promoting risk-sensitive planning in Rwanda and its towns. One of the most relevant programs in the strategy is that on climate resilient human settlements. This program is focused on promoting residential risk reduction and adaptation to climate change impacts that include rising temperature and flooding. The program also endeavours to promote preparedness for and the responses to increased precipitations and floods in all the towns. On the same note, the programs shall promote climate resilient infrastructure like roads and bridges and address cross sectoral climate change challenges. This bold move in Rwanda is a positive indicator on the rising awareness and urgency to address climate change issues at strategic and local levels in Kigali. To promote coherence and better coordination, the SPCR has been harmonized with the FIP. This implies adaptation strategies and projects shall be arrived at in a well-coordinated way that reduces conflicts. Having been planned to be implement in a process synonymous to urban planning process, both the FIP and SPCR will most likely promote effective spatial adaptation in the city of Kigali. Budgetary indications have been made with the SPCR expected to cost about $160,000,000 for its four main components that include: climate-sensitive spatial planning and land use, resilient storm water management, sustainable waste water management and resilient urban infrastructure. Successful implementation of these proposals, more so through Kigali urban plans will be a major boost in the strive towards risk-sensitive urban planning and resilience.

ii) Green Growth Climate Resilient Strategy (GGCRS), 2011

GGCRS 2011 proposes 14 critical programs, five of which focus on low carbon growth, adaptation and disaster management at all spatial levels. It advocates for urban green growth through developments that minimize both ecological footprints and carbon emissions. Synergistically, GGCRS has double impacts of both reducing carbon emissions and promoting flood management through ecosystem-based adaptation like forestry and nature conservation. As an approach to low footprint development, eco-tourism has the potential to improve water infiltration during rains and reduce surface run-off and the subsequent flooding. Thus, an effective implementation of the program will in the long run contribute to mainstreaming climate change adaptation in Kigali city.

Flooding and landslides are common in Kigali given its topographical characteristics. Thus, the GGCRS advocates for measures managing disasters and diseases. GGCRS promotes risk assessments and mapping in vulnerable areas and introduction of disaster objectives into urban planning, buildings and infrastructure developments in Rwanda. GGCRS also calls for community-based adaptation strategies in risk reduction by employing contextual methodologies to improve the resilience of the local population. Much as these strategies are worth emulating in the contemporary urban planning, they are not explicitly reflected in the urban plans.

Realizing the objectives of GGCRS is stifled by numerous constraints such as lack of development space in Kigali due to both informal developments and ban topography. Furthermore, 75% of the key informants mention limitations caused by private land tenure reducing room for city authority development. Encroachments into urban wetlands and forested steep slopes all undermine this objective of the GGCRS. Also, the city still grapples with

land acquisition to relocate those in steep slopes in order to create more room for reforestation and biodiversity protection.

iii) Rwanda Forest Investment Program (2015)

The Rwanda Forest Investment Program (FIP) proposed in 2015 by the Ministry of Lands and Forestry forms one of the most promising adaptation approaches. Though not explicitly designed for flood risk adaptation, the FIP aims at increasing the forest cover in Rwanda and the socio-economic and ecosystem services of forests. It is informed by dwindling forest cover due to deforestation, agriculture, wood fuel needs, droughts, and urban growth and sprawl. When focused on flood prone areas and steep slopes, the FIP can act as an ecosystem-based adaptation strategy in Kigali to prevent chances of multiple hazards like floods and landslides. Following its introduction in Rwanda as a pilot forestry project in Kibuye in the late 1960s, more than 5000 hectares of land had been reforested in Rwanda by 1970s. With time, it was made mandatory for people to plant trees on the National Tree Planting Day started in 1976 that increased forest cover from 26000 ha in 1975 to 250000 ha in 1990. Given the need to increase forested land uses, the forestry strategic plan (2017-2021) was established. Table 4-3 shows the records of forest cover as per 2015 in Rwanda.

Table 4-3: Forest Cover in Rwanda as per 2015 (Source: FIP, 2015)

Province	Natural forest (ha)	Forest plantation (ha)	Shrubland (ha)	Total (ha)
Northern	11,716	54,813	-	66,529
Southern	42,850	109,765	582	153,197
Eastern	1,843	35,986	258,403	296,232
Western	69,733	74,905	1,519	146,157
Kigali City	59	11,340	-	11,399
Total	**126,201**	**286,809**	**260,504**	**673,516**

The FIP in Rwanda will be planned and implemented following the land use planning procedure like that of urban planning. Thus, the identification of areas afforestation and reforestation will be systematic without prior contradictions based on city and national priorities. If this proposed approach is successfully realized, then mainstreaming urban forestry into urban planning will be effectively achieved in Kigali city.

iv) Environmental Impact Assessment

The Rwanda Organic Law (2005) demands that all substantial developments to be subjected to Environmental Impacts Assessment (EIA). EIA is thus a necessity for all new projects that have an effect on the environment or that pertain to any body of water (wetlands, rivers, lakes), in the interest of the public good. Public good projects include, but are not limited to: roads, drainage, energy, or infrastructure etc. The EIA provides guidelines on all projects as far as what is permitted or not within various locations. Thus, measures such as storm water drainage, landscaping and hydrological assessments are mandatory when applying for development approvals. On the same note, the protection of wetlands is effected by observing buffer zones of a minimum of 10 meters from rivers and 20M from water bodies like lakes.

Incidentally, a critical review of the EIA indicates the term "Adaptation" has not been mentioned at all, leave alone defined. Moreover, neither climate change impacts nor inclusion of adaptation measures are required elements of the assessments. Thus, this makes the EIA guidelines not effective in mainstreaming climate change adaptation. on the same note, the EIA just mentions the need to conduct risk assessments but does not offer the framework through which the assessment is to be undertaken. It becomes very cryptic to harmonize developments if achieving a resilient city holistically is the key goal.

To protect wetlands and water bodies, reduce flood vulnerability and maintain water quality, Kigali mandates buffer zones extending from the high-water mark, in order to restrict land use close to the water's edge. This buffer zone could be seen as protecting investment, such as buildings, crops or infrastructure, in areas prone to flooding. Buffer zones are reinforced through building permits, Environmental Impact Assessments, zoning and enforcement of the Land Law (2013). Although buffer zones are not designed specifically to protect land use investments against flooding, they nevertheless do act as risk mitigation measures. Some temporary structures and settlements still

occur in wetland areas, and agriculture is common in many wetlands. Yet government interventions to relocate people living or cultivating within these areas are typically singular events without coordinated effort or a formalized program to move people from vulnerable environments.

v) Building Codes

The Rwanda Building Code (RBC) and Urban Planning Code (UPC) provide directives on how development should be addressed in flood prone areas of the city. For instance, the RBC prescribes that any dwelling unit in flood prone areas must have its floor at least 300 mm above the determined or anticipated flood heights. Alternatively, the buildings should be built on a ground of 600 mm in height above the expected flood heights in areas not yet mapped in Kigali city. This is backed by the fact these expected flood heights have very low probability of being exceeded. Even though this are very promising non-structural adaptation measures, it beats the purpose of not including this in the Master planning process so that all possible climate risks are analyzed strategically and prevent macro-assessments that are costly and time consuming. On the same note, with the prevalent encroachments into the wetlands and riparian reserves, it becomes necessary to evaluate if this guidelines are truly observed. Furthermore, the fact that 75% of Kigali is informal and unplanned, how much of these regulations are respected?

vi) KCMP 2013

On the environmental front, KCMP 2013 aims at enhancing nature and biodiversity thrive. Thus, the KCMP 2013 advocates for 6 critical environmental goals including: management of wetlands and water bodies; promoting urban agriculture and forestry; conservation of the dwindling forest cover and biodiversity; protection of steep slopes and watersheds; protection of open spaces and encourage their access; and the integration of natural landscape in the urban setups of Kigali city. KCMP 2013 also provides for storm water management strategy towards the reduction of the impacts of surface run off and floods (Figure 4-8). Several strategies have been proposed that include construction of bioswales, retention basins, and constructed wetlands. Moreover, the KCMP 2013 proposes a Water Bodies Management Strategy geared towards reduction to flood risks by inhibiting development in vulnerable areas and identifying flood plain boundaries based on the 100-year flood return period.

Moreover, KCMP has also zoned the flood plains into areas of varying risk levels as per the 20-year, 50-year and 100-year return periods as low, medium and high-risk levels respectively, determining the admissible land uses in these flood prone areas and strict observation of the minimum 10M and maximum 50M buffer around lakes as stipulated by the organic law. The visions and goals of the KCMP 2013 cut across all the three districts of the city. Besides contextual development concerns and the district specific planning goals, the 6 visions of KCMP 2013 aim at promoting harmonious development in Kigali as an integrated unit for purposes of economic robustness and excellence.

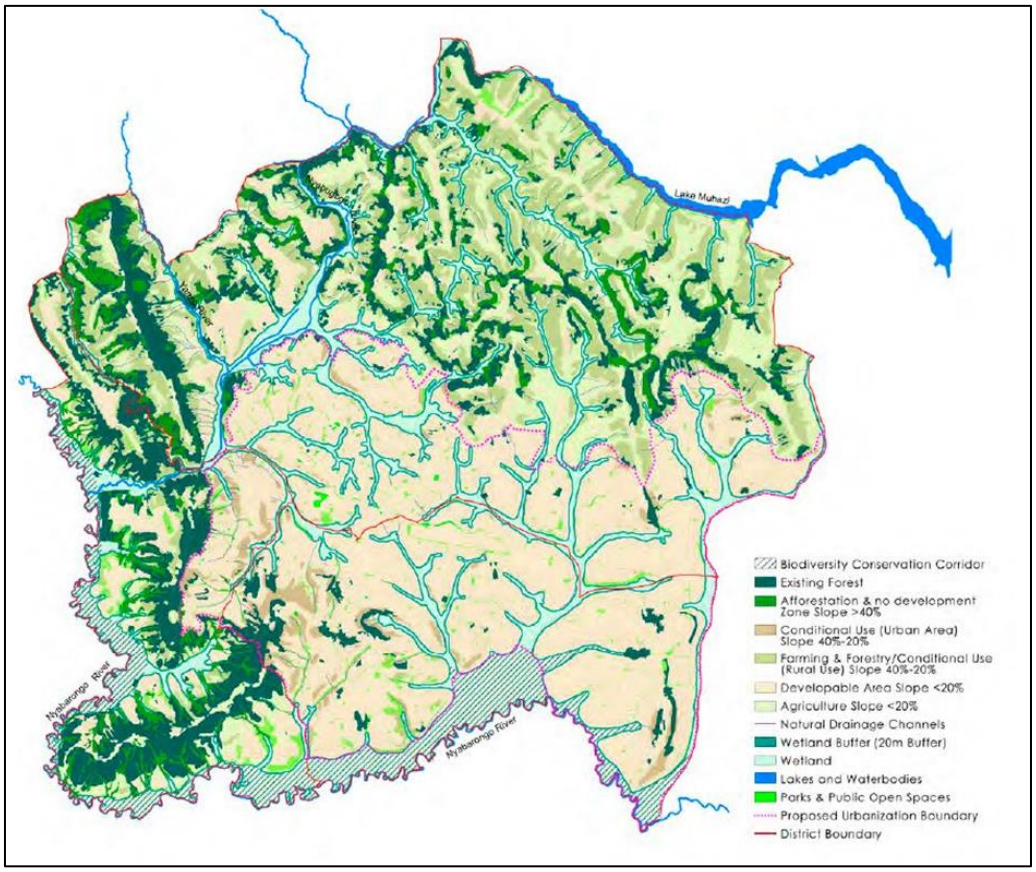


Figure 4-8: KCMP 2013 Proposed Biodiversity and Nature Strategy (KCMP, 2013)

Synthesis

The analysis from adaptation approaches in Kigali city demonstrate some of the critical challenges that mainstreaming is trying to address. The above results confirm that redundancy, incoherence, jurisdictional challenges and conflicts of interest challenge adaptation in Kigali. For instance, as the NLUDMP proposes adaptation measures that are never observed during the process of planning by the city, but becomes an afterthought during the implementation of developments in Kigali. On the same note, when the GGCRS, FIP, Land Laws and other agencies dictate what must be done for the city to adapt to climate change, who is responsible for implementing these measures? If the city of Kigali is mandated with executing these proposed measures, yet it is never involved in their preparation, how will it accurately address adaptation as expected? Moreover, the analysis found out that the higher and segregated authorities are preparing and proposing adaptation measures without considering both the financial and technical capacity of Kigali City to adequately implement them. All these factors get compounded and further limit the possibility of mainstreaming climate change adaptation in a coherent manner in Kigali.

Additionally, it was apparent that little formal and scientific research has been done to ensure that land use programs are reaching their intended level of effectiveness, and that climate change adaptation elements of land use plans are helping Kigali to better adapt to climate related risks. Since few specific climate adaptation targets exist in sector specific plans, development of such targets, with corresponding monitoring and evaluation efforts could help leverage stronger efforts to implement adaptation measures and further reduce climate risks. Lacking scientific research or consistently tracked data forced this study to depend on qualitative information gained from relevant documents, urban planners, policymakers and non-governmental experts with insights on Kigali's urban and land use and climate change adaptation. All the key informants cited piecemeal single events or lack of recent events as evidence of advances in Kigali's adaptive capacity, without directly attributing program effectiveness as adaptation successes. However, longer term monitoring and evaluation is necessary to accurately determine effectiveness of programs and policies related to land use and climate change.

Evident cognitive challenges limiting effective mainstreaming relate to data availability. As a result of addressing the challenge of evidence-based policy formulation, there is need for the collection, compilation and accessibility of climate change data and projections which will are appropriate decision making tools. MIDIMAR was tasked with national risk management and disaster response, though this never happened. MIDIMAR, according to key informants was basically doing disaster response, though ineffectively due to funding challenges, and collecting very aggregated risk data nationally that was not usable to local planning. This has led to the city relying on overlays to earmark NO-GO zones during planning. land cover overlays do not indicate risk levels for appropriate interventions. Even though the key informants claim additional restrictions are imposed on any development within the overlays, this fails to promote optimal land uses for socio-economic gains. For instance, when a forest land cover overlay is used to mark protected areas as NO-GO zones, it blocks out any potential compatible land uses for the same site hence limiting its overall outputs.

4.3.2 Explicit Integration of Flood Risks in Spatial Adaptation Projects in Kigali City

Research question one of objective 2 above has provided an account of adaptation strategies in Kigali city, both implemented and proposed ones. Understanding adaptation strategies isn't enough in determining whether the projects were explicit in integrating flood risk challenges or not. However, a scientific and systematic evaluation of the planning process enable to determine its consistency and validity.

The Nyabugogo Transit Hub and Market Redevelopment project is located in Nyabugogo area, a wetland a very flat plain at an elevation of about 1370 m asl. The area is also the lowest zone of Nyarugege District in Kigali. The surface area of the wetlands is estimated to be less than 3 km². This area is at the confluence of Nyabugogo river and its tributary Rugunga. At the end of the wetlands, Nyabugogo also receives water from Mpazi river just before the bridge at the Kigali-Gatuma road. The three rivers have significantly low slopes when entering the wetlands, making it possible for riverine floods.

Nyabugogo River crosses the floodplain with an average slope of about 1% and the cross section of the riverbed is approximately 10 m width and 2-3 m depth. The floodplain is clearly limited by the bridge of the Kigali – Gutama road. It is reported that Rugunga River, which drains densely urbanized areas in the eastern part of Kigali, does not seem the main cause of flooding because its extreme water levels are evened out in the Rugunga valley and the Muhima wetland before arriving in the Nyabugogo floodplain. Figure 4-9 shows a section of the river with the encroaching settlements

Figure 4-9: A section of Nyabugogo River (Fieldwork 2018)

For the purpose of the Nyabugogo Transit Hub and Market Redevelopment project, the wetlands were considered as a floodplain that received the incoming floods from the three rivers and the surrounding hills and buffers the

outgoing flowrate through the bottleneck of the valley created between Mont Kigali and the opposite hill just after the bridge of Kigali – Gatuma road. Figure 4-10.is a google image of the site.

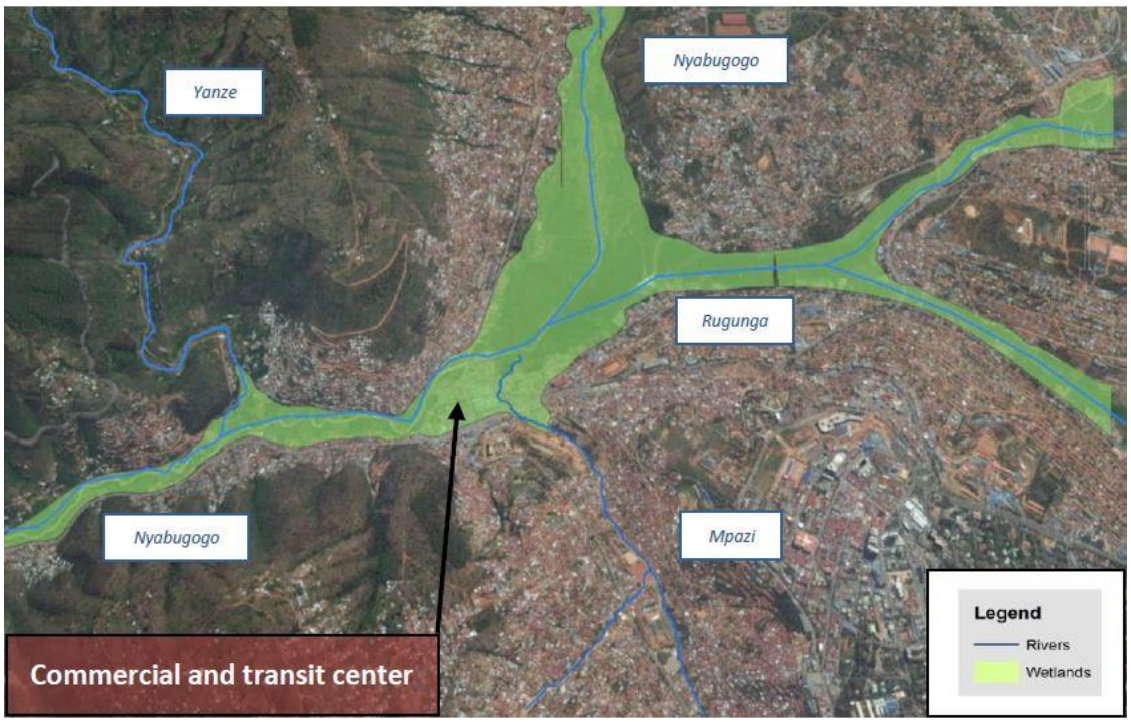


Figure 4-10. Overlay of flood extent and built up wetland encroachment in the Project Area (NDMP,2015)

The findings based on the systematic Logframe evaluation of the spatial adaptation project were as presented below:

Situational analysis: From the evaluation of the spatially-oriented adaptation project of the Nyabugogo Transit Hub and Market Redevelopment, it was clear that an adequate situational analysis, and explicit observance of flood risk and vulnerability was done. In the process, buildings, land uses, fauna among others that were affected by flooding were well identified and quantified. The population likely to be displaced and their livelihoods were also analyzed explicitly. In fact, a door to door and building specific profiling was done in a participatory way to determine the extent of vulnerability and exposure to floods. Slope analysis and potential flood heights for the various return periods was conducted in order to inform decision making for the various land uses and building typologies to be proposed once he planning phase is completed. This move demonstrated how the awareness of flood risks and climate change at large was increasing unlike in the previous planning activities in the city. Even the KCMP 2013 never conducted a flood risk assessment. However, the situational analysis in Nyabugogo was limited to floods only. A comprehensive multi-hazard assessment of the area would have informed an all-round adaptation intervention and avoid potential risks in future due to unforeseen hazards like landslides and mud storms.

Although stakeholder analysis was not done at the exact stage of the planning process as stipulated by the Logframe, relevant stakeholders were identified at the start of the study and mapped accordingly. After reviewing previous studies on the project site, more stakeholders were identified and brought on board. For instance, REMA, MINECOFIN, CoK, MIDIMAR, METEO, private sector, the public, transport and real estate community. Stakeholder analysis was implicitly done because it never included an actual pre-planning stakeholder mapping in a participatory way so that all the relevant actors are brought on board. Hand picking actors just because they were mentioned in previous planning documents had the potential of bringing into the planning team the very agencies that had limited cognitive ability on flood risks and climate change at large leading to the risk insensitive urban plans in Kigali. Furthermore, this approach may pave way for subjective and based selection of key actors, more so involving similar minded and or those with a common interest and possibly avoid actors of contrary but critical ideas worth including in the planning process.

The onset of the project was based on a precursor of having a flood free Kigali city in 50 years. This vision was identified, though without adequate evidence from the ground. As such, there were proposals for enhanced conservation, wetland protection, urban greenery, relocation from flood plains and rejuvenation of dilapidated and encroached wetlands. Moreover, the Vision envisaged reforestation of steep slopes currently with informal settlements. Thus, the losses of property, lives, developable land and erosion, above all the need to upgrade Nyabugogo into a modern transit hub, increase land values and a high-end residence formed the basis of this project.

Objective Analysis: Normally, the objectives of any study are explicitly defined in the project TORs. Indeed, Nyabugogo Transit Hub and Market Redevelopment project had very clear objectives of arriving at an optimal use of land, development a flood free transit zone and install flood management hydraulic systems. All these were aimed at boosting the economic thrive of the region. Besides, environmental conservation and upgrading of settlements formed key areas of consideration. The development guidelines were risk-sensitive and aimed at both avoiding risks and mitigating against potential flood impacts. From the analysis, it is evident that the indicator was explicitly addressed.

Analysis of Alternatives: once the results of the situational analysis were out, relevant structure and conceptual plans were developed. These ranged from different land use options, transport infrastructure and flood management hydraulics. The steering committee was faced with three options to choose from. Concept 1 by Nyarugenge zoning plan 2013 provided for maximum utilization of the land by capitalizing on the built up areas to increase urban vibrancy. The option also limited the need for land for open spaces but more housing as a strategy to attract more urban activities and investments. Concept 2 by the KCMP Zoning plan 2015 dwelt on the "Tradeoff approach" between commercial activities and wetland conservation. It was observed that the concept will promote both businesses and provide a quality public life. On the same note, by retaining the area as a transport hub would reduce expenses on the project. Finally, Concept 3 (KCZP 2015) of the land use happened to be costly. Besides observing the regulatory provisions and protecting nature, it was costly to relocate the transit hub, create new parks and restore the old industrial areas. After considering the dynamics between the transit hub expected, urban functions and flood management, Concept 2 was selected for further detailing and designing (Figure 4-11). Furthermore, green areas and public space organization were provided for to give a certain level of permeability and connectivity of the urbanized area towards the wetlands. This would promote infiltration and prevent surface run-off thus reduced flash floods in the area.

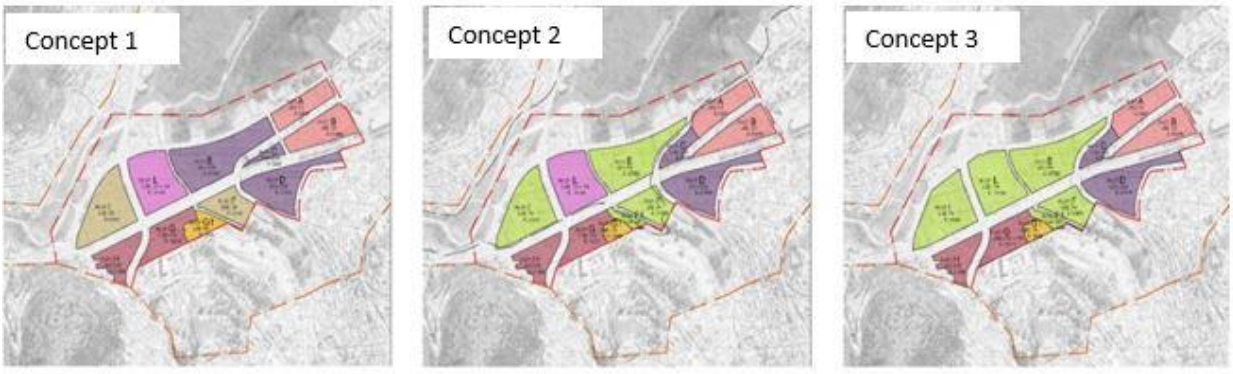


Figure 4- 11:.Land Use Options/Concepts (Source: NDMP, 2015)

Targets and indicator selection was done based on the expected outputs from each component of the project. The need for a flood free transit hub led to designing flood proof bus park and intersections well designed. Flood proofing the residential units was proposed to include having low density units with high green plot rations near the protected areas for flood management and high-density units in flood free areas. This reduces both vulnerability and exposure to floods, and of course any possible loss is reduced.

One critical missing indicator was how to address potential maladaptation. It is expected that the flood free zone will have increased land values. Even though only 600 people were expected to be relocated, will the rehabilitated

and new flood free have a balanced socio-economic demographic composition? The possibility of the challenge of gentrification affecting the lifestyle of the region was never factored in the setting of targets and indicators of success. Moreover, the potential negative impacts (maladaptation) of the project to other sectors were never considered.

Risk analysis and assumptions: Much as the project was aimed at alleviating flood risk in the Nyabugogo area, actual risk assessment wasn't explicitly conducted. The tasks involved identifying the people and properties within the wetland boundaries and mapping. What the project is calling flood risk maps are flood extent maps for the various return periods. Levels if risks as per the floods were never determined. All the project did was a blanket mapping of the flood extents and assumed it indicated risk levels. Furthermore, no realistic assumptions were made. What if the projections were underestimated?

Plan Implementation: The implementation of the project was well phased out. The phasing had a logic that included land availability, funding and the urgency of the intervention. For instance, phase 0 focused on improving the infrastructure and flood proofing the area with the hydraulics constructions. These strategic proposals are expected to improve accessibility, land values, attract investors and reduce the risk of flooding before introducing the other urban functions in the area. Phase 1 was slotted for development of open and green spaces and eradicating informal developments on the sloppy areas. Phase 2 of the project implementation entailed compensating the properties to be displaced during the implementation of the project. This was aimed at creating more land for the road intersections and construction of flood management installations. The construction of modern housing to improve the status of the area were placed in phase 3. Units of varying densities ranging from 1 floor to 12 floors will be developed during this phase. Finally, phase 4 was earmarked for environmental reclamation and rejuvenation of the encroached wetlands and formerly polluted industrial sites.

Finally, an evaluation of the various interventions was done in a participatory way. This led to realizing the most effective and economically viable options. The impacts of the hydraulics in mitigating floods were done for the various return periods leading to the selection of high impact reduction ones. What the project didn't look into were the indirect unexpected impacts of the project like gentrification and maladaptation. Also, the economic impact of the project in terms of Return on investment was not conducted.

Synthesis

The overall evaluation of the explicit integration of flood risk indicators in the Nyabugogo Transit Hub and Market Redevelopment project indicates and equal observation of the indicators in both the implicit and explicit dimensions. A total of 14 and 13 indicators were explicitly and implicitly addressed respectively. Incidentally, a total of 10 indicators were missing as shown in Figure 4-12. This improvement in the level of explicitness in adaptation project as compared to the evaluation of the plans done in objective 1 is influenced by a number of factors as observed by the key informants. For instance, the Nyabugogo project planning was undertaken by consultants who part of the spatial planning process in were not 2013. This approach in a way covered the knowledge gap observed in the level of awareness in spatial plans. On the same note, having been a project focused on a small spatial scale, the city of Kigali believes it was possible to fund the project and undertake a comprehensive risk, vulnerability and exposure assessments than if it was a city wide project. Even so, the project planning was funded by MINECOFIN, which has specific interest of improving the areas transport and economic potential. Therefore, the Nyabugogo project is a manifestation of the potential of mainstreaming flood risk adaptation in Kigali city. This approach may be reviewed and upscaled systematically across the entire city.

Critically, the approach employed in analyse the explicit integration of flood risks into the spatial adaptation project could not have revealed the true state of events. for instance, it is not possible to determine all the risks covered or not by the project from just analysing its documentation and interviews. The level of risk adaptation can only be truly determined if the project was implemented, monitored and evaluated against the set achievement indicators of resilience. That a side, this analysis sheds some light on the possible state of affairs based on the Logframe approach.

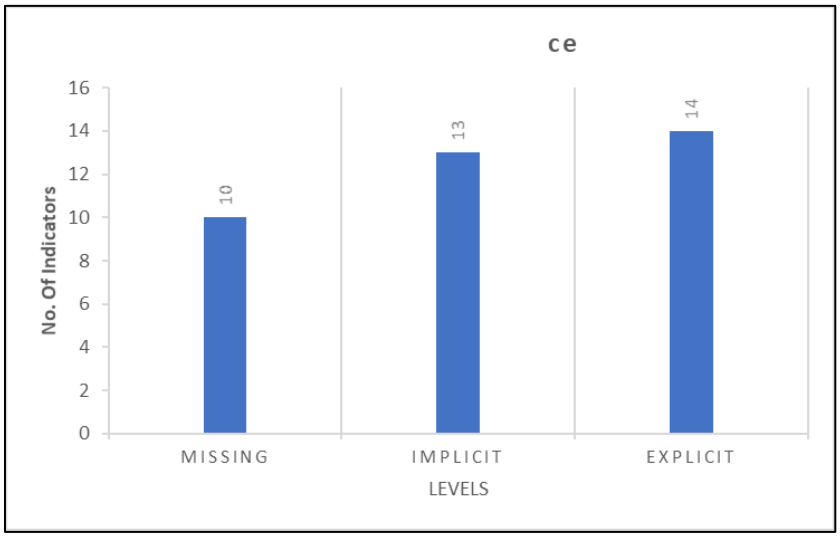


Figure 4-12: Overview of Indicator Performance (Source: Author, 2018)

4.4 Objective 3:To Identify the Main Factors Influencing Regulatory Mainstreaming Flood Risk Adaptation in Kigali City.

This objective focused on analysing the effectiveness of regulatory mainstreaming of flood risk adaptation, and the main barriers and drivers in Kigali.

4.4.1 Evaluating the Effectiveness of Regulatory Mainstreaming Of Flood Risk Adaptation in Kigali City

Gaining adequate comprehension of urban flood risk dynamics is a prerequisite for effective risk-informed urban planning. This section delves deeply into trying to understand how effective regulatory mainstreaming is in Kigali, and how it can possibly be addressed based the relevant literature. The analysis looked at the four main phases of regulatory mainstreaming that included: agenda setting, context evaluation, risk-informed plan making and implementation, and monitoring and evaluation. The analysis also cuts across all the geographical space of Kigali city with respect to the existing and accessed urban frameworks. This led to a total of 8 urban frameworks being evaluated as discussed below.

— **Overview of the Regulatory Mainstreaming Effectiveness**

Of the evaluated regulatory frameworks, only KCMP had an explicit form of flood risk integration score of 41% followed by Kigali district development plans at 38% and >35% for the rest of the plans. One of the most astonishing results was the poor performance of the missing indicators across all the plans. For instance, 75% of the plans had missing with scores ranging between 34% and 47%. On the same note, implicitly addressed indicators scored between 19% and 25% among all the evaluated plans. These results demonstrate that little emphasis was given to explicitly mainstream flood risks in Kigali across all the planning jurisdictions. When the missing indicators are compounded with the implicitly addressed ones, a lot is left to be desired. This poor overall performance is because the planning framework across Kigali is generic, having been adopted from the prescriptions of the NLUDMP discussed in objective 1. The omission of climate change in the mother development guidelines leads to problem's replication across all the plans. Figure 4-13 indicates the overview of the regulatory mainstreaming flood risk performance.

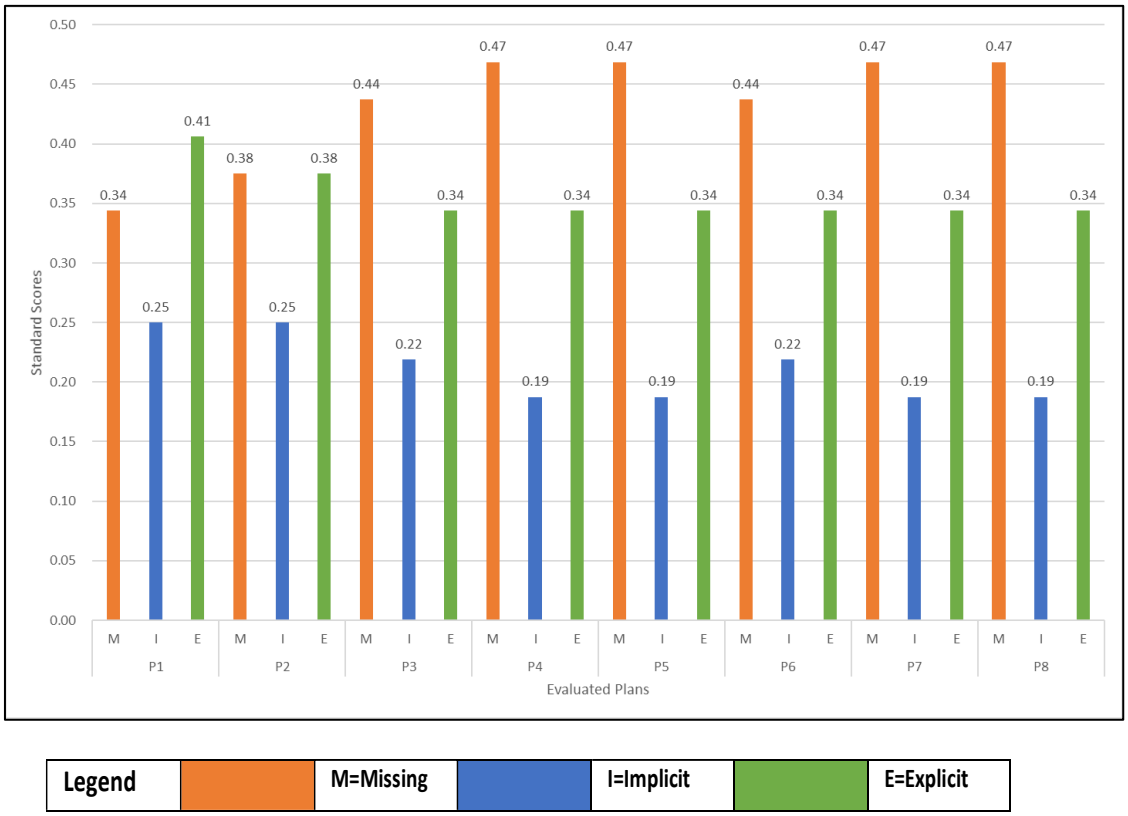


Figure 4-13: Overview of Regulatory mainstreaming Effectiveness in Kigali (Source: Author, 2018)

NOTE 1: P1:Kigali city Master Plan; P2:Kigali District Development plan; P3:Nyarugenge Master Plan; P4: Nyarugenge Zoning Plan; P5:Kicukiro Master Plan; P6: Kicukiro Zoning Plan; P7: Gasabo Master Plan; P8: Gasabo Zoning Plan

— **Phase 1: Agenda Setting Effectiveness**

Phase 1 of an effective regulatory mainstreaming evaluation framework entails four main indicators including: stakeholder mapping, project team management formulation, and identification of actors' climate change knowledge gaps and data needs. Findings indicate that across all the evaluated plans, stakeholder mapping was explicitly done, and all the relevant agencies were identified based on their roles. A similar case was reported with the project management team indicator in which all the regulatory frameworks had a clear indication of who was to do what in the plan making and implementation. Interestingly, much as the stakeholders and project teams were perfectly addressed, no knowledge gaps on climate change adaptation (flood risks focus) was conducted in 75% of the plans evaluated. On the same note, 25% of the frameworks had an implicit mention of the relevant knowledge gaps in question. This omission of explicitly identifying climate change knowledge gaps among the stakeholders sets the stage on a wrong footing. This is because, they are the team to spearhead the process and lack of knowledge on climatological challenges in the urban domain will undermine the goals of addressing flood risks. Finally, all the frameworks had a clear indicator on the data needs for the plans. However, these data needs focused on generic urban planning issues like housing, traffic, economic and social issues. Other data needs included environmental issues like avoiding development in steep slopped areas and wetland protection. The need for flood risk and resilience assessment was never among the data needs in the frameworks. This eventually led to the poorly risk-informed urban plans currently in use. Figure 4-14 shows the results of the Agenda setting performance

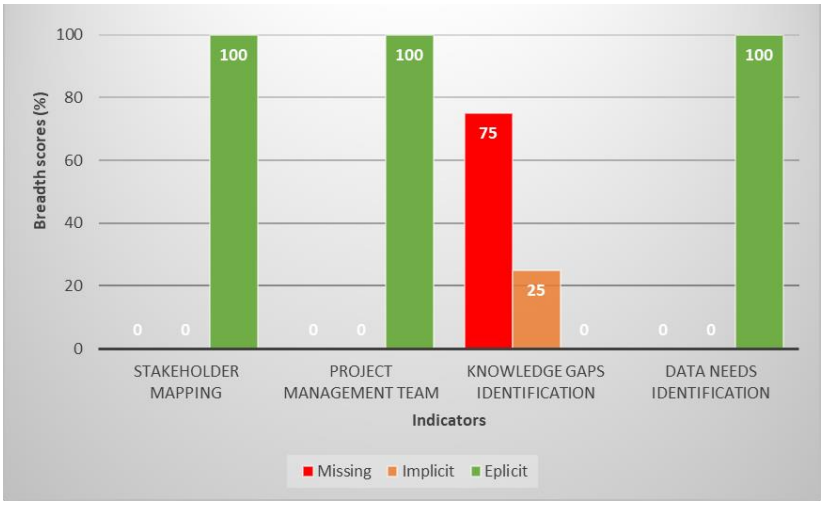


Figure 4-14: Agenda Setting Effectiveness (Source: Author, 2018)

— **Phase 2: Context Evaluation Effectiveness**

The second phase of effective regulatory mainstreaming evaluation includes explicit and comprehensive context analysis. This aims at understanding the relevant baseline conditions informing decision making. Risk-informed plans are expected to conduct vigorous risk and resilience assessments and explicitly represent findings formats like risk maps and risk matrices. Such baseline information may be generated from both literature review of previous plans, laws, current experiments, and case studies. As shown in Figure 4-15 only two indicators were explicitly addressed across all the 8 planning areas. These included participatory situational analysis and review of relevant literature to learn from the past for effective decisions. Incidentally, 100% of the evaluated frameworks did not analyze emergency systems, had no flood risk assessments and quantification, lacked flood risk matrices and spatial risk level distribution, and did not include analytical tools like "Problem trees" to assess the main contextual flood risk concerns in the city. Implicitly, 25% of the evaluated plans mentioned flood needs but this was limited to NO-GO zones with respect to wetlands, and generic demarcation of wetland extents where development is prohibited. However, this was not accompanied by real risk level evidence as far as vulnerability, exposure and flood scenarios are concerned.

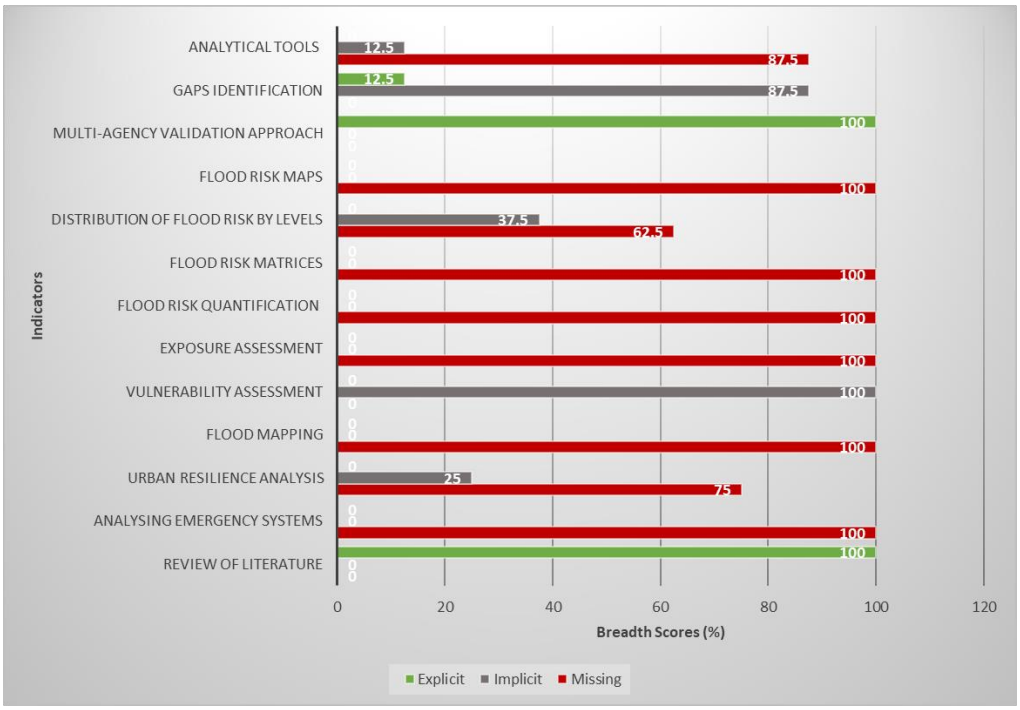


Figure 4-15: Context Evaluation Effectiveness(Source: Author, 2018)

— **Phase 3: Risk-Informed Planning Effectiveness**

The third component for effective regulatory mainstreaming of flood risks entails an explicit risk-informed plan formulation. This phase has key and critical indicators that include urban flood resilience visions, urban flood resilience models/concepts, budgetary allocation for flood risk mainstreaming and stakeholder commitments to implement identified adaptation mainstreaming projects. From the analysis, 100% of the evaluated plans lacked any spatial flood resilience models and budgetary indications of regulatory mainstreaming of flood risks. On the same breadth, 100% of the plans implicitly addressed flood resilience (Figure 4.16) via measures such as bioretention ponds, retention ponds, bioswales and green parks; and implicit budgetary commitments whereby, since the city and district jurisdictions were responsible for implementing the plans, it is inferred they are to fund the identified adaptation projects. This approach normally yields bad results putting in mind that 100% of the key informants alluded to low capacity financially as a critical limitation to city operations. An effective regulatory mainstreaming calls for explicit financial commitments and responsibilities across the board to achieve comprehensive and coherent results.

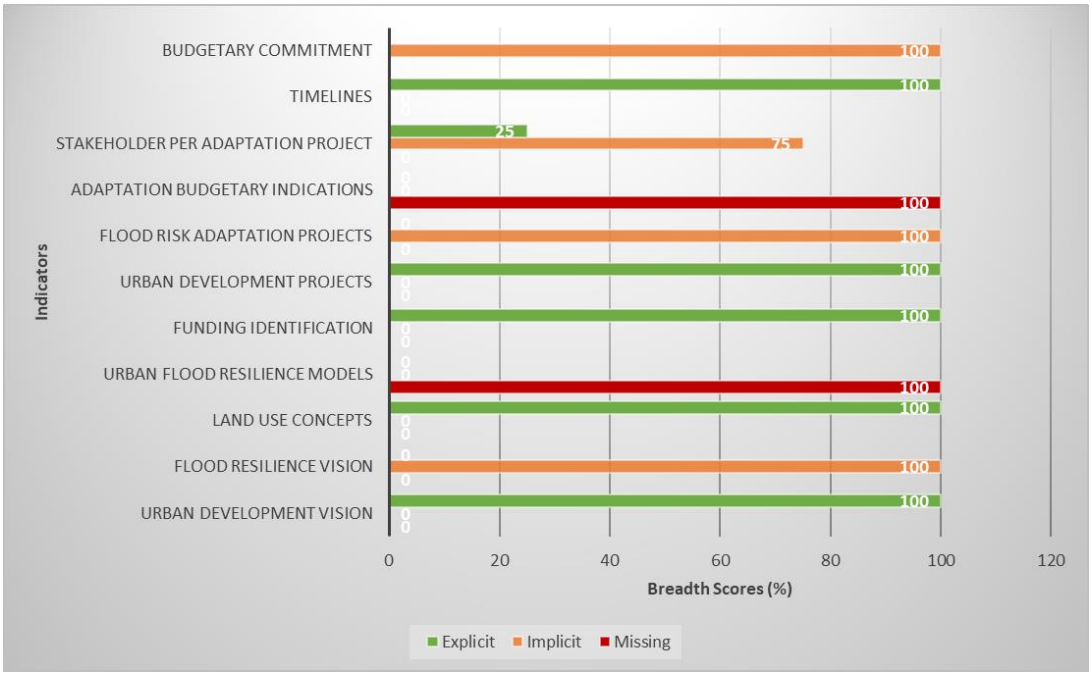


Figure 4:16: Risk-informed Planning Mainstreaming Effectiveness (Source: Author, 2018)

— **Phase 4: Implementation, Monitoring and Evaluation Effectiveness**

The final phase of effective regulatory mainstreaming calls for an explicit address of the indicators by all the plans in questions, more so if phase 3 was optimally addressed. Phase 4 included four significant indicators, i.e. timeline definitions, explicit mainstreaming indicators, mainstreaming evaluation framework and regulatory mainstreaming review criteria. From the analysis, 100% of the evaluated plans lacked mainstreaming indicators making difficult to assess achievements at the end of the plan timeline/cycle. On the same breadth, 100% of the plans lacked a mainstreaming assessment framework. Thus, even if the plans had indicators established, assessment would be limited. Similarly, 100% of the plans evaluated didn't have a regulatory mainstreaming review criterion. Thus, it makes it hard to incorporate flood risks in future plans when undertaking the plan reviews. For instance, as the KCMP 2013 is currently being reviewed, what factors will inform the inclusion of flood risks, how will they be included, and how will they be assessed? All these are critical limitations of the current state of events in Kigali. Figure 4-17 shows the results of phase 4 effectiveness.

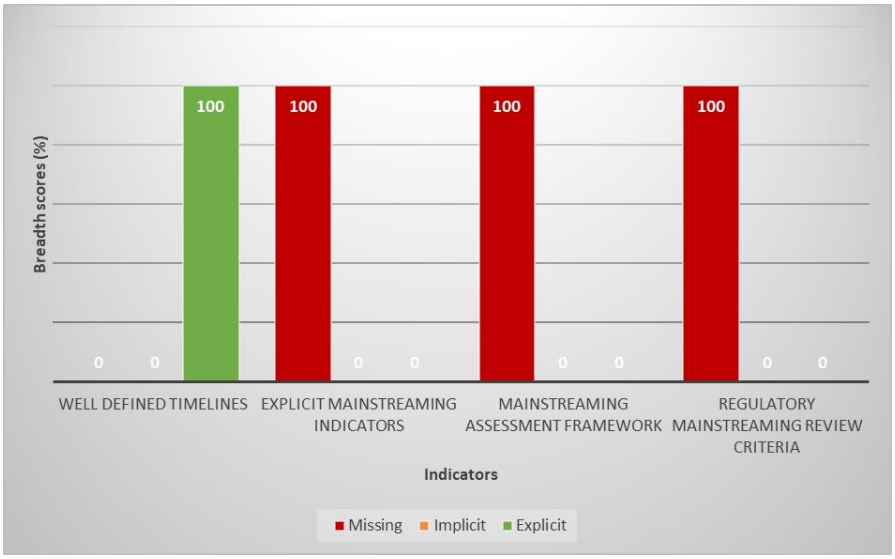


Figure 4-17: Implementation, Monitoring and Evaluation Effectiveness

Summary of Regulatory Mainstreaming Effectiveness

For decision making purposes, this study synthesized the detailed findings provided above into a 4-pointer summary. The effectiveness of each dimension of the regulatory mainstreaming framework was thus arrived at by standardizing all the frequencies of each indicator per scoring criterion. Accordingly, the number of occurrences of each indicator under the provided scoring criteria was divided by the total possible occurrences and multiplied by 1 to get a score of between 0-1. Thus, agenda setting managed an explicit effectiveness of 0.75, context analysis had an explicit score of 0.16, risk-informed planning had 0.53 and finally implementation, M &E had 0.25. As much as agenda setting had a high explicit score, it never gave flood risks the emphasis it deserves. The same applies to the risk-informed planning dimension. Therefore, this summary scores should not be viewed in isolation as the fundamental truth but must be read in relation to the above results per dimension as discussed. Table 4-3 and figure 4-18 summarizes effectiveness scores.

Table 4-3: Summary of mainstreaming effectiveness

Phases	Missing	Implicit	Explicit	Expected Max. score
Agenda setting	0.19	0.06	0.75	1.0
Context Evaluation	0.63	0.20	0.16	1.0
Risk-informed planning	0.20	0.38	0.53	1.0
Implementation, M & E	0.75	0	0.25	1.0

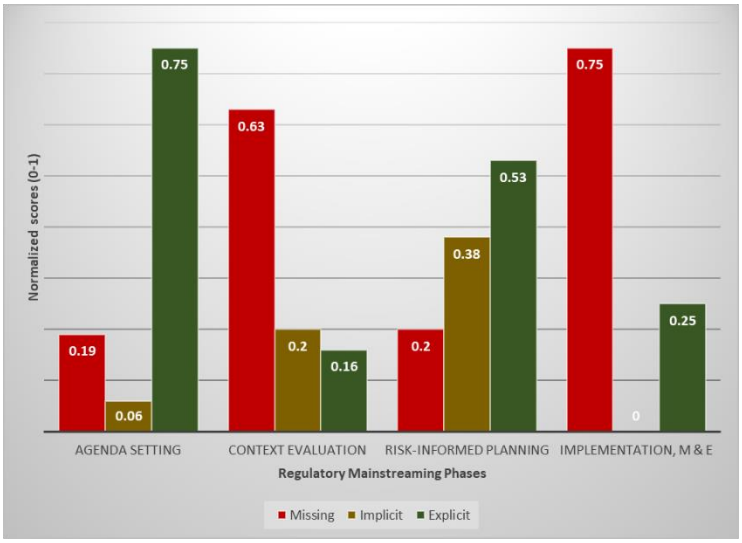


Figure 4-18: Overall Regulatory Mainstreaming Extent (Source: Author, 2018)

Table 4-4 offers the standardized frequency breadth scores of regulatory mainstreaming indicators.

Table 4-4 Regulatory Mainstreaming Indicators' Standardized Breadth Scores

Phases	**Dimensions**	**Indicators**	**Std. Breadth Scores (0-1)**		
			Missing	**Implicit**	**Explicit**
Phase 1	Agenda setting	Stakeholder mapping	0.00	0.00	1.00
		Project management team	0.00	0.00	1.00
		Adaptation Knowledge gaps identification	0.75	0.25	0.00
		Data needs identification	0.00	0.00	1.00
Phase 2	context evaluation	Review of literature	0.00	0.00	1.00
		Analysing emergency systems	1,00	0,00	0.00
		Urban resilience analysis	0.75	0.25	0.00
		Flood mapping	1.00	0.00	0.00
		Vulnerability assessment	0.00	1.00	0.00
		Exposure assessment	1.00	0.00	0.00
		Flood risk quantification	1.00	0.00	0.00
		Flood risk matrices	1.00	0.00	0.00
		Distribution of flood risk by levels	0.65	0.35	0.00
		Flood risk maps	1.00	0.00	0.00
		Multi-agency validation approach	0.00	0.00	1.00
		Gaps identification	0.00	0.88	0.12
		Analytical tools	0.88	0.12	0.00
Phase 3	Risk-informed Plan making	Urban development vision	0.00	0.00	1.00
		Flood resilience vision	0.00	1.00	0.00
		Land use concepts	0.00	0.00	1.00
		Urban flood resilience models	1.00	0.00	0.00
		Funding identification	0.00	0.00	1.00
		Urban development projects	0.00	0.00	1.00
		Flood risk adaptation projects	0.00	1.00	0.00
		Adaptation Budgetary indications	1.00	0.00	0.00
		Timelines	0.00	0.00	1.00
		Budgetary commitment	0.00	1.00	0.00
Phase 4	Implementation, monitoring and evaluation	Well defined timelines	0.00	0.00	1.00
		Explicit mainstreaming indicators	1.00	0.00	0.00
		Mainstreaming assessment framework	1.00	0.00	0.00
		Regulatory mainstreaming review criteria	1.00	0.00	0.00

The overall scores of the extent of regulatory mainstreaming are as shown in Table 4-5 below

Table 4-5: Extent of Regulatory Mainstreaming Evaluation

Phases	Dimensions	Indicators	P1			P2			P3			P4			P5			P6			P7			P8			Breadth Score		
			M	I	E	M	I	E	M	I	E	M	I	E	M	I	E	M	I	E	M	I	E	M	I	E	M	I	E
Phase 1	Agenda setting	Stakeholder mapping			2			2			2			2			2			2			2			2	0	0	8
		Project management team			2			2			2			2			2			2			2			2	0	0	8
		Knowledge gaps identification		1			1		0			0			0				0		0			0			6	2	0
		Data needs identification			2			2			2			2			2			2			2			2	0	0	8
Phase 2	context evaluation	Review of literature			2			2			2			2			2			2			2			2	0	0	8
		Analysing emergency systems	0			0			0			0			0			0			0			0			8	0	0
		Urban resilience analysis		1			1		0			0			0			0			0			0			6	2	0
		Flood mapping	0			0			0			0			0			0			0			0			8	0	0
		Vulnerability assessment		1			1			1			1			1			1			1			1		0	8	0
		Exposure assessment	0			0			0			0			0			0			0			0			8	0	0
		Flood risk quantification	0			0			0			0			0			0			0			0			8	0	0
		Flood risk matrices	0			0			0			0			0			0			0			0			8	0	0
		Distribution of flood risk levels		1			1			1		0			0			0			0			0			5	3	0
		Flood risk maps	0			0			0			0			0			0			0			0			8	0	0
		Multi-agency validation approach			2			2			2			2			2			2			2			2	0	0	8
		Gaps identification			2		1			1			1			1			1			1			1		0	7	1
		Analytical tools		1		0			0			0			0			0			0			0			7	1	0
Phase 3	Risk-informed Plan making	Urban development vision			2			2			2			2			2			2			2			2	0	0	8
		Flood resilience vision		1			1			1			1			1			1			1			1		0	8	0
		Land use concepts			2			2			2			2			2			2			2			2	0	0	8
		Urban flood resilience models	0			0			0			0			0			0			0			0			8	0	0
		Funding identification			2			2			2			2			2			2			2			2	0	0	8
		Urban development projects			2			2			2			2			2			2			2			2	0	0	8
		Flood risk adaptation projects		1			1			1			1			1			1			1			1		0	8	0

		Stakeholder per adaptation project			2			2		1			1			1			1			1			1			0	6	2
		Timelines			2			2			2			2			2			2			2			2	0	0	8
		Budgetary commitment		1			1			1			1			1			1			1			1			0	8	0
Phase 4	Implementation, monitoring and evaluation	Well defined timelines			2			2			2			2			2			2			2			2	0	0	8
		Explicit mainstreaming indicators	0			0			0			0			0			0			0			0			8	0	0
		Mainstreaming assessment framework	0			0			0			0			0			0			0			0			8	0	0
		Regulatory mainstreaming review criteria	0			0			0			0			0			0			0			0			8	0	0
Frequencies			**11**	**8**	**13**	**12**	**8**	**12**	**14**	**7**	**11**	**15**	**6**	**11**	**15**	**6**	**11**	**14**	**7**	**11**	**15**	**6**	**11**	**15**	**6**	**11**			
Standardized scores (10^{-2})			34	25	41	38	25	38	44	22	34	47	19	34	47	19	34	44	22	34	47	19	34	47	19	34			

NOTE 1: P1: Kigali city Master Plan; **P2**:Kigali District Development plan; **P3**:Nyarugenge Master Plan; **P4**: Nyarugenge Zoning Plan; **P5**:Kicukiro Master Plan; **P6:** Kicukiro Zoning Plan; **P7:** Gasabo Master Plan; **P8:** Gasabo Zoning Plan

NOTE 2: Breadth scores implies the total number of plans under each of the score categories divided by the total possible number of plans

NOTE 3: **M**=Criterion Missing; **I**= Criterion Implicitly addressed; **E**= Criterion Explicitly addressed.

NOTE 4: Frequencies refers to the total number of criterion occurrence under each score across the framework. The higher the frequency of E (Explicit) the better the extent of mainstreaming.

4.4.2 Barriers and Drivers to Regulatory Mainstreaming of Flood Risk Adaptation into Urban Planning

This research sub-question delves into the main factors influencing the city of Kigali in its attempts to mainstream flood risk adaptation from the key informants' points of view. The figures in this section show indicators that were arrived at after coding the key informants' interviews, and conducting a network analysis

— **Political Factors**

Uittenbroek, (2016) and Runhaar et al., (2018) allude that political influence can act both as a barrier and driver to mainstreaming climate change adaptation into spatial planning. In Rwanda, good political will to address the impacts of climate change has led to formulation of nationally determined strategies. On the same note, key informant interviews revealed the same trend of political support. All the key informants confirm the existence of political good will in Kigali city towards climate change impacts. Some of their responses included: "*First of all now planning for the city of Kigali is at the heart of the government wing, that is one chance, right from the top to down to local there is government a will to have a proper planning, and the proper planning is the sustainable one where we have both the environment, social economics planning is both encouraged, so if we have that kind of we have that kind of advantage or chance where the politicians are supporting this, it's really good to capitalize on that"* (Key Informant ,2018)

On the contrary, the national government has had a negative impact in some instances on planning in the city. This is particularly in land use jurisdictions and management. For instance, according to some of the key informants, government ministries may propose land uses in the city that are contrary to the wishes and plans of the city itself. Cases of proposing, for instance, urban forests on land by the Ministry of Environment have at times gone against the city plans of reforesting steep slopes from which city dwellers have been relocated. About 70% of the respondents claim vision disparities between the national and city authorities have potentially impeded the implementation of vulnerability reduction projects. When asked if there exist vision contradictions between the national government and the city, one of the informants claimed: "*Of course, yes and everywhere. We can actually set up a policy now that is going to work. But when you want to go for implementation, it fails. If you are designing a paper as an architect and you want to implement in the ground, it's a different. You can adopt the amendments of yesterday's vision however; these policies may not be applicable*…." (Key Informant ,2018).

Equally, some of the nationally determined policy and planning directives are never in touch with the actual needs on the ground. This may imply they are not evidence based leading to contradictions and making it hard to link theory to practice. Thus, one key informant agrees that: "*So really, we have got all those misunderstanding with the, different institutions. Even with that Rwanda Land Management and Use Authority that i mentioned, they make the national land use development Masterplan and also make master plans for urban are but sometimes we contradict"* (Key Informant ,2018). However, it is confirmed that the city of Kigali is an autonomous entity capable of making its own land use regulations. This may be a solution in dictating what the city needs and harmonize the conflicting provisions from the national government. For instance, a responded said: *"For example, the city of Kigali has that autonomy. So, they make their own regulations through the city council, they have councils even districts, but also the city of Kigali has a council as in the overall. So, they make their own regulations. Sometimes they can make regulations which is really contradicting towards the policies says. But they are autonomous they have that autonomy. They have that power to make some regulations. Yes. For example, on taxes. They have that mandate to plan their own tax" (Key Informant, 2018).* Figures 4-19 and 4-20 provide an overview of the political factors influencing mainstreaming of climate change in Kigali city. The factors in pink boxes represent enablers of integration while those in orange boxes are 'Barrier to the process.' On the other hand, green boxes indicators point at the political factors that promote (Drivers) mainstreaming and the pink ones denote the main barriers as observed by key informants.

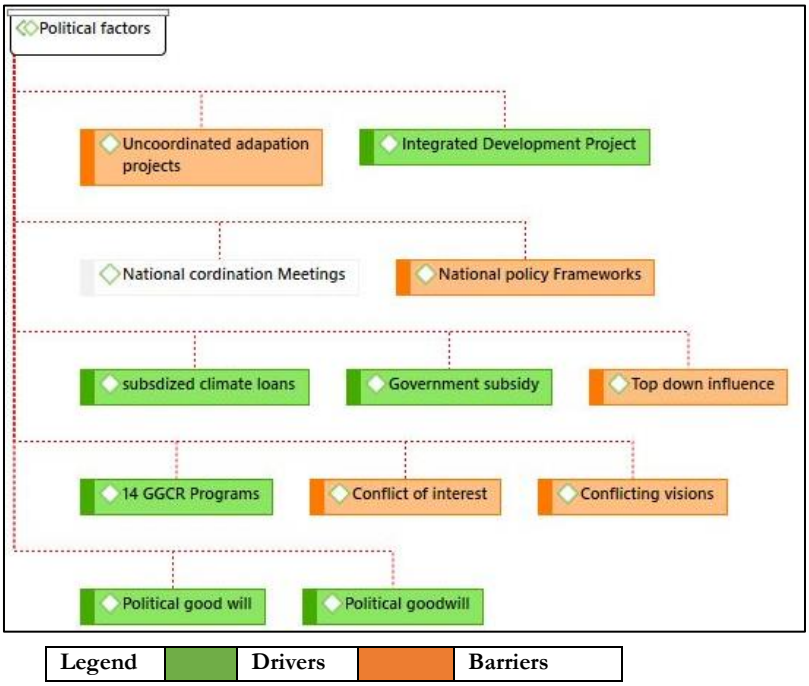


Figure 4-19: Political Drivers and Barrier in Kigali City (Source: Author, 2018)

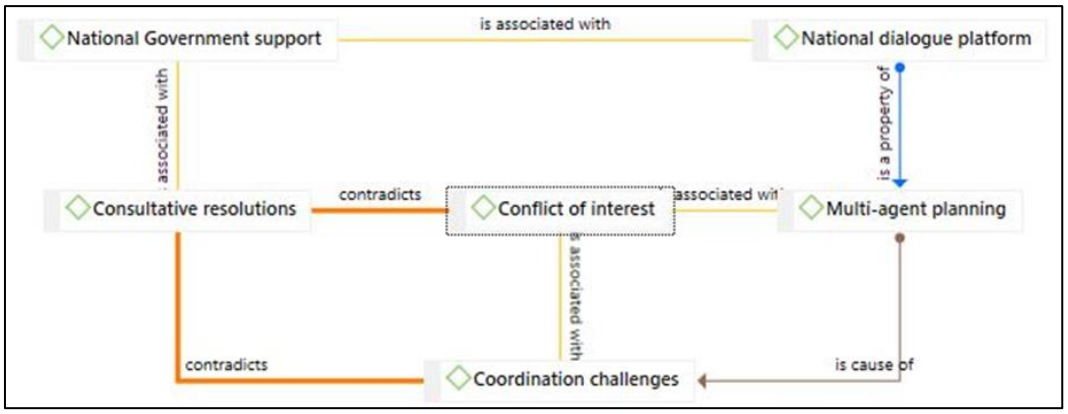


Figure 4-20: Conflict of interest manifestations (Source: Author, 2018)

— **Organizational Factors**

The level of success of climate change mainstreaming calls for appropriate institutional arrangement to implement the process. The process calls for complementary regulations, plans and frameworks, collaborations with other agencies and actors and climate championship (Persson, Eckerberg, & Nilsson,2016). On the contrary, fragmented operations and lack of clear responsibility definitons could undermine the aims of mainstreaming climate change adaptation (Runhaar et al., 2018). Kigali city presents a very participatory approach tourban planning. almost all the relevant stakeholders are brought on board in the decision making in order to cater for the interests of all. Key agents involved in the planning process include Ministries of Local government, infrastructure, Finance and Economics, Environment, Industrialization among others. Some of the lead agencies include but not limited to Rwanda Housing Authority, Rwanda Transport Development Authority, and Rwanda Environment Management Authority. Besides, the private sector, international organizations like GGGI and UN-Habitat are also involved in the plan making. Even though these agencies and minisstries take part in the planning process, it is apparent that the concept of mainstreaming climate change adaptation has never been explicitly addressed. The plans evealuated in sub-question 1 of objective 2 indicated an implicit approach to integrating climate change adapation yet all the stakeholders were involved in the process.

One critical factor that limits adaptation mainstreaming is lack of a framework the is interdepartmental and multi-sectoral. Although KCMP 2013 has a sustainability framework, it doesn't address how mainstreaming may be tackled. About 73% of the respondents agree that poor coordination among the stakeholders is one limiting factor in the planning process. This, according to the interviews, was due to lack of prioritizing flood risk by all. According to COK_2, a lacking sense of ownership by key agencies makes it hard to arrive at harmonized decisions on flood management. On the same note, Key Informant responded to coordination challenges by alluding that: *"Coordination because sometimes each institution is independent in its working manner. Sometimes, their priorities aren't our priorities. The bigger challenge become collaboration within these institutions."*

To address the challenge of coordination, the KCMP 2013 review process has introduced a thematic approach to problem brainstorming and decision making. Thus about 12 focused group discussions have been introduced in the planning process with environment and climate change being one of them. Even though the KCMP 2013 proposed the introduction of an environment department in the CoK, it never gave and focus climate adaptation per se. thus, there is a need to establish a dedicated department on climate change for effective decision making, Figure 4-21 below shows some of the dynamics limiting mainstreaming of climate change adaptation in Kigali city. The indicator in green was identified as driving factor in the currently ongoing KCMP review whereby themes have been formed to discuss various needs, climate change being one of them. On the same note pink indicators show some of the barriers to mainstreaming.

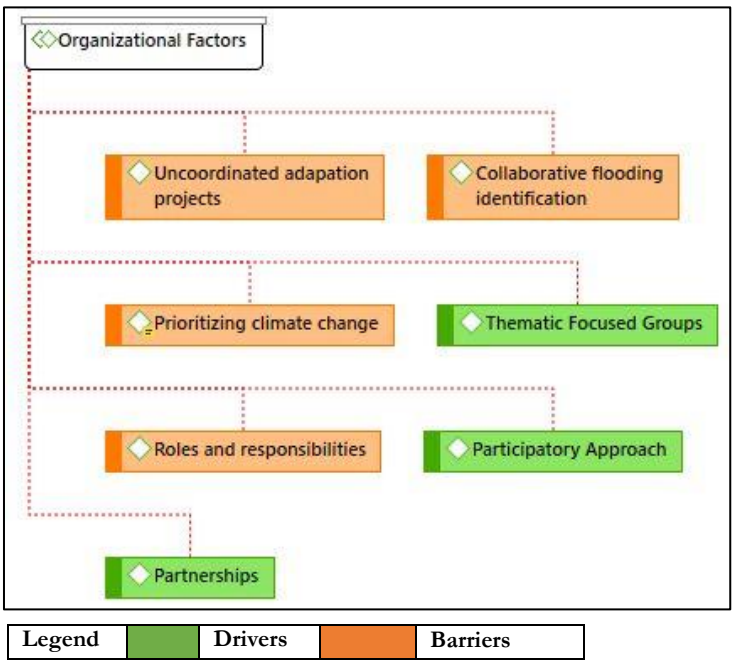


Figure 4-21: Organizational Factors Influencing Mainstreaming in Kigali City. (Source: Author, 2018)

— **Capacity Factors**

Mainstreaming climate change adaptation is a new dimension to many development sectors, planning included. In most cases, it calls for requisite technical and financial provision in terms of experts and budgeting. Almost all the key informants (90%) alluded to the lack of experts as a main limiting factor. Even though the plan preparation process is alleged to involve climate experts from government ministries (MIDIMAR), the lack of flood risk assessment indicates the presence of a void in this dimension. The city only conducts slope analysis to determines high risk zones of >40% slope for zoning as no go areas and further relocation of residents. The physical identification of vulnerability adequately confirms the lack of requisite expertise in risk informed planning. financially, the city lacks a dedicated budget for mainstreaming flood management into planning. the process calls for additional assessments such as risk levels based on projected scenarios. For instance, when asked about some of the challenges impeding the integration of climate change adaptation into planning, some of the responses included: "*The challenge comes when we are going to target some funds, because if a project is targeted in the next seven years program and you want to implement it in two years program. While the Central government has not given the money, this becomes a challenge because the city itself cannot sustain themselves when still waiting for these funds….*" (Key Informant ,2018).

On the positive side, there are subsidies in acquiring rainwater harvesting tanks to the residents of the city. Even though this is a good gesture, one wonders how much flooding can be prevented by rain water harvesting, putting in mind most people live in informal settlements. On the same note, the presence of FONERWA, though limited in budget, offers an option for a source of funding for adaptation projects in Kigali. However, the city has never managed to benefit from the fund yet. One key advantage the city has in terms of planning and urban management is autonomy. The city has the mandate to run its business as it wishes but observing nationally determined policy provisions is expected, more so since they are mostly funded by the government. This point is alluded to by all the key informants in the study. When asked about any existing opportunities, one informant responded: …. "*The city is autonomous and has the mandate for example to change the land use. Yes. For example, we propose a forest here, the council can sit and decide that no, this forest is not needed here we need something else maybe commercial either commercial there or we need a park there or we need something else. So, they have that mandate" (*Key Informant ,2018*).* Figure 4-22 below summarizes some of the capacity challenges limiting mainstreaming of climate change adaptation in Kigali.

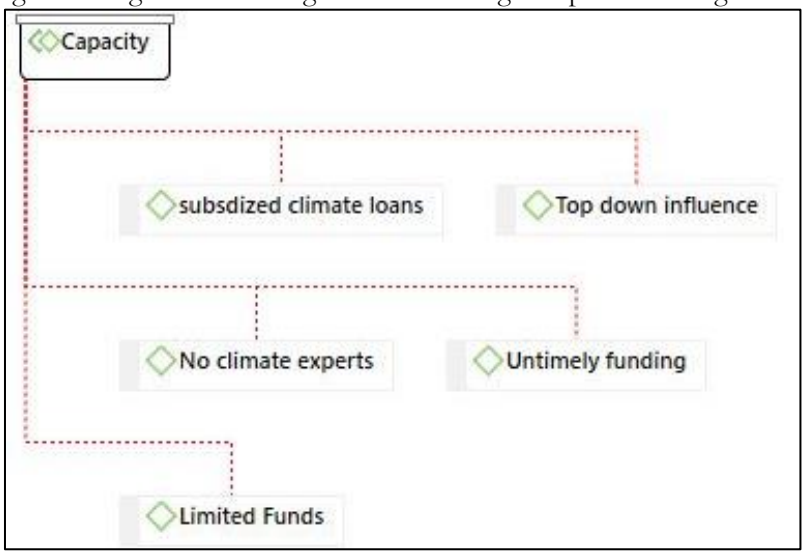


Figure 4-22: Capacity Factors Influencing Mainstreaming Adaptation in Kigali (Source: Author, 2018)

— **Cognitive Factors**

With respect to cognitive influencers, the extent of intellectual ability of the actors about mainstreaming climate change adaptation determines the effectiveness of the entire process. There exists a sense of urgency to address flood risks in Kigali as indicated by all the key informants interviewed. However, the most acknowledged limitation was the ability to accurately predict and forecast future impacts as a decision making tool. The level of uncertainty in the methods and tools used in planning make effective mainstreaming impossible. Even though mainstreaming was never explicitly addressed in the plans and the planning process, the inclusion of nature-based strategies like green and blue plans, wetland protection, urban forestry, storm water management and Natural Environment Management plan in the KCMP 2013 all point to implicit approach to mainstreaming. Thus, there is room for learning on how to mainstream by the city officials, a collective sense of urgency in planning and implementing risk informed urban plans. However, 80% of the city of Kigali key informants lacked awareness of the critical climate change impacts concepts such as risks, floods and damages. For instance, some would allude to flood damages as. *"a lot of water flowing downstream and washing away houses and roads…."* (Key Informant ,2018) Besides, the concepts and terminology, lack of scientific data for risk-informed planning coupled with unaware of requisite methodology for mainstreaming were reported by almost 90% of the informants as key limitations to this paradigm shift in Kigali city. Figure 4-23 shows a summary of some of the cognitive limitations to mainstreaming climate change adaptation in Kigali city.

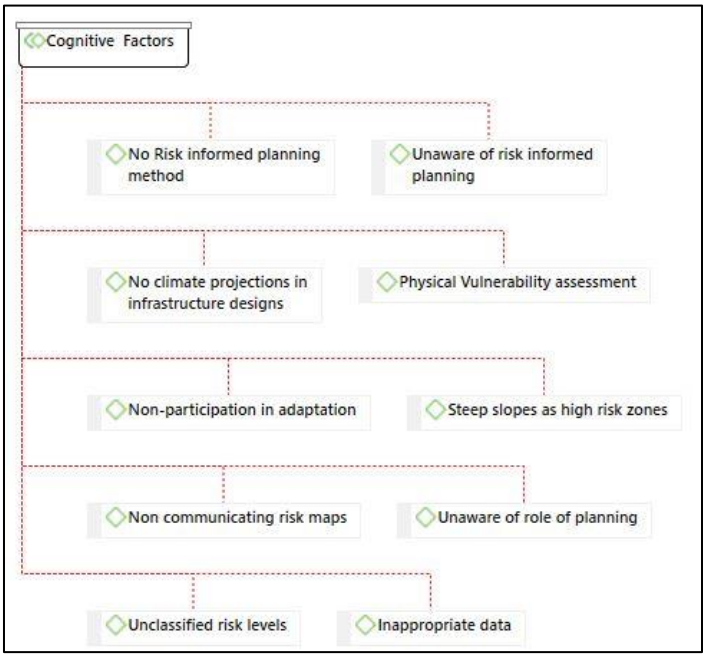


Figure 4-23: Some of the cognitive limitations (Source: Author, 2018)

— **Problem Framing Factors**

The first step to problem solving is appropriate definition of the problem itself. How can the problem at hand be framed in order to elicit the right interventions for effective outcomes? Though Kigali is experiencing an increase in precipitation and floods consequently, the city has never recognized this trend for what it is. Most of the urban plans over-emphasize on storm water management and very limited focus of floods. Thus, most strategies are on storm water management through such measures as upgrading drainage channels and wetland protection. storm water is a common phenomenon during rains and its potential impacts may be negligible. However, floods need accelerated efforts beyond drainage. Assessments of flooding vulnerability, exposure, coping capacity, flood intensity are among the key factors that will inform proper flood risk mitigation. The preparation of the Urban plans in Kigali never conducted all these necessities which led to assumptions that enlarging drainage and avoiding steep slope developments will be adequate to achieve a flood-free city in 50 years. This is indeed a narrow approach to distinguishing, defining and addressing the challenge of flooding in Kigali city.

— **Timing Factors**

Finally, all the key informants suggest a review of the KCMP 2013 as one big opportunity in addressing flooding in Kigali. Furthermore, they concur that the previous planning approaches did not give floods the focus it deserved. To them this is the most appropriate time to comprehensively include climate change adaptation in the anticipated urban plans. As some of the interviewees responded: "*What you can know, is that we are updating and reviewing the Master-plan. And in the previous master plan was adopted in 2013 some plans are not successfully integrated, but when we are updating it will include this plan and also these floods and flood management. (*Key Informant ,2018*)*

Summary of Drivers and Barriers

Figure 4-24 gives a summary of the barriers and drivers by indicating the most influential indicators based on code densities/frequencies as observed after coding the key informant interviews. As it can be seen, both political and cognitive factors have higher influence followed by capacity factors. For a complete understanding of the barriers and drivers under each code category (see ANNEX 16). Figures 4-25 and 4-26 below denote the main barriers and drivers of regulatory mainstreaming in Kigali city respectively. It can thus be concluded that political factors, cognitive factors and capacity played a major role in the attempt to mainstream climate change in Kigali, both in the barrier and driver dimensions.

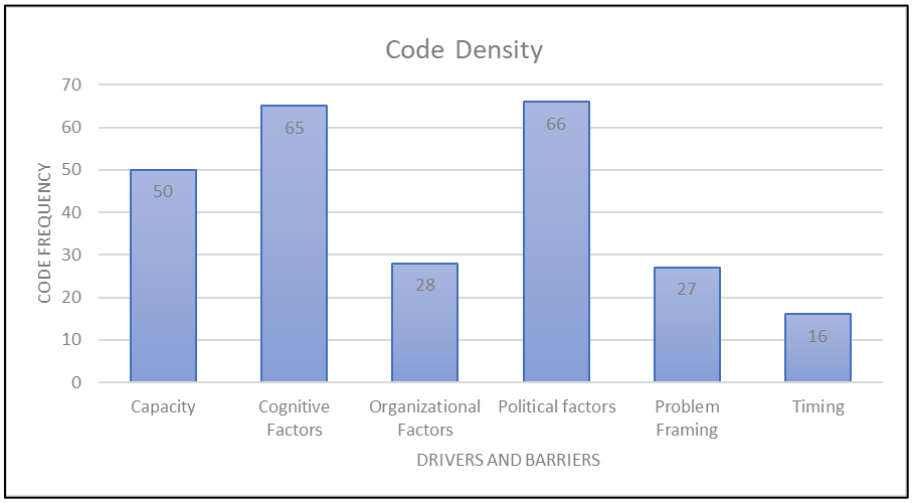


Figure 4-24: Code Densities for the Influencers of Mainstreaming (Source: Author, 2018)

Synthesis

The above findings shed light on what influences the attempt to integrate climate change adaptation into urban planning Kigali. Like most Global South cities, it is apparent that Kigali is facing political challenges such as directed adaptation programs that are not in line with city priorities and development timelines. Moreover, the inconsistent funding from the national government is a key impediment to achieving mainstreaming. On the positive, however, Kigali possesses good political good will for climate change and urban planning is one of the political class key agenda. Both financial and expert capacity challenge were reported. Critical to this capacity challenge was limited cognitive ability among city experts and lack of know-how on risk informed planning methodologies.

Finally, the city is at a strategic moment to effectively mainstream climate change adaptation during this process of master plan review. If the requisite measures are taken as discussed in the regulatory mainstreaming evaluation section, then good results may be achieved. An adequate operationalization of a regulatory mainstreaming framework that addresses well all the four facets of: agenda setting, context evaluation, risk-informed planning, and implementation, monitoring and evaluation, then the stage will be set for greater flood risk resilience.

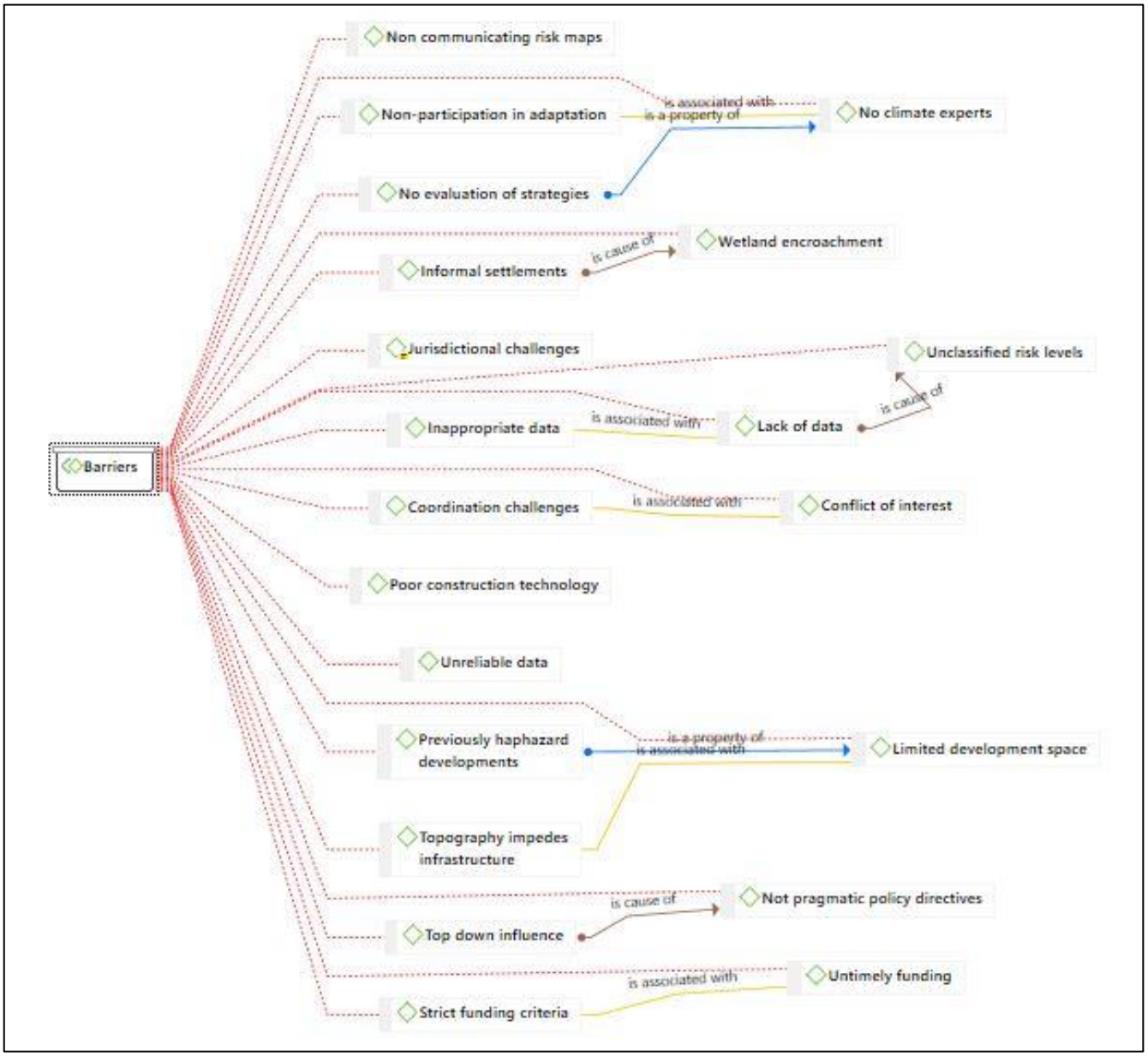


Figure 4-25: An Overview of the Barriers to Mainstreaming Adaptation in Kigali (Source: Author, 2018)

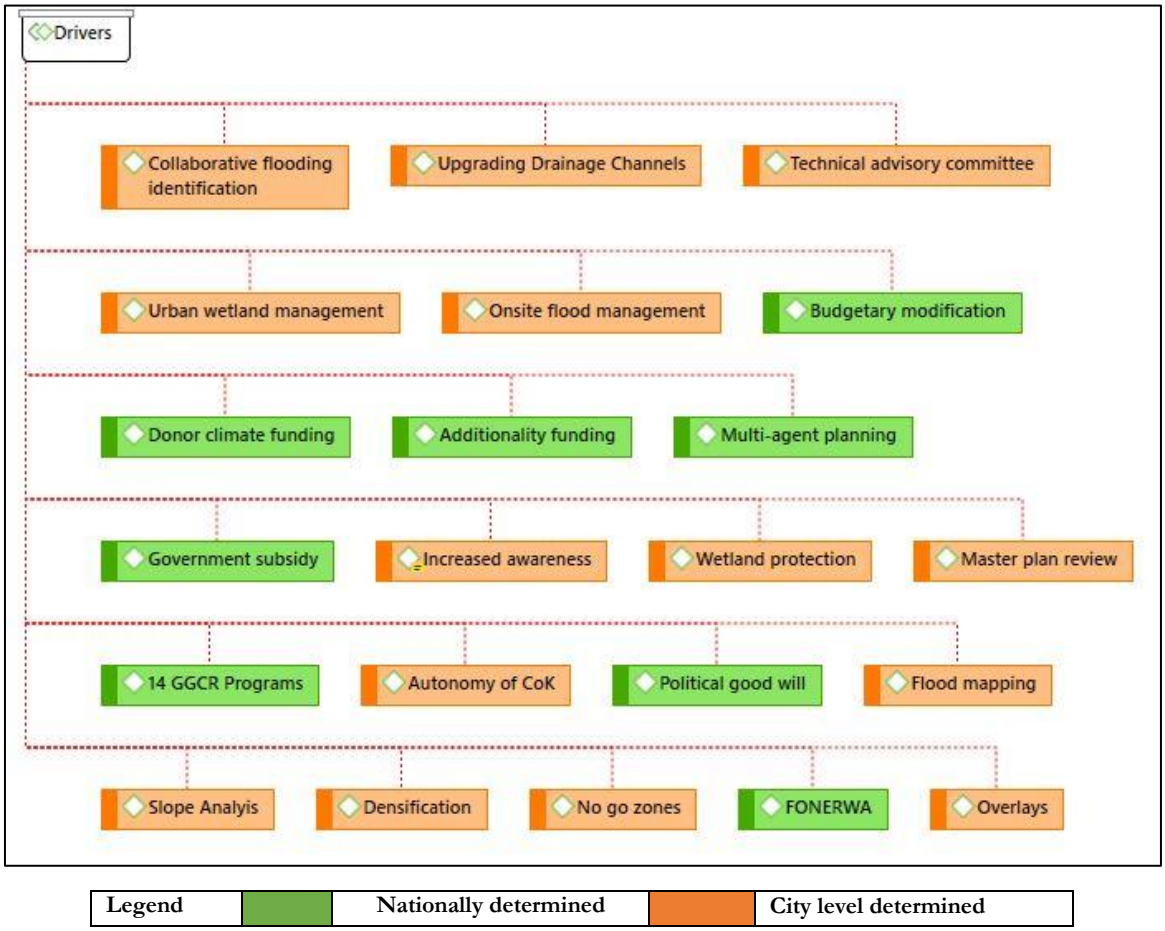


Figure 4-26: A Summary of the Drivers of Mainstreaming in Kigali. (Source: Author, 2018)

5 DISCUSSION

5.1 Overview

This chapter provides a discussion of the study findings based on the objectives and highlighting the supporting literature.

5.2 Policies and Urban Plans Influencing Development in Kigali City

The main aim of analysing the urban policies and plans influencing urban development in Kigali was to identify the presence or lack of coherence between the two sets of regulatory provisions (National and Local planning). Indeed, planning and development in Kigali are heavily influenced by the national government directives as far as the national development visions and strategies are concerned.

The top down approach to planning and decision making in Kigali and Rwanda at large has been reported to have its limitations to decision making. Studies adaptation management by Adger et al.,(2005) and Alam, (2014) assert that the national government may be tasked with preparing planning legislation, regulations on the use of flood prone areas, and conflict resolution on settlement planning and relocations/compensations. In the same context, the regional/county government level may be expected to advice municipalities and city authorities on planning, developing regional plans, and oversee national planning regulations and mediating in dispute resolutions. Lastly, the municipal/local level institutional set up is mandated with local planning responsibilities, role of reducing local vulnerability to climate impacts/hazards, conducting risk and resilience assessments for risk-informed spatial planning. These jurisdictional set ups pose a stage for a coherent framework of mainstreaming to be developed and adopted across the spatial planning levels. Unfortunately, if higher authorities don't factor climate change mainstreaming, this gap may be trickled down to the local levels of planning. All these expected approaches are missing in the attempt to mainstream climate change adaptation in Kigali.

The study findings depict flood risk adaptation mainstreaming is not well structured, let alone being observed across all the planning levels in Rwanda. The National Land Use and Development Master Plan does not provide a framework through which mainstreaming is to be affected in the country. Since the NLUDMP dictates the planning approaches in the districts and urban set ups, the entire goal of addressing climate change faces an obvious gap leaving local planning authorities to grapple with the situation unsuccessfully. This findings conquer with the findings of similar study by Uittenbroek,(2016) in Dutch municipalities, and Stiller & Meijerink, (2016) in northern Hesse, who assert that a lack of coherent mainstreaming framework among planning institutions and department Amy lead to ineffective results and limit the efforts to mainstreaming climate change adaptation by urban municipalities.

This study findings further revealed the implicit nature of the NLUDMP and urban plans in incorporating climate change adaptation. As claimed by all the key informants, urbanization is a new concept in Kigali and addressing it in line with the emergent climate change dynamics becomes more complicated. Accordingly, urban planning at all levels as results show, has always focused on the conventional urban needs of housing, transport, environment and job creation. This planning approach has consistently neglected urban vulnerability, exposure and climatic risks. When this omission of including adaptation, mainstreaming is compounded by encroachments into flood prone areas, hazard vulnerability and exposure increase leading to potentially high risks.

On the climate change adaptation front, Kigali experiences a directed-adaptation approach. According to Wamsler, (2014) and Runhaar et. al, (2018), for directed adaptation to be effective, it should be well structured and focused on the immediate contextual factors like local vulnerability, adaptive capacity and developmental priorities among others. In Kigali, climate change adaptation isn't the primary focus of the city thus, Kigali depends on external funding from bodies such as FONERWA and government ministries like MINECOFIN and the former MIDIMAR. These externally determined strategies and funding that are not well structured fail to meet the expected level of coordination, sense of ownership and accountability. In the end, most of the adaptation strategies and projects are either never implemented to completion, or not funded at all making the city more vulnerable than before (Key Informants, 2018).

5.3 Fitness of Urban Planning Process in Integrating Flood Risk in Kigali City

A study on the fitness of urban planning in integration climate change adaptation in Indian cities by Kumar & Geneletti, (2015), ascribe that urban planning process that is fit to integrate climate change concerns ought to as explicit as possible in doing so across all the 3As. Thus, adequate awareness, analysis and actions all combine to improve urban planning fitness. The case study area has demonstrated a very weak performance against this criterion. The fitness of the urban planning process to integrate flood risks in Kigali was found to be inadequate (see Table 4-1) indicated by the low level of incorporating flood risks in the urban planning process. For adequate capability in addressing climate change, the study by Kruse & Putz, (2014) ascribes the extent of urban planning fitness is thus identified by its ability to enhance awareness and willingness to include adaptation, flexible in addressing emergent development challenges like climate change impacts and include both short and long term visions towards climate change.

Apart from the planning fitness assessment, the quality of the plans was also determined based on bread and depth percentage scores. According to Tang, Brody, Quinn, & Chang, (2010) depth percentage scores depict the importance given to each 3As sub component in the urban planning in terms of explicitness. On the other hand, breadth scores addressed the degree to which the planning process addressed the 3As components by focusing on how many of the local planning levels have tackled each component of the evaluation criteria. The higher the depth and breadth percentage scores, the higher the quality of the planning in integrating climate change adaptation.

From the analysis, the results depict very poor quality for both the awareness and analysis components as per the evaluation criteria. This implies most plans either completely missed certain criteria like development of climate change scenarios and risk assessments for decision making or had implicit mentioning of the same. For instance, as shown in Table 12, 80% of the evaluation criteria had poor quality depth scores of less than 40% and breadth scores of less than 20%. A study by Tang, Brody, Quinn, & Chang, (2010) and Kumar & Geneletti, (2015), confirms that such very low scores imply inconsistency and weakness of urban planning in addressing climate flood risks in Kigali.

While KCMP 2013 made efforts to conceptually propose implicit adaptation measures, the same trend was not reflected across all the urban planning jurisdictions of Nyarugenge, Gasabo and Kicukiro districts. Actions towards integrating flood risk concerns into urban planning also had low depth scores in Kigali. This indicates how implicitly the evaluation criteria were addressed in the planning process. For instance, as shown in figure 18 most of the planning never reflected on potential funding, expert needs, cross-sectoral dynamics with respect to committed and sense of ownership among others. These factors indicate how limited the planning process was in addressing and incorporating flood risk concerns in Kigali city. These results are contrary to what previous study by Preston, Westaway, & Yuen, (2011) and referred to as the most recommendable approach to integrating flooding in planning processes.

5.4 Flood Risk Adaptation Strategies in Kigali City

The main objective of climate change mainstreaming is to curb the challenges of dedicated, stand alone and ad hoc adaptation strategies. As noted by scholars, dedicated adaptation brings about numerous challenges among them are policy redundancy, additional expenses, demand for experts, and are time consuming when responding to climate change in already planned areas (Wamsler, 2014;). Besides, since these dedicated adaptation measures are proposed by different agencies, they bring about conflicts of interest and jurisdictional challenges when it comes to implementation and taking responsibilities, and accountability. Besides, funding such dedicated adaptation strategies by different agencies becomes a problem putting in mind the city lacks adequate funds, capacity to implement, and the agencies in charge do not have direct responsibility to effect developments in Kigali city (Key Informants, 2018).

Climate change adaptation in Kigali is affected in a very disjointed manner with very many policies and agencies endeavouring to have an impact on the ground. This approach causes challenges of coordination and collaboration in the attempt to achieve harmonious vulnerability reduction and sustainable developments (Uittenbroek et al., 2016) According to Adger et. al, (2005), when multiple agencies are responsible for adaptation in any spatial unit, challenges of efficiency and success arise. For instance, who is responsible for the project, who evaluates the extent of success, who funds, and who monitors and evaluates? On the same front, if the project fails or maladaptation

happens, who takes the blame? All these re critical emergent realities that exist in Kigali city. With respect to Kigali, so far, no scientific study has been done to ascertain the level of success of the dedicated adaptation such as rain water harvesting, relocations and NO-GO Zones regulations (steep slopes). On the jurisdictional line, different agencies play varying roles in the same urban set up. REMA is keen on protecting the environment, KFWA focusses on forest safety from encroachments, GGCRS aims at green growth and the KCMP also has direct mandate to promote vulnerability reduction in Kigali. One would ask, who takes precedence? and who is accountable to who? (Adger et al., 2005)

In Kigali, one striking problem of dedicated and disintegrated adaptation strategies relates to the observation of wetlands buffer zones. Whereas the city of Kigali proposes a minimum of 20M, REMA on the other hand demands a minimum of 50M which according to the city authority isn't an optimal use of land. Besides this jurisdictional challenge, one would ask which of the two buffer zones spaces is safer, and for what flooding intensity? Similarly, in the attempt to promote onsite storm water management, KCMP 2013 prescribes a minimum plot size for single dwelling units at 600M^2 so as to cater for green plot ration, whereas the urban building code proposes a minimum plot size of 300M^2. Since both regulations are applicable in the same city, questions arise on how this can be harmonized. Furthermore, the presence of different dedicated adaptation strategies by different agencies raises the issue of conflicts of interest and contradictions between the aspirations of the city and the other lead agencies. For instance, the government through its directed adaptation strategies fails to understand the aspirations of the city or the matter of urgency. Such situations call for consultative approach to decision making to arrive at harmonized and relevant solutions to all involved parties (Mickwitz et al., 2010; EMI, 2015)

5.5 Explicit Integration of Flood Risks in Spatial Adaptation Projects in Kigali

Findings indicate that the only spatial adaptation project in Kigali implicitly implemented a systematic approach (Benson, C., & Twigg, J. 2007a; Umhlaba, 2011). Almost a third of the evaluation indicators were missing across the Logframe of evaluation. This denotes the lack of consistency in the project planning process thus limiting the extent of flood risk mainstreaming. For instance, during the analysis of project alternatives, no measures were done to address potential unintended maladaptation implications of the project. Therefore, should the project produce unforeseen negative impacts, chances of adequately addressing them are very slim. This may demand additional assessments to tackle the emergent challenges of flood risk adaptation options proposed like retention ponds and embarkment reinforcements. Moreover, the findings revealed that the spatial adaptation project never factored any significant assumptions that may influence the final outcomes. As noted by Vaggione, (2004), it is possible that the projected flooding scenarios for the 10-year, 20-year, 50-year and 100-year return periods may not have the exact intensities. This calls for adjustments in regulatory provisions such as change in land uses and relocation of people as per the prevailing circumstances. Based on the evaluation criteria, no measures were put in place to enable appropriate evaluation of the performance of the adaptation measures proposed. This may signify challenges in understanding the success and or failure of the project. It is expected that any adaptation project has an appropriate monitoring and evaluation framework that is cross-sectoral and arrived at in a participatory approach. This is due to the fact that urban land uses are many and are affected differently by flooding.

Apart from some of the evaluation indicators missing completely, a third of the evaluation indicators were implicitly addressed as shown in Table 11. Similar to the missing indicators discussed above, the implicitly addressed indicators cut across the entire project management cycle. For instance, the stakeholders mapping indicator was based on the review of previous urban planning projects from which actors were identified for inclusion. Putting in mind that the previous planning processes never factored flood risks as one of their objectives, it was apparent that this knowledge gap would still be reflected in the flood risk integration project in Nyabugogo. According to Benson, C., & Twigg, J. (2007a) and Rauken, Mydske, & Winsvold, (2015), inclusion of climate change experts in such adapttaion projects is key to addressing all the critical factors like risk assessments, vulnerability and coping capacities of both the land uses and urban populations. One of the most improtant indicator that was impicitly addressed was setting of specific, measurable, achievalbe, realistic and time-bound (SMART) objectives for the project. This limitations makes it hard to evaluate the gains made by the project in both integrating flood risks, improving coping capacities and reduction in vulnerability and risk levels. SMART objectives make the planning process more focused and assessing the final deliverables becomes easier as far as learning from previvous actions is anything to go by.

Lastly, the Nyabugogo Transit Hub and Market development project made substantial efforts compared to other planning endeavours to explicitly address some of the evaluation criteria. About 40% of the evaluation indicators

were explicitly addressed, though this is still a very low figure as far as achieving effective integration is concerned (Benson, C., & Twigg, J. 2007a). As shown in Table 11, the explicit indicators cut across the entire dimensions of the Logframe. At the stakeholder analysis step, the local community (potential victims of flood risks) were well identified and invloved in the profiling and vulnerability assessment of the project. The problem of flooding was adequately determined and the potential socio-economic impacts discussed. The land use options and other regulatory inteverntions like green infrastructure and structural adaptation measures were well focused on the key objective of flood risk and vulnerablity reduction in the project area. In overall, of all the 9 steps of systematic plannig as depicted by Benson, C., & Twigg, J. 2007a), the most explicitly observed were two (2): problem analysis and the analysis of alternative interventions criteria. Thus, different land use options were analyzed in a participatory way, various flood adaptation alternatives like retention ponds, reiforcing the river banks and relocation of land uses and people all received a very detailed discussion. According to Lopes, (2008), Umhlaba, (2011) and EMI,(2015), such a detailed evaluation enables an understanding of all the relevant dynamics that may influence the final decision. For example, different flood risk interventions may be informed by the potential vulnerability reduction levels of each option. However, there is still room for improving the extent of explicit integration of flood risks in urban adaptation projects since most of the indicators never received the desired level of attention.

The spatial adaptation evaluation findings offer knowledge gaps that should to be addressed for effective integration of flood risks in any urban development project. As observed by Lopes, (2008), explicit observation of the Logframe criteria (or any adopted/localized methodology), as long it is systematic and logical enough improves the chances of arriving at the desired goals.

5.6 Evaluating the Effectiveness of Regulatory Mainstreaming of Flood Risk Adaptation in Kigali City

A study by Albrechts, (2004) revealed that urban planning tasks are driven by overriding urban challenges that need to be addressed. Conventional urban planning has always focused on urban housing, transport, environment and job creation. As such the emergence of climate change dynamics were neither anticipated nor included in such planning approaches. Thus, a study by Watson, (2009) the stat of urban planning in the contepmoprary world asserts the need to redefine how urban planning is done in the light of climate change challenges. Achieving the integration of climate change into urban planning needs deliberate measures to make adaptation one of the focal points of the plan. The plans should explicitly indicate its intention to mainstream climate change adaptation within its objectives. On the same note, the perceptions of the key informants should also be precise on the status and direction of mainstreaming climate adaptation. This study found out that all the urban plans lack flood risk adaptation one of their key objectives. For instance, KCMP 2013 has 6 guiding principles, and flood management happens to be a sub-component of nature and biodiversity conservation. This approach lessens the focus and attention needed by flood risk adaptation since it is one of the critical climate change impacts in Kigali.

Studies indicate that no universal definition of mainstreaming exists. However, several authors have made both individual and collective attempts to define the concept as depicted in urban plans (Wamsler, Luederitz, & Brink, 2014; Runhaar et al., 2018). That said, an evaluation of the urban plans in Kigali never revealed any form of definition of the concept of mainstreaming. It's expected that any plan geared towards integration of flood risks ought to adopt a precise terminology for the definition of adaptation mainstreaming in order to formulate necessary measures to achieve this goal. Some definitions may refer to "Adaptation mainstreaming, or adaptation integration" etc. (Runhaar et al., (2018). The absence of mainstreaming concept recognition and/or definition of in the urban plans blinds the entire regulatory provision from not only perceiving, but also addressing climate change adaptation. This limited cognitive ability does not enable urban plans in the Global South to effectively integrate climate change adaptation into urban plans (Mukheibir & Ziervogel, 2007; Runhaar et al., 2016)

The current study findings also highlighted one of the critical limitations about "Operationalization of regulatory mainstreaming." Operationalization forms a critical and pivotal point in any attempts to integrate climate change into urban plans. The question of "How?" has always crippled and challenged any measures to address emergent issues that are madden with uncertainties such as climate change. This critical observation actually limits how climate change mainstreaming can be approached in Kigali. As noted by key informants, limited technical and financial capacity and relevant data have been key in reducing the possibility of risk informed planning in Kigali city.

Due to the lack of a regulatory mainstreaming operationalization framework, it becomes cryptic to propose relevant flood risk mainstreaming strategies in Kigali. This is because effective mainstreaming demands that adaptation be a component of planning, and in the absence of integration mechanisms, the proposed strategies just remain to be dedicated and ad hoc in nature. According to Sutanta, Rajabifard, & Bishop, (2013), Menoni, (2015) and EMI, (2015) urban risk assessments lead to the determination of acceptable risk levels which determine both suitable and unsuitable land uses for each portion of land. Moreover, risk assessments enable an understanding of the appropriate adaptation strategies in vulnerable areas such as devoting eco-system adaptation in flood prone areas, proposing functions that can be easily relocated from risky areas like recreational parks. That aside, without having an understanding of the risk dynamics in Kigali, it becomes very hard to arrive at plausible and feasible adaptation strategies in any urban planning context (EMI, 2015). On the same note, the study revealed that only Nyabugogo area had a spatial adaptation project which was arrived at after re-planning the area. However, the evaluation of the approach used in planning the project indicate how implicit it was.

Overall, Kigali city presented a very limited understanding and application of the regulatory mainstreaming at all aspects. From the analysed plans, there was no indication of mainstreaming agenda setting, lack of risk assessment and lack of risk-informed planning. Moreover, the results depicted the absence of mainstreaming indicators, evaluation framework and regulatory review criteria. As found out by Runhaar et al,.(2018) these four dimensions of regulatory mainstreaming dictate more on how the eventual strategies and their implementation will be realized and their absence imply a possible ineffective mainstreaming result.

5.7 Regulatory Mainstreaming Drivers and Barriers

Kigali enjoys immense political goodwill and support on matters urban planning and climate change adaptation. This places Kigali on a good starting point in trying to mainstream flood risk adaptation into urban planning. The formation and call for the implementation of national climate change strategies at the urban scale will accelerate this move, more so when it comes to funding and capacity building. However, political influence also acts as a barrier to the process of mainstreaming through varying perceptions and priorities of the actors involved. From the study on what works for effective mainstreaming, Runhaar et al., (2018) confirmed similar findings in that conflicting interests and perceptions have the potential to impede the effectiveness of mainstreaming adaptation. Similarly, the study on overcoming the barriers to mainstreaming adaptation by Uittenbroek, (2016a) conqir that unless there exists good political will, then achieving the anticipated success may become elusive. To demonstrate this political concern in Kigali, the national government sets development agenda that sometimes turn out not to be in line with the aspiration of the city objectives as far as priorities are concerned. The central government may propose climate change programs in 10 or 20 year development visions thus it delays in discussing funds yet floods are the immediate needs of the city. This calls for both spatial planning coherence and vertical integration in decision making and collaborations as it was found by Wamsler et al., (2014) in their study on manstreaming eco-system based adaptation at the local municipal levels.

Findings revealed a very limited cognitive ability among 75% of the key informants. This was informed by the lack of scientific data and methodology for risk-informed planning. On the same note the majority of the key informants could not explain the key concepts in flood risk adaptation such as exposure, risks, flooding and vulnerability. A study of inclusive adaptation planning in the global south by Chu, Anguelovski, & Carmin, (2016) confirms this limitation where they call for adequate knowledge sharing for effective spatial adaptation planning. Cognitive limitation therefore affects the extent of addressing flood risks in the planning process as confirmed by a study on adaptation mainstreaming at local planning levels by Wamsler, Luederitz, & Brink, (2014). Low cognitive ability may have led to the low awareness and analysis of flood risks and climate change at large in the planning process. Thus, there is need to promote the cognitive ability of the city officials in terms of capacity building for risk-informed planning dynamics as observed in studies by Tang, Brody, Quinn, & Chang, (2010); Solecki, Leichenko, & O'Brien, (2011)

Organizational factors such as the set-up and structuring of the regulatory frameworks; formal requirements to develop integrated spatial adaptation plans; supportive regulative framework (i.e. supportive legislation, regulation); coordination and cooperation between departments; cooperation with private actors and citizens; clarity about responsibilities and/or problem ownership determines the success and/or failure of the mainstreaming process (e.g. Wamsler, 2014 and Uittenbroek, 2016a). Although Kigali city has a proposed sustainability framework, the framework wasn't focused on addressing flood risks. The framework heavily dwelt on the three pillars of

sustainability that entail the economic, environmental and social dimensions. This narrowly conceptualized framework has a significant potential in limiting the scope of urban planning as far as the inclusion of climate change dynamics are concerned. This calls for restructuring both the regulatory framework and organizational set up to adequately include climate change in a multi-sectoral and multi-departmental way as studies by (Chu, Anguelovski, & Carmin, 2016) found out in their paper on inclusive adaptation planning in the global south..

In the study by Stead & Meijers, (2009) it was found out that effective mainstreaming calls for resources such funds, experts, information, accurate data among other factors. A similar observation was also held by Pasquini et al., (2015) in their study on what enables municipalities to plan for adaptation in South African cities. The availability of qualified and adequate experts, sufficient and accurate data, and financial resources are key to effective flood risk adaptation mainstreaming. From the study results, all the key informants confirmed that the city of Kigali is highly limited when it comes to resource availability. For instance, the GIS department is not in a position to undertake flood risk assessments for planning purposes. Both Sutanta, Rajabifard, & Bishop, (2013) and Benson, C., & Twigg, J. (2007a), conquir that the planning process should be accompanied by risk and resilience assessments for purposes identifying risks and land use suitabilities for the various urban urban functions. Even though the city of Kigali outsources data from the previous MIDIMAR (currently called Ministry of Disaster Response and Management), no local level risk data was availed apart from generic flood maps that never factored exposure, vulnerability and hazard intensities (Key Informant, 2018).

One of the most significant steps in problem solving is process of identifying and conceptualizing the problem itself. This therefore calls for accurate definition and framing of the problem at hand. A study on he cost and benefits of spatial adaptation planning in Netherlands by Bruin, K. De, & Goosen, H. (2014) claims that wrong diagnosis and characterization of climate problems may lead to inappropriate solutions and results in the end. This concern was conformed in Kigali in that previous planning efforts have alwayes focussed on housing, transport and job creation, and paud limited efforts on climate change. Moreover, in the attempt to address flooding challenges, the city plans have been limited on storm water management which diminishes the actual flooding hazard. A study by Menoni & Adriana, (2015) shows that planning process that explicilty identifies the need for flood risk adapation as one of the key objectives of the plan, conducts risk and vulnerability assesspemts, and prepares urban risk and resilience indices (matrices) will make it easier and direct to effectively incoporate flooding challengs.

In a study on what works for effective adaptation, Runhaar et al. (2018), claim that when preparedness meets opportunity, possible positive results can be expected. Thus, in the endeavour to mainstream flood risk adaptation in the context of Kigali, it is very significant that the process be done in a strategic way that coincides with the contemporary planning and development scenarios. For instance, the current good political good will in Kigali provides an ample atmosphere to spearhead the mainstreaming agenda. The existence of FONERWA and its ability (though limited) to fund climate related projects provides Kigali city an opportunity to capitalize on. On the same, the current process of reviewing the KCMP 2013 happens to be the best opportune moment ever to conduct a comprehensive city-wide flood risk mainstreaming initiative. This is due to the fact that the process of master review will include the full urban planning process spectrum, bringing on board all the relevant agencies which will make it possible to promote a sense of ownership, collaboration and responsibility across the board. Moreover, Wamsler (2015) found out that if adaptation is brought in focus when flooding challenges are prevalent, chances of the responsible actors addressing the problem are high.

6 CONCLUSION AND RECOMMENDATIONS

6.1 Overview

This study aimed at unearthing the efficacy of regulatory mainstreaming flood risk adaptation in Kigali city. Thus, it looked into urbans, planning frameworks, adaptation strategies and factors influencing mainstreaming. Below is the reflection of the findings, recommendations, contribution to science, future research and study limitations.

6.2 Conclusions

i) Objective 1: Fitness of Urban Planning in Integrating Flood Risk Adaptation

Urban plans in Rwanda and Kigali are hierarchical (in a top-down structure). Much as this approach has the potential to promote policy coherence and harmonized adaptation measures, it has failed to explicitly address climate change leading to a national gap in addressing climate change spatial adaptation in Kigali. This is evident by the lack of explicit integration of climate change concerns in the national, city and district plans leading to potential increase in vulnerability, risks and reducing coping capacities of both urban land uses and urban dwellers. Moreover, Urban policy, plans and programs include intervention examples with adaptation qualities, but are unclearly designed or implemented. Besides, there no mechanism to evaluate the impacts of the existing adaptation urban adaptation measures. With no guiding policy or mainstreaming framework, costly post-flooding interventions will continue.

With respect to the fitness of urban planning i.e. the capacity and ability of urban planning frameworks to be modified to respond to reduce flood risk vulnerability and exposure, there's need for improved adaptation Awareness, Analysis and Action. The poor performance of the 3As denote the need for improvement in developing more climate responsive and flexible urban planning framework that is amendable to address contemporary climate challenges. That said, the key informants expressed a high level of awareness and sense of urgency on matters climate change. This was because flood risks have exuberated in the recent years when the plans were already in place, and no measures were made to integrate climate change. As the KCMP is being reviewed, this is a lee way for future planning to be risk-sensitive across all the urban planning levels.

ii) Objective 2: Translation of Flood Risk Concerns into Urban Adaptation in Kigali City.

Kigali adaptation strategies are mostly directed with a great influence from the higher authorities. Moreover, different institutions and government agencies are responsible for various adaptation strategies to be implemented in Kigali. This adaptation approach has brought about challenges such as conflicts of interest, incoherence in development guidelines and prioritization. Furthermore, the challenge of responsibility, accountability and evaluation of success has been hindered by the presence multiple agencies proposing disintegrated proposals for the same area of action. For instance, REMA has the EIA guidelines, MoE has the Forest Investment Program and KCMP proposes nature and biodiversity strategy for Kigali, which of these proposals should take precedence, and who should be responsible for funding, monitoring and evaluation? As a result, it has become difficult to achieve harmonized adaptation planning and implementation.

The only spatially oriented adaptation project in Kigali, Nyabugogo Transit Hub and market redevelopment project was to have implicitly integrated flood risks in its project planning process. Eve though the planning of this project was outsourced, the lack of explicit integration indicates that knowledge gap identification among the actors involved was never done. This is a critical problem putting in mind that the project was on a small scale and one would expect an excellent and explicit integration of flood risks into the spatial project to be realized.

iii) Objective 3: Factors Influencing Effective Regulatory Mainstreaming Flood Risk Adaptation

The effectiveness of regulatory mainstreaming as evaluated revealed an overall implicit result. As depicted by the mainstreaming framework, a lot is left to be desired with respect to knowledge gap identification, risk assessments during situational analysis, formation of flood resilience visions to guide a flood free urban plan and adequate risk profiling of the entire planning area. On the same note, the lack of indicators of flood risk mainstreaming makes it hard to evaluate the success level of the plan at the end of the planning cycle (eg 5 years).

Critical factors behind the poor efficacy in mainstreaming flood risk adaptation into urban planning included but not limited to factors that were political, cognitive, capacity, coordination and problem framing in nature. For instance, much there is political backing from climate change adaptation, untimely funding and coordination challenges robe the potential of success available. Limited cognitive ability among the experts and city officials about the requisite climate risk data, risk-sensitive urban planning and relevant technology have led to conventional development planning and proposals in Kigali. Furthermore, poor problem framing has always led to floods not being viewed as a derivative of climate change but considered simply as storm water. Therefore, measures to address storm water management like enlarging drainages o not have the capacity to tackle floods in Kigali.

These results indicate how the entire approach to flood risk mainstreaming in Kigali has been compromised. At the policy level, no framework exists to guide the integration of flood risks, at the city and district planning, the process has been found not to be capable and flexible enough o include climate change concerns. A similar challenge was evident in the adaptation strategies and the only spatial adaptation project in Kigali. The effects of the above findings have finally limited the effectiveness of regulatory mainstreaming flood risk adaptation into urban planning in Kigali as a whole. This gap calls for affirmative actions to streamline the planning framework and harmonize the roles and responsibilities of relevant actors in order to arrive a unified and agreed upon mainstreaming framework for the city of Kigali. To achieve this demand, there's a need to overcome the identified critical barriers to mainstreaming climate change adaptation. Thus, the negatives of political influence such as unfunded directed adaptation projects, lack of coordination and a sense of ownership among actors. Also, an improved capacity status and cognitive ability in terms of funds, experts and risk informed planning methods and data respectively will be a big positive move towards achieving regulatory mainstreaming of a higher efficacy in Kigali city and its districts. This may as well be scaled up to the other secondary cities in Kigali.

6.3 Recommendations

Kigali has made attempts to incorporate climate change adaptation into land use plans, strategies and planning tools, even if this incorporation is often not explicit to objectives of mainstreaming climate risks. Additionally, some adaptation incorporation is incoherent and discordant from different actors. With the observed climate change impacts in Kigali, there is an urgent need to ensure that present and future urban plans and policies are operational to improve Kigali's climate change adaptive capacity. Recommendations described below address current weaknesses in incorporating climate change adaptation into existing policy and plans and highlights best practices from locales similar to Kigali.

6.3.1 Contribution to Urban Planning and Policy

i) Localize an effective Regulatory Mainstreaming Framework

One of the most important factors in effective mainstreaming adaptation into urban plans is the planning framework/methodology. Conventional planning process has always neglected the need to undertake climate risks and resilience assessments. Thus, a regulatory mainstreaming approach such as that prescribed by EMI (2015) could aid Kigali city in mainstreaming flood risks and other related hazards into urban planning (see Section 2.8.2)

ii) Coordination and Sharing

Harmonizing climate change strategies will ensure policies and plans are comprehensive, optimize funds for adaptation strategies, minimize redundancy and contradictions, and ensure policies and plans are implemented at the city and district levels. This can be achieved through mandating representation from ministries, agencies, and experts with a stake in spatial and climate change planning (e.g. MINILOC, MININFRA, MIDIMAR, MoE etc.) within a climate change taskforce. This collaborative initiative will ensure all sectors contribute towards a coordinated effort to mainstream climate change adaptation not only to urban planning, but also to various government and community sectors.

iii) Improve Cognitive Factors

Rwanda conducted a climate vulnerability assessment and collected data on climate patterns and has access to substantial climate change resources. Although some of the collected data is disseminated to end users like Kigali city authority, important information such as data packing and usefulness to urban planners, environmentalists,

and land use managers is unclear. Therefore, better data collection, analysis, packaging and dissemination strategies to stakeholders can help new spatial adaptation efforts build off of past experiences.

iv) Capacity Development and Resource Allocation

Funding for climate change adaptation mainstreaming is a major issue that prevents scaled up interventions in Kigali. Dedicating portions of the city budget to addressing climate change impacts as well as adaptation strategies is thus necessary. The allocation of funding for climate change impacts and adaptation strategies will ensure smooth operation of these initiatives. Since FONERWA is already operating and funding climate change related projects, dedicating long term funding continuing the grant program should be developed.

6.3.2 Contribution to Science

Runhaar et al (2018) provided the latest 15-indicator framework against which potential effective mainstreaming should be evaluated. However, one of the most critical and significant indicators that may improve mainstreaming is the operationalization of the mainstreaming process. Since this study focused on regulatory mainstreaming, it has attempted to indicate how effective regulator mainstreaming of flood risks into urban planning may be addressed in the Global South, with respect to Kigali city. Besides, unearthing of the limiting factors makes it possible to localize a regulatory mainstreaming framework for Kigali, a study that had never been done before. Last but not least, the study by Runhaar et al (2018) did not demonstrate how effective regulatory mainstreaming can be quantitatively evaluated for appropriate decision making. It is thus notable that this study creates an entry into further climate change mainstreaming in the context of Kigali.

6.4 Future Research

This study focused of regulatory mainstreaming of flood risk adaptation into urban planning in Kigali city. This limited and specific scope was informed by time constraints for this study. However, mainstreaming has various types that include: Programmatic mainstreaming; Managerial mainstreaming; Intra- and inter-organizational mainstreaming; and Directed mainstreaming (Runhaar et al 2018). An overall understanding of how all these facets of mainstreaming can be effected in Kigali city will provide a holistic approach to climate change mainstreaming. Thus, further research about the state of these other dimensions of mainstreaming may be of great significance.

On the same note, this study managed to evaluate the extent regulatory mainstreaming, and also operationalized how it can be achieved which was an improvement on what Runhaar et, al (2018) did. However, urban planning being spatially-oriented, this study suggests the need for appropriate geo-spatial methodologies for risk-informed planning apart from the ineffective land cover overlays done in Kigali city. Numerous geo-spatial approaches exist but identifying one that may be applicable in the context of Kigali is paramount to the success of risk-informed planning, also called regulatory mainstreaming.

6.5 Study Limitations

The use of indicator frameworks may have failed to accurately reveal the contextual issues in Kigali as depicted in the evaluated urban plans. This is informed by the fact that mainstreaming flood risks was never one of the cardinal goals of urban planning in Kigali. This calls for context specific indicator frameworks in future studies through thorough piloting. On the same note, this study was limited by time and therefore aimed at providing an indication of regulatory mainstreaming status in Kigali and its districts. Therefore, there is need for more detailed studies by focussing deeply on every available climate change impact, looking at cross-sectoral climate change issues beyond urban planning and a wider range of stakeholders. On the same note, since the study was limited to policy and urban plans, there's need for studies that include the urban dwellers, informal planning and adaptation, and the role of the international community in climate change adaptation in Kigali city.

7 LIST OF REFERENCES

Adger, W. N., Arnell, N. W., & Tompkins, E. L. (2005). Successful adaptation to climate change across scales, *15*, 77–86. https://doi.org/10.1016/j.gloenvcha.2004.12.005

African Union. (2014). African Strategy on Climate Change, (May), 86.

Alam, M. (2014). Mainstreaming Climate Change Adaptation into Development Planning, *5*(1), 2. https://doi.org/10.4314/gjds.v14i2.11

Albrechts, L. (2004). Strategic (spatial) planning reexamined. *Environment and Planning B: Planning and Design*, *31*(5), 743–758. https://doi.org/10.1068/b3065

Araos, M., Berrang-Ford, L., Ford, J. D., Austin, S. E., Biesbroek, R., & Lesnikowski, A. (2016). Climate change adaptation planning in large cities: A systematic global assessment. *Environmental Science and Policy*, *66*, 375–382. https://doi.org/10.1016/j.envsci.2016.06.009

Asumadu-Sarkodie, S. (2015). Situational Analysis of Flood and Drought in Rwanda. *International Journal of Scientific and Engineering Research*, *6*(8), 960–970. https://doi.org/10.14299/ijser.2015.08.013

AU (African Union). (2017). *2017 Africa Sustainable Development Report: Tracking Progress on Agenda 2063 and Sustainable Development Goals*. https://doi.org/978-92-1-125130-2

Benson, C., & Twigg, J. (2007). *Tools for Mainstreaming Disaster Risk Reduction : Guidance Notes for Development Organizations*. *International Federation of Red Cross and Red Crescent Societies / the ProVention Consortium*.

Bierbaum, R. M., & Zoellick, R. B. (2009). *Development and Climate Change*. *World Development Report 2010* (Vol. 326). https://doi.org/10.1126/science.1183876

Brouwer, S., Rayner, T., & Huitema, D. (2013). Mainstreaming climate policy: The case of climate adaptation and the implementation of EU water policy. *Environment and Planning C: Government and Policy*, *31*(1), 134–153. https://doi.org/10.1068/c11134

Bryman, A. (2012). *Social Research Methods* (4th ed.). New York: Oxford University Press. https://doi.org/10.15713/ins.mmj.3

Butterfield, R. (2018). Inspiring climate action in African cities : practical options for resilient pathways About the authors, (January).

Cantada, I. D. (2017). Urban Planning Study For Tanzania – Impact And Effectiveness Of Urban Planning On City Spatial Development October 2017, (October).

Chang, Y., Wilkinson, S., Potangaroa, R., & Seville, E. (2010). Resourcing challenges for post-disaster housing reconstruction: A comparative analysis. *Building Research and Information*, *38*(3), 247–264. https://doi.org/10.1080/09613211003693945

Chmutina, K., & Bosher, L. (2015). Disaster risk reduction or disaster risk production: The role of building regulations in mainstreaming DRR. *International Journal of Disaster Risk Reduction*, *13*, 10–19. https://doi.org/10.1016/j.ijdrr.2015.03.002

Chu, E., Anguelovski, I., & Carmin, J. (2016). Inclusive approaches to urban climate adaptation planning and implementation in the Global South Inclusive approaches to urban climate adaptation planning and implementation in the Global South, *3062*. https://doi.org/10.1080/14693062.2015.1019822

Claudia, R. (2016). *Disaster risk management and climate change adaptation in urban contexts : Integration and challenges*. Lund University, Sweden.

Cluva. (2012). Climate Change and the Vulnerability of African Cities. *Climate Change and the Vulnerability of African Cities*.

Community East African. (2010). East African Community Eac Climate Change Policy, (May).

Di Gregorio, M., Nurrochmat, D. R., Paavola, J., Sari, I. M., Fatorelli, L., Pramova, E., … Kusumadewi, S. D. (2017). Climate policy integration in the land use sector: Mitigation, adaptation and sustainable development linkages. *Environmental Science and Policy*, *67*, 35–43. https://doi.org/10.1016/j.envsci.2016.11.004

Earthquake and Megacities Inititative. (2015). *Urban Resilience Master Planning: A Guidebook for Practitioners and Policymakers*.

EMI. (2015). *Urban Resilience Master Planning: Aguide for Priactitioners and Policy Makers* (First). Quezon City. Retrieved from http://www.emi-megacities.org

Few, R. (2003). Flooding, vulnerability and coping strategies: local responses to a global threat. *Progress in Development Studies*, *3*(1), 43–58. https://doi.org/10.1191/1464993403ps049ra

Filho, W. L. (2017). *Climate Change Adaptation in Africa*. (Walter Leal Filho, B. Simane, J. Kalangu, Menas Wuta, P.

Munishi, Musiyiwa, & Kumbirai, Eds.) (Climate Ch). Hamburg, Germany: Springer Nature. https://doi.org/10.4324/9781315794907

Galderisi, A., & Menoni, S. (2015). *Improving the Role of Land Use Planning for Reducing Existing and Future Risks*.

GoK. (2014). Kenya - National Spatial Plan 2015-45.

Iglesias, G. R. (2014). Mainstreaming Disaster Risk Reduction, (January 2010).

IPCC. (2007). *Climate Change 2007: impacts, adaptation and vulnerability: contribution of Working Group II to the fourth assessment report of the Intergovernmental Panel. Genebra, Suíça*. https://doi.org/10.1256/004316502320517344

IPCC. (2014a). Climate Change, Adaptation, and Vulnerability. *Organization & Environment*, *24*(March), 1–44. https://doi.org/http://ipcc-wg2.gov/AR5/images/uploads/IPCC_WG2AR5_SPM_Approved.pdf

IPCC. (2014b). *Climate Change 2014: Mitigation of Climate Change. Summary for Policymakers and Technical Summary. Climate Change 2014: Mitigation of Climate Change. Part of the Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. https://doi.org/10.1017/CBO9781107415416.005

Joshi, S., Damani, H., Ng, J., Lauwa, L., & Joshi, S. (2013). *Kigali City Master Plan Report*.

Klein, R. J. T., Eriksen, S. E. H., Næss, L. O., Hammill, A., Tanner, T. M., Robledo, C., & O'Brien, K. L. (2007). Portfolio screening to support the mainstreaming of adaptation to climate change into development assistance. *Climatic Change*, *84*(1), 23–44. https://doi.org/10.1007/s10584-007-9268-x

Kruse, S., & Putz, M. (2014). Adaptive Capacities of Spatial Planning in the Context of Climate Change in the European Alps, (January). https://doi.org/10.1080/09654313.2013.860516

Kumar, P. (2015). Spatial planning to integrate climate change adaptation at local level Parveen Kumar, 187.

Kumar, P., & Geneletti, D. (2015). How are climate change concerns addressed by spatial plans? An evaluation framework, and an application to Indian cities. *Land Use Policy*, *42*, 210–226. https://doi.org/10.1016/j.landusepol.2014.07.016

Levina, E., & Tirpak, D. (2006). Adaptation to Climate Change : Key Terms, 25.

Lin, L. (2018). Integrating a national risk assessment into a disaster risk management system: Process and practice. *International Journal of Disaster Risk Reduction*, *27*(August 2017), 625–631. https://doi.org/10.1016/j.ijdrr.2017.08.004

Lopes, A. C. S. (2008). Management of Nongovernmental Organizations A case study on project management procedures.

Lwasa, S. (2010). Adapting urban areas in Africa to climate change: The case of Kampala. *Current Opinion in Environmental Sustainability*, *2*(3), 166–171. https://doi.org/10.1016/j.cosust.2010.06.009

Menoni, A. G. and S. (2015). Improving the Role of Land Use Planning for Reducing Existing and Future Risks in The " State of DRR at the Local Level " A 2015 Report on the Patterns of Disaster Risk Reduction Actions at Local Level 1 Improving the Role of Land Use Planning for Reducin. *Report*, 1–10.

Metternicht, G. (2017). Land use planning. *Global Land Outlook Working Paper*, 67.

Moser, S. C., & Ekstrom, J. A. (2010). A framework to diagnose barriers to climate change adaptation. https://doi.org/10.1073/pnas.1007887107/-/DCSupplemental.www.pnas.org/cgi/doi/10.1073/pnas.1007887107

Moser, S. C., & Luers, A. L. (2008). Managing climate risks in California : the need to engage resource managers for successful adaptation to change. *Climatic Change*, *87*, 14. https://doi.org/10.1007/s10584-007-9384-7

Mukheibir, P., & Ziervogel, G. (2007). Developing a Municipal Adaptation Plan (MAP) for climate change: The city of Cape Town. *Environment and Urbanization*, *19*(1), 143–158. https://doi.org/10.1177/0956247807076912

Niang, I., Ruppel, O. C., Abdrabo, M. A., Dube, P., Leary, N., Schulte-Uebbing, L., … White, L. (2014). IPCC report on Africa. *South Africa)South Africa)South Africa)*, 1199–1265. https://doi.org/10.1017/CBO9781107415386.002

O' Brien, K., Leichenko, R., & Vogel, C. (2008). Disaster Risk Reduction , Climate Change Adaptation and Human Security Norwegian Ministry of Foreign Affairs Disaster Risk Reduction , Climate Change Adaptation and Human Security. *Security*, *3*, 78. https://doi.org/ISSN: 1504-5749

Pasquini, L., Ziervogel, G., Cowling, R. M., Shearing, C., Pasquini, L., Ziervogel, G., … Shearing, C. (2015). What enables local governments to mainstream climate change adaptation ? Lessons learned from two municipal case studies in the Western Cape , South Africa. *Climate and Development*, *7*(1), 60–70. https://doi.org/10.1080/17565529.2014.886994

Persson, Å., Eckerberg, K., & Nilsson, M. (2016). Institutionalization or wither away? Twenty-five years of environmental policy integration under shifting governance models in Sweden. *Environment and Planning C: Government and Policy*, *34*(3), 478–495. https://doi.org/10.1177/0263774X15614726

Preston, B. L., Westaway, R. M., & Yuen, E. J. (2011). *Climate adaptation planning in practice: An evaluation of adaptation plans from three developed nations*. *Mitigation and Adaptation Strategies for Global Change* (Vol. 16). https://doi.org/10.1007/s11027-010-9270-x

Rahamn, M. H., Noor, M. A., & Ahmed, A. (2011). *Climate change impacts and adaptation strategies for Bangladesh*. *Climate Change and Growth in Asia*. https://doi.org/http://dx.doi.org/10.1016/j.clay.2015.02.014

Rahman, A. B. (2017). Mainstreaming Climate Change Adaptation in a Developing Country Context : an Indonesian Case Study, (April).

Rauken, T., Mydske, P. K., & Winsvold, M. (2015). Mainstreaming climate change adaptation at the local level. *Local Environment*, *20*(4), 408–423. https://doi.org/10.1080/13549839.2014.880412

REMA. (2013). Rwanda: State of Environment and Outlook Report 2015. https://doi.org/10.13140/RG.2.1.5148.6328

Runhaar, H. A. C., Uittenbroek, C. J., van Rijswick, H. F. M. W., Mees, H. L. P., Driessen, P. P. J., & Gilissen, H. K. (2016). Prepared for climate change? A method for the ex-ante assessment of formal responsibilities for climate adaptation in specific sectors. *Regional Environmental Change*, *16*(5), 1389–1400. https://doi.org/10.1007/s10113-015-0866-2

Runhaar, H., Mees, H., Wardekker, A., van der Sluijs, J., & Driessen, P. P. J. (2012). Adaptation to climate change-related risks in Dutch urban areas: Stimuli and barriers. *Regional Environmental Change*, *12*(4), 777–790. https://doi.org/10.1007/s10113-012-0292-7

Runhaar, H., Wilk, B., Persson, Å., Uittenbroek, C., & Wamsler, C. (2018). Mainstreaming climate adaptation: taking stock about "what works" from empirical research worldwide. *Regional Environmental Change*, *18*(4), 1201–1210. https://doi.org/10.1007/s10113-017-1259-5

Schmidt-thom, P., Survey, G., & Schmidt-thom, P. (2017). Development of Natural Hazard maps for European Regions Natural and Technological Hazards and Risks Affecting the Spatial Development of European Regions Edited by Philipp Schmidt-Thomé Geological Survey of Finland, (June).

Schmidt-thome, P. (2017). Development of Natural Hazard maps for European Regions Natural and Technological Hazards and Risks Affecting the Spatial Development of European Regions Edited by Philipp Schmidt-Thomé Geological Survey of Finland, (June).

Smit, B., & Wandel, J. (2006). Adaptation, adaptive capacity and vulnerability. *Global Environmental Change*, *16*(3), 282–292. https://doi.org/10.1016/j.gloenvcha.2006.03.008

Solecki, W., Leichenko, R., & O'Brien, K. (2011). Climate change adaptation strategies and disaster risk reduction in cities: Connections, contentions, and synergies. *Current Opinion in Environmental Sustainability*, *3*(3), 135–141. https://doi.org/10.1016/j.cosust.2011.03.001

Sönke, K., Eckstein, D., Dorsch, L., & Fischer, L. (2016). *Global climate risk index 2016: Who suffers most from Extreme weather events? Weather-related loss events in 2014 and 1995 to 2014*. https://doi.org/978-3-943704-04-4

Stead, D., & Meijers, E. (2009). Spatial planning and policy integration: Concepts, facilitators and inhibitors. *Planning Theory and Practice*, *10*(3), 317–332. https://doi.org/10.1080/14649350903229752

Stiller, S., & Meijerink, S. (2016). Leadership within regional climate change adaptation networks: the case of climate adaptation officers in Northern Hesse, Germany. *Regional Environmental Change*, *16*(6), 1543–1555. https://doi.org/10.1007/s10113-015-0886-y

Sutanta, H., Rajabifard, A., & Bishop, I. D. (2013). Disaster risk reduction using acceptable risk measures for spatial planning. *Journal of Environmental Planning and Management*, *56*(6), 761–785. https://doi.org/10.1080/09640568.2012.702314

Tang, Z., Brody, S. D., Quinn, C., & Chang, L. (2010). Moving from agenda to action : evaluating local climate change action plans. *Journal of Environmental Planning and Management*, *0568*, 17. https://doi.org/10.1080/09640560903399772

Tobergte, D. R., & Curtis, S. (2013). *Adapting Cities to Climate Change*. *Journal of Chemical Information and Modeling* (Vol. 53). https://doi.org/10.1017/CBO9781107415324.004

Uittenbroek, C. J. (2016a). From Policy Document to Implementation: Organizational Routines as Possible Barriers to Mainstreaming Climate Adaptation. *Journal of Environmental Policy and Planning*, *18*(2), 161–176. https://doi.org/10.1080/1523908X.2015.1065717

Uittenbroek, C. J. (2016b). Mainstreaming Climate Adaptation at the Implementation Level: Routines As Possible Barriers to Organizational Change. *Journal of Environmental Policy & Planning, 18(2): 161-167.*, *18(2)*(November), 1–49.

Uittenbroek, C. J., Janssen-Jansen, L. B., & Runhaar, H. A. C. (2013a). Mainstreaming climate adaptation into urban planning: overcoming barriers, seizing opportunities and evaluating the results in two Dutch case

studies. *Regional Environmental Change*, *13*(2), 399–411. https://doi.org/10.1007/s10113-012-0348-8
Uittenbroek, C. J., Janssen-Jansen, L. B., & Runhaar, H. A. C. (2013b). Mainstreaming climate adaptation into urban planning: Overcoming barriers, seizing opportunities and evaluating the results in two Dutch case studies. *Regional Environmental Change*, *13*(2), 399–411. https://doi.org/10.1007/s10113-012-0348-8
Umhlaba. (2011). Introduction to Monitoring and Evaluation Using the Logical Framework Approach, 1–59.
UN-HABITAT. (2011). *Global Report on Human Settlements 2011. Cities and climate change*. Nairobi.
UNEP-UNDP. (2011). *Mainstreaming climate change adaptation into development planning : a guide for practitioners*.
UNFCCC. (2005). *Climate Change: Impacts, Vulnerabilities And Adaptation In Developing Countries.*
UNFCCC. (2017). Opportunities and options for integrating climate change adaptation with the Sustainable Development Goals and the Sendai Framework for Disaster Risk Reduction 2015–2030. *United Nations Climate Change Secretariat*, *GE.17-1846*(October), 1–29. https://doi.org/10.1016/j.jsames.2008.06.001
UNISDR. (2004). *Living with Risk* (Vol. I).
UNISDR. (2014). Progress and challenges in disaster risk reduction: a contribution towards the development of policy indicators for the post-2015 framework for disaster risk reduction -
UNISDR. (2014). Progress and challenges in disaster risk reduction: a contribut. *Progress and Challenges in Disaster Risk Reduction: A Contribution towards the Development of Policy Indicators for the Post-2015 Framework for Disaster Risk Reduction* - 217. https://doi.org/10.1016/j.parkreldis.2015.02.017
URT. (2007). The United Republic of Tanzania. National Adaptation Programme of Action (NAPA). *Prospects*, *13*(1), 95–103. https://doi.org/10.1007/BF02233368
Vaggione, P. (2004). *Urban Planning for City Leaders*. https://doi.org/10.1007/SpringerReference_168760
Wamsler, C. (2014). *Cities, disaster risk and adaptation*. (U. Malcon Miles (University of Plymouth, UK) and John Rennie Short (University of Maryland, Ed.). London: Routledge.
Wamsler, C., & Brink, E. (2014). Moving beyond short-term coping and adaptation. *Environment and Urbanization*, *26*(1), 86–111. https://doi.org/10.1177/0956247813516061
Wamsler, C., & Ing, D. (2007). *Operational Framework for Integrating Risk Reduction for Organisations Working in Settlement Development Planning* (Vol. 14).
Wamsler, C., Luederitz, C., & Brink, E. (2014). Local levers for change : Mainstreaming ecosystem-based adaptation into municipal planning to foster sustainability transitions. *Global Environmental Change*, *29*, 189–201. https://doi.org/10.1016/j.gloenvcha.2014.09.008
Wamsler, C., & Pauleit, S. (2016). Making headway in climate policy mainstreaming and ecosystem-based adaptation : two pioneering countries , different pathways , one goal. *Climatic Change*, 71–87. https://doi.org/10.1007/s10584-016-1660-y
Watson, V. (2009). Seeing from the South : Refocusing Urban Planning on the Globe ' s Central Urban Issues, *46*(October), 2259–2275. https://doi.org/10.1177/0042098009342598

8. ANNEXES

Annex 1: Interview Guide A

CITY HALL/MINISTERIAL/AGENCY KEY INFORMANTS INTERVIEW GUIDE

My name is Emmanuel Mwenje, a MSc. student at ITC, University of Twente. I am undertaking my thesis in Kigali city on the topic;" **Mainstreaming Climate Change Adaptation into Urban Planning in the Global South. A Case of Kigali City".** The aim of this research is to investigate organizational constraints that may limit the city of Kigali from fully institutionalizing **flood risk** adaptation into spatial planning. Thus, it focuses on key areas of mainstreaming that include policies/plans, planning processes, financial resources, institutional capacity, expert in mainstreaming and relations between the organization with other stakeholders. The interview is entirely for **ACADEMIC PURPOSE** and the information provided will be confidential and treated anonymously. A copy of the report will be provided on request. I **KINDLY** request your consent to **RECORD** the interview to enable transcription for further analysis and reporting. The Interview will take approx. **30 MINUTES.**

1.0 BACKGROUND INFORMATION

1 What's your current position in the organization/department?
2 For how long have you held this position?
3 What are your responsibilities in spatial planning processes in Kigali?
4 How does your responsibility perceive flooding adaptation in Kigali city?

2.0 CLIMATE CHANGE IMPACTS PERCEPTIONS

1 What are the major climate change hazards in Kigali city?
2 What's your level of awareness about the existing and predicted impacts of flooding to built environment in Kigali city?

3.0 INTEGRATION OF FLOODING IN PLANNING DEPARTMENT/AGENCY
(Policy, plans, strategy, planning, actors/agencies and capacity)

1. Which policies have had the major influence on urban development in the last 15 years?
2. Did they address the challenge of flooding in Kigali city? How?
3. Is flooding currently being considered within planning in your department? Explain.
4. Are there any specific initiatives (policies or strategies) that are in progress or under development for integrating flooding into planning in your department? Explain.
5. Has there been any specific actions (programmes or projects) directly taken to deal with flooding in your department? Explain. (**IF NO PROCEED TO 6**).
   IF YES for both **3 and 4** probe for:
   _ What is their focus (Adaptation, Mitigation, Development, or an integration thereof)?
   _ Who is involved?
   _ Is it funded/is there a budget (who, how much, where from); do you get the money when you need it?
   _ Do implementation plans exist? E.g., Are there targets/actions?
   _ What is the timeline?
   _ What are the achievements so far? OR What opportunities do you envisage?
   _ What challenges have been faced?/What challenges do you envisage facing?
   _ Are there any gaps in knowledge or capacity among any of the actors/ institutions involved?
   _ What are the strengths and weaknesses of actors/institutions involved?
   Look out for activities/initiatives that:
   a) Support people to spontaneously cope with and adapt to change (assist people to adapt in practice) (supporting adaptive capacity) (A)?

b) Support people to prevent negative flooding impacts that could happen in future (supporting adaptive capacity) (A)?
c) Support people to cope with impacts and adapt after events have been experienced (A)?
(supporting recovery)
d) Harness opportunities associated with climate change (A,)?

6. Are there any higher-level initiatives (national/ministerial policies, strategies, or programmes) currently in place to support and guide departmental flooding initiatives? Explain (see prompts above).
7. Does your department have the independence to integrate flooding into flooding? If yes, explain if not why, who do you consult?
8. Which actors and institutions do you think should be involved and leading on planning, strategy, and implementation of flooding integration initiatives in your department? Who and why? Any support needed?
9. Are there any gaps in knowledge or capacity among any of the actors/institutions involved?
10. Does your department have access to information about flooding hazards? Yes/No If yes, what? Who has access to information, why? And for each: Who provides the information? Is it used? If yes, by whom and how/methodology? Is it useful? Yes/No Explain answer.
11. Does your department use any geo-spatial tools to integrate flooding into spatial planning? Explain.
12. Do you have any (other) ideas that your department should or could do in relation to flooding integration into planning? Yes/No

If yes, explain. How? Budget? What is the timeline for action? Who? Why? Is support, or would support be, needed (e.g., finance, knowledge, training, and capacity development) to implement/achieve this? If yes, what?

13. If **NO to 2–5,** what is limiting your department in integrating flooding into spatial planning?
14. If **NO to 2–5,** what would be the best way to incorporate flooding into your department's working? Is support, or would support be, needed (e.g., finance, knowledge, training, and capacity development) to implement/achieve this? If yes, what?
15. Is there potential or interest in integrating flood risks adaptation with spatial planning and development? Why? Who is interested? How will this be achieved? What opportunities and challenges do you envisage in doing so? Is support, or would support be, needed (e.g., finance, knowledge, training, and capacity)
16. Any additional information you think I should know?

Annex 2: Interview Guide B

CLIMATE EXPERT/ENVIRONMENTALIST/NGO STUFF/CONSULTANT SPATIAL PLANNER

My name is Emmanuel Mwenje, a master's student at ITC, University of Twente. I am doing my thesis on Kigali city on the topic;" ***Mainstreaming Climate Change Adaptation into Urban Planning in the Global South. A Case of Kigali City".*** The aim of this topic is to investigate constraints that may limit the city of Kigali from fully institutionalizing flood risk adaptation into spatial planning. Thus, it focuses on key areas of mainstreaming that include Policies/plans, planning processes, financial resources, institutional capacity, expert in mainstreaming and relations between the organization with other stakeholders. The interview is entirely for academic purpose and the information provided will be confidential and treated anonymously. I KINDLY request your consent to record the interview.

1. What is your organizations key responsibilities in urban development in Kigali city?
2. What is your position and role within your organization? What are your responsibilities?
3. Can you tell me about your personal experience about climate change impacts in Kigali city?
4. What do you think are or should be the spatial development priorities in Kigali city?
5. Do you think there is a relation between flood risks impacts and spatial development in Kigali city? What kind of relationship?
6. Were/Are you involved in projects concerning integration of flood risks adaptation into local Spatial planning in Kigali city? Kindly explain.
7. Who else was involved in the project? Why?
8. What do you think are the challenges in integrating flood risks adaptation into spatial planning in Kigali city?
9. What do you think are the opportunities in integrating flood risks adaptation into spatial planning in Kigali city?
10. In your opinion what should the city authority do to best integrate flood risks adaptation into spatial planning?

Annex 3: Interview Programme

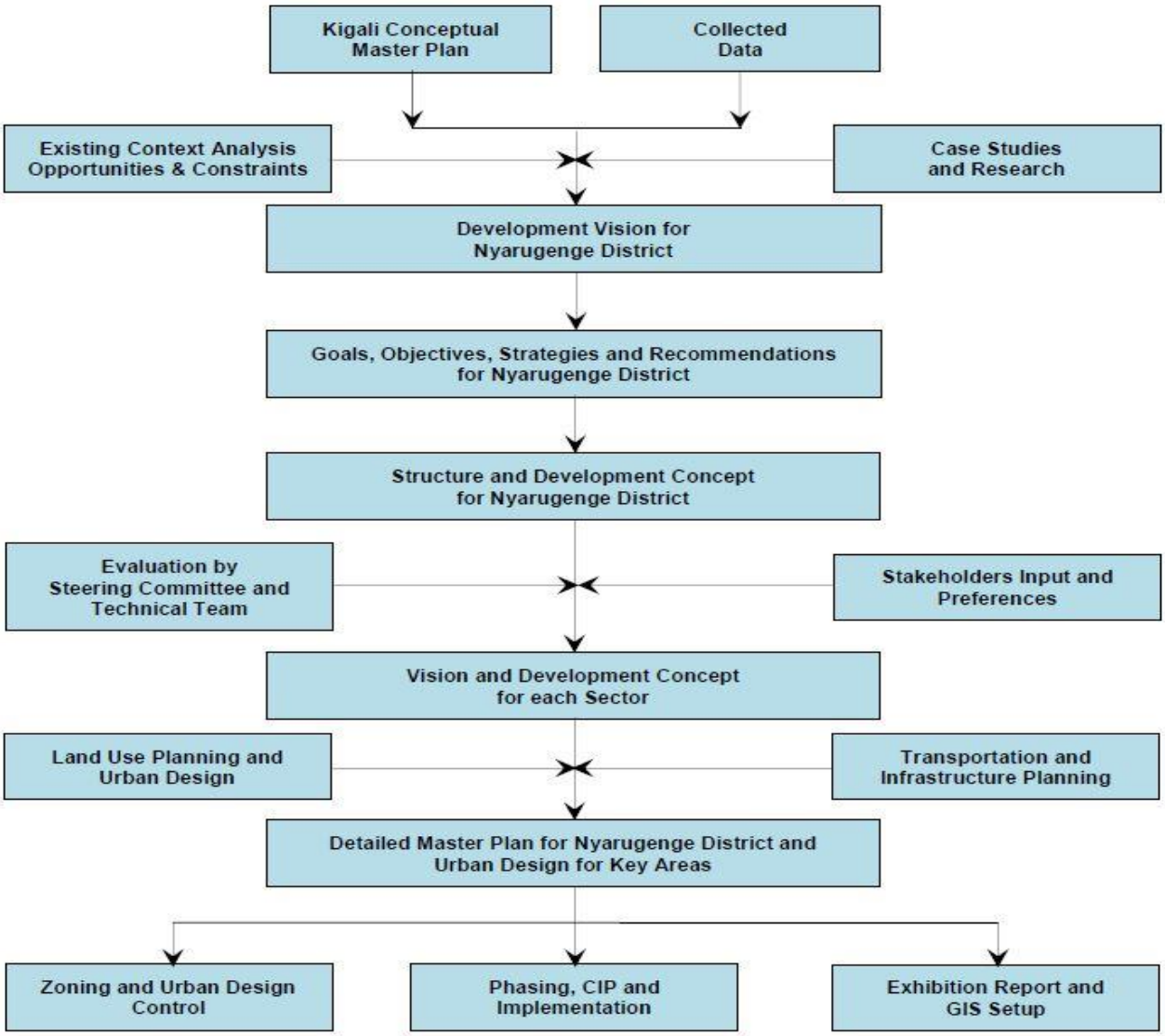
Date	Description
4th Oct. 2018	Reported to City Hall
6th Oct. 2018	Interviewed Green City Development director from Rwanda Housing Authority (RHA)
8th October	Interviewed Division manager of Human settlement planning and Development at RHA
8th Oct. 2018	Interviewed RWFA Acting Director at MoE.
8th oct. 2018	Interviewed a water expert at MoE
9th oct. 2018	Interviewed the Division Manager of Human settlements and Housing Development at MININFRA
9th October	Interviewed Director of Urban planning and construction one stop centre (CoK)
9th oct	Interviewed Department Head: Master Planning Zoning Guidelines Assessment (CoK)
9th Oct	Interviewed Head of Building Construction Architectural department (CoK)
9th Oct	Interviewed Head of neighbourhood and Housing department (CoK)
10th Oct	Interviewed Division Manager Building Regulations, Inspection and Audits (RHA)
10th Oct 2018	Interviewed Head of GIS Department (CoK)
11th Oct 2018	Interviewed Head of Disaster Response and preparedness at MIDIMAR
11th Oct. 2018	Interviewed Department head of Master plan implementation (CoK)
11th oct. 2018	Interviewed Head of Master plan review and development control (CoK)
12th Oct 2018	Interviewed Department Head of Neighbourhood and Housing Infrastructure (CoK)
	Interviewed Climate Change Adaptation expert at Rwanda Environment Authority (REMA),
16th Oct 2018	Interviewed Country Representative Global Green Growth Institute (GGGI)
23rd Oct 2018	Interviewed DRR director at Ministry of Disaster Management and Refugees (MIDIMAR)
25th Oct 2018	Interviewed former engineer at CoK

Annex 4: Urban Planning Framework/Process in Kigali

Planning process	Description	Implications
1.	Formation of a planning office and identification of key stakeholders. A technical team to spearhead the process is formed which composed of CoK, Districts' technical officials, national ministries like MININFRA, MoE, MINALOC, MINECOFIN, and lead agencies that included REMA, RHA, RTDA, WFRA among others	Forms the foundation for a participatory planning process through which both the interested and affected are given an opportunity to air their aspirations
2	Vision setting for the urban plan in question which is conducted in a multi-stakeholder way in order to avoid cases of duplications as far as development objectives are concerned.	Has to be done in line with Vision 2020, the national development agenda. Thus, Kigali assumed the path of becoming a center of economic excellence both locally and regionally
3	Situational assessment and benchmarking	To understand the existing social, economic, environmental and transport realities in the planning area. Neither flood risk nor hydraulic assessments were conducted to determine risk levels, land use suitability levels for appropriate development standards.
4	Goal and objective setting. The goals and objectives aimed at addressing the public good are set in a consultative way through consensus building.	Aims at factoring the aspirations of the urban communities, private sector, lead government agencies' aspirations, more so by paying close attention to the results of the situational analysis. Since no flood risks were assessed, then flood adaptation was m
5	Land use options or concepts are formulated during the fifth stage of planning process. For instance, in the KCMP planning, some of the concepts included the radial city concept, compact city and the polycentric city.	Provides a wide variety of land use options to choose from. If flood risk were assessed this could have led to a more flood resilient concept.
6	Public consultative measures during which the preliminary urban concepts are discussed by all the relevant stakeholders including the general public.	Ensures the aspirations of actors are observed as much as its feasible. This also promotes a sense of ownership among the stakeholders. clarification of plan concepts are made. Meetings were held at various locations including district councils, public forums and online displays.

7	Detailed drafting of the plan being prepared	Formulation of preliminary development guidelines, regulations and development control standards.
8	A participatory review of the detailed plan proposals	Aims at validating the draft guidelines with respect to cross-cutting issues and the aspirations or observations made by stakeholders. Once reviewed the draft plan is then approved for adoption
9	Implementation of the plan prepared	Calls for requisite resources organizational set ups and frameworks. (KCMP 2013 included a Sustainability Framework that details out cross-cutting issues that range from economic, environment, social, transport and infrastructure.)
10	Monitoring and evaluation framework for the master plan and the respective district plans.	Aims at understanding progress made, the challenges faced and areas of urgent interventions or revisions.

Annex 5: Kigali Sub-Areas Planning Scheme



Annex 6.:Kigali City Master Plan 2013

MAINSTREAMING FACTORS	DESCRIPTION	INDICATORS	FINDINGS
Focus	The plan should explicitly indicate its intention to mainstream climate change adaptation within its objectives. The perceptions of the key informants should also be precise on the status and direction of mainstreaming climate adaptation.	-Climate change adaptation mainstreaming -Spatial planning -Environmental management	-Spatial planning dominated - Environmental management included. -No mention of mainstreaming. -KCMP mentions the aim of a flood free city in 50 years but doesn't mention whether it will be an integrated or dedicated approach. -The plan proposes the protection of nature and biodiversity (NEM). -Protection of wetlands to manage flood is implicitly done since no flood risk assessments were done. -upgrading of drainages proposed for storm water management but floods per se nor any flood scenarios created to inform the decisions.
Defining mainstreaming	A precise terminology used to imply the definition of mainstreaming	-Adaptation mainstreaming -Adaptation integration	-No mention, definition and address of mainstreaming. -no mention of adaptation integration and or mainstreaming
Operationalizing mainstreaming	Was the concept of mainstreaming operationalized?	-Yes -No	Not addressed explicitly
Mainstreaming types/strategies	Did the plans demonstrate the nature of mainstreaming to be	-Dedicated/stand alone -Integrated approach -Not mentioned	- Dedicated and integrated approaches - Nature and wetland protection for (flood containment) -Natural Environmental management strategies -Wetlands management strategies -water bodies management strategies -Forest Management strategies (social,ecological and economic and Urban forestry) -Watershed management strategies -Green blue plan

			-Storm water management (Bioswales, constructed wetlands, bioretention ponds) -Slope Management strategies -Landscape Network plan. -upgrading of drainage for stormwater management -Densification and urban renewal of informal housing
Sectoral focus	What is the main focus of the plans?	-Housing development -Nature conservation -Urban planning and land use -Infrastructure -Risk management (flood, land slides) -Urban forestry	-Housing -urban Planning -Infrastructure -Urban natural and biodiversity -Flood management
Climatic risks addressed	The plan should adequately indicate the types of risks it is tackling or adapting to	-Flooding -Landslides -Extreme events -Heatwaves -Temperature rise	- No risk assessment conducted -implicit prevention of flooding -Land slides prevention by not developing on steep slopes and relocations
Plans' outputs (proposals)	Evidence of frameworks or procedures for planning and or institutional re-organization to implement the proposed mainstreaming strategies	-Steps towards modifications to address climate change adaptation in spatial plans	-KCMP proposes stormwater management master plan -Nature and Biodiversity masterplan -
Quality of plans' mainstreaming proposals	The plan should demonstrate the proposed procedure for re-organizing the institutional setup or planning process for effective mainstreaming of adaptation.	Regulatory or institutional restructuring frameworks to mainstream adaptation	-Missing
Plans' actual adaptation mainstreaming projects	The mainstreaming should lead to actual implementable projects on the ground	Actual actionable steps undertaken to realize the mainstreamed aspects of adaptation eg local adaptation plans/projects	-Nyabugogo transit Hub and Market redevelopment plan -Informal settlement upgrading -Zoning guidelines (no-go zones)
Quality of the actual mainstreaming projects	The plans should describe comprehensively the mainstreaming projects on the ground.	Actual implemented projects on the ground towards flood risk mainstreaming.	Conceptually shown in the KCMP. Nyabugogo district demonstrated how the flood management will be done.

Annex 7:Kigali City Development Plan 2013

MAINSTREAMING FACTORS	DESCRIPTION	INDICATORS	FINDINGS
Focus	The plan should explicitly indicate its intention to mainstream climate change adaptation within its objectives. The perceptions of the key informants should also be precise on the status and direction of mainstreaming climate adaptation.	-Climate change adaptation mainstreaming -Spatial planning -Environmental management	-Urbanization and housing - transport and congestion -Road networks -Climate change only Mentioned as a cross-cutting issue
Defining mainstreaming	A precise terminology used to imply the definition of mainstreaming	-Adaptation mainstreaming -Adaptation integration	-No mention, definition and address of mainstreaming. -no mention of adaptation integration and or mainstreaming
Operationalizing mainstreaming	Was the concept of mainstreaming operationalized?	-Yes -No	Not addressed
Mainstreaming types/strategies	Did the plans demonstrate the nature of mainstreaming to be	-Dedicated/stand alone -Integrated approach -Not mentioned	- Dedicated wetland rehabilitation -upgrading informal housing
Sectoral focus	What is the main focus of the plans?	-Housing development -Nature conservation -Urban planning and land use -Infrastructure -Risk management (flood, landslides) -Urban forestry	-Housing -urban Planning -Road Infrastructure -Job creation
Climatic risks addressed	The plan should adequately indicate the types of risks it is tackling or adapting to	-Flooding -Landslides -Extreme events -Heatwaves -Temperature rise	- No risk assessment conducted -implicit prevention of flooding -Landslides prevention by not developing on steep slopes and relocations
Plans' outputs (proposals)	Evidence of frameworks or procedures for planning and or institutional re-organization to implement the proposed mainstreaming strategies	-Steps towards modifications to address climate change adaptation in spatial plans	-Road networks -congestion reduction -Wetland rehabilitation -Urban Risk Assessment -
Quality of plans' mainstreaming proposals	The plan should demonstrate the proposed procedure for re-organizing the institutional setup or planning process for effective mainstreaming of adaptation.	Regulatory or institutional restructuring frameworks to mainstream adaptation	-Missing
Plans' actual adaptation mainstreaming projects	The mainstreaming should lead to actual implementable projects on the ground	Actual actionable steps undertaken to realize the mainstreamed aspects of adaptation eg local	-Nyabugogo wetland rehabilitation -Informal settlement upgrading

		adaptation plans/projects	-Zoning guidelines (no-go zones) -
Quality of the actual mainstreaming projects	The plans should describe comprehensively the mainstreaming projects on the ground.	Actual implemented projects on the ground towards flood risk mainstreaming.	Missing

Annex 8:Gasabo District Master Plan 2013

MAINSTREAMING FACTORS	DESCRIPTION	INDICATORS	FINDINGS
Focus	The plan should explicitly indicate its intention to mainstream climate change adaptation within its objectives. The perceptions of the key informants should also be precise on the status and direction of mainstreaming climate adaptation.	-Climate change adaptation mainstreaming -Spatial planning -Environmental management	-Employment hub and cultural heritage -Environmental and Nature conservation -Urbanization and housing - transport and congestion -sustainable agriculture
Defining mainstreaming	A precise terminology used to imply the definition of mainstreaming	-Adaptation mainstreaming -Adaptation integration	-No mention, definition and address of mainstreaming. -no mention of adaptation integration and or mainstreaming
Operationalizing mainstreaming	Was the concept of mainstreaming operationalized?	-Yes -No	Not addressed
Mainstreaming types/strategies	Did the plans demonstrate the nature of mainstreaming to be	-Dedicated/stand alone -Integrated approach -Not mentioned	-Blue green plan to protect forests, rivers and wetlands
Sectoral focus	What is the main focus of the plans?	-Housing development -Nature conservation -Urban planning and land use -Infrastructure -Risk management (flood, landslides) -Urban forestry	-Housing -urban Planning -Road Infrastructure -Job creation
Climatic risks addressed	The plan should adequately indicate the types of risks it is tackling or adapting to	-Flooding -Landslides -Extreme events -Heatwaves -Temperature rise	- No risk assessment conducted - -Landslides prevention by not developing on steep slopes and relocations
Plans' outputs (proposals)	Evidence of frameworks or procedures for planning and or institutional re-organization to implement the proposed mainstreaming strategies	-Steps towards modifications to address climate change adaptation in spatial plans	-Road networks -Wetland and forest protection - Stormwater management (Bioswales, vegetated swales, constructed wetlands)
Quality of plans' mainstreaming proposals	The plan should demonstrate the proposed procedure for re-organizing the institutional setup or planning process for effective mainstreaming of adaptation.	Regulatory or institutional restructuring frameworks to mainstream adaptation	-Missing
Plans' actual adaptation mainstreaming projects	The mainstreaming should lead to actual implementable projects on the ground	Actual actionable steps undertaken to realize the mainstreamed aspects of adaptation eg local	-Zoning guidelines (no-go zones) -

		adaptation plans/projects	
Quality of the actual mainstreaming projects	The plans should describe comprehensively the mainstreaming projects on the ground.	Actual implemented projects on the ground towards flood risk mainstreaming.	Missing

Annex 9:Nyarugenge District Master Plan 2010

MAINSTREAMING FACTORS	DESCRIPTION	INDICATORS	FINDINGS
Focus	The plan should explicitly indicate its intention to mainstream climate change adaptation within its objectives. The perceptions of the key informants should also be precise on the status and direction of mainstreaming climate adaptation.	-Climate change adaptation mainstreaming -Spatial planning -	-Employment hub and cultural heritage -Environmental and Nature conservation -Urbanization and housing - transport hub -sustainable agriculture
Defining mainstreaming	A precise terminology used to imply the definition of mainstreaming	-Adaptation mainstreaming -Adaptation integration	-No mention, definition and address of mainstreaming. -no mention of adaptation integration and or mainstreaming
Operationalizing mainstreaming	Was the concept of mainstreaming operationalized?	-Yes -No	-Mainstreaming Not addressed -Has a sustainability framework
Mainstreaming types/strategies	Did the plans demonstrate the nature of mainstreaming to be	-Dedicated/stand alone -Integrated approach -Not mentioned	Dedicated approach
Sectoral focus	What is the main focus of the plans?	-Housing development -Nature conservation -Urban planning and land use -Infrastructure -Risk management (flood, landslides) -Urban forestry	-Housing -urban Planning -Eco-friendly Infrastructure -socio-economic -Environmental management
Climatic risks addressed	The plan should adequately indicate the types of risks it is tackling or adapting to	-Flooding -Landslides -Extreme events -Heatwaves -Temperature rise	- No risk assessment conducted - Landslides prevention by not developing on steep slopes and relocations -Storm water and floods
Plans' outputs (proposals)	Evidence of frameworks or procedures for planning and or institutional re-organization to implement the proposed mainstreaming strategies	-Steps towards modifications to address climate change adaptation in spatial plans	-No mainstreaming focused proposals -Wetland and forest protection - Stormwater management (Bioswales, vegetated swales, constructed wetlands) -constructed wetlands Blue green plan -urban design for storm water damage mitigation

Quality of plans' mainstreaming proposals	The plan should demonstrate the proposed procedure for re-organizing the institutional setup or planning process for effective mainstreaming of adaptation.	Regulatory or institutional restructuring frameworks to mainstream adaptation	-Missing
Plans' actual adaptation mainstreaming projects	The mainstreaming should lead to actual implementable projects on the ground	Actual actionable steps undertaken to realize the mainstreamed aspects of adaptation eg local adaptation plans/projects	-Zoning guidelines (no-go zones) -
Quality of the actual mainstreaming projects	The plans should describe comprehensively the mainstreaming projects on the ground.	Actual implemented projects on the ground towards flood risk mainstreaming.	Missing

Annex 10 :Kicukiro District Master Plan 2013

MAINSTREAMING FACTORS	DESCRIPTION	INDICATORS	FINDINGS
Focus	The plan should explicitly indicate its intention to mainstream climate change adaptation within its objectives. The perceptions of the key informants should also be precise on the status and direction of mainstreaming climate adaptation.	-Climate change adaptation mainstreaming -Spatial planning -	-Urban Planning and development. -Environmental and Nature conservation -Urbanization and housing
Defining mainstreaming	A precise terminology used to imply the definition of mainstreaming	-Adaptation mainstreaming -Adaptation integration	-No mention, definition and address of mainstreaming. -no mention of adaptation integration and or mainstreaming
Operationalizing mainstreaming	Was the concept of mainstreaming operationalized?	-Yes -No	-Mainstreaming Not addressed -Has a sustainability framework
Mainstreaming types/strategies	Did the plans demonstrate the nature of mainstreaming to be	-Dedicated/stand alone -Integrated approach -Not mentioned	Implicit dedicated approach
Sectoral focus	What is the main focus of the plans?	-Housing development -Nature conservation -Urban planning and land use -Infrastructure -Risk management (flood, landslides) -Urban forestry	-Housing -urban Planning -Eco-friendly Infrastructure -socio-economic -Environmental management
Climatic risks addressed	The plan should adequately indicate the types of risks it is tackling or adapting to	-Flooding -Landslides -Extreme events -Heatwaves -Temperature rise	- No risk assessment conducted - -Landslides prevention by not developing on steep slopes and relocations -Storm water and floods
Plans' outputs (proposals)	Evidence of frameworks or procedures for planning and or institutional re-organization to implement the proposed mainstreaming strategies	-Steps towards modifications to address climate change adaptation in spatial plans	-Wetland and forest protection - Stormwater management (Bioswales, vegetated swales, constructed wetlands) -constructed wetlands Blue green plan -water proofing urban design from storm water damage -Environmental strategic plan -Urban Forestry

Quality of plans' mainstreaming proposals	The plan should demonstrate the proposed procedure for re-organizing the institutional setup or planning process for effective mainstreaming of adaptation.	Regulatory or institutional restructuring frameworks to mainstream adaptation	-Missing
Plans' actual adaptation mainstreaming projects	The mainstreaming should lead to actual implementable projects on the ground	Actual actionable steps undertaken to realize the mainstreamed aspects of adaptation eg local adaptation plans/projects	-Zoning guidelines (no-go zones) -
Quality of the actual mainstreaming projects	The plans should describe comprehensively the mainstreaming projects on the ground.	Actual implemented projects on the ground towards flood risk mainstreaming.	Missing

Annex 11:Gasabo District Zoning Plan 2013

MAINSTREAMING FACTORS	DESCRIPTION	INDICATORS	FINDINGS
Focus	The plan should explicitly indicate its intention to mainstream climate change adaptation within its objectives. The perceptions of the key informants should also be precise on the status and direction of mainstreaming climate adaptation.	-Climate change adaptation mainstreaming -Spatial planning -Environmental management	-Employment hub and cultural heritage -Environmental and Nature conservation -Urbanization and housing - transport and Infrastructure .
Defining mainstreaming	A precise terminology used to imply the definition of mainstreaming	-Adaptation mainstreaming -Adaptation integration	-No mention, definition and address of mainstreaming. -no mention of adaptation integration and or mainstreaming
Operationalizing mainstreaming	Was the concept of mainstreaming operationalized?	-Yes -No	Not addressed
Mainstreaming types/strategies	Did the plans demonstrate the nature of mainstreaming to be	-Dedicated/stand alone -Integrated approach -Not mentioned	-Blue green plan to protect forests, rivers and wetlands
Sectoral focus	What is the main focus of the plans?	-Housing development -Nature conservation -Urban planning and land use -Infrastructure -Risk management (flood, land slides) -Urban forestry	-Housing -urban Planning -Road Infrastructure -Job creation
Climatic risks addressed	The plan should adequately indicate the types of risks it is tackling or adapting to	-Flooding -Landslides -Extreme events -Heatwaves -Temperature rise	- No flood risk assessment conducted - storm water management
Plans' outputs (proposals)	Evidence of frameworks or procedures for planning and or institutional re-organization to implement the proposed mainstreaming strategies	-Steps towards modifications to address climate change adaptation in spatial plans	-Road networks -Wetland and forest protection - Stormwater management (Bioswales, vegetated swales, constructed wetlands) -Drainage planning -Hydrological analysis -Protected areas and parks
Quality of plans' mainstreaming proposals	The plan should demonstrate the proposed procedure for re-organizing the institutional setup or planning process for effective mainstreaming of adaptation.	Regulatory or institutional restructuring frameworks to mainstream adaptation	-Missing

Plans' actual adaptation mainstreaming projects	The mainstreaming should lead to actual implementable projects on the ground	Actual actionable steps undertaken to realize the mainstreamed aspects of adaptation eg local adaptation plans/projects	-Zoning guidelines (no-go zones) -
Quality of the actual mainstreaming projects	The plans should describe comprehensively the mainstreaming projects on the ground.	Actual implemented projects on the ground towards flood risk mainstreaming.	Missing

Annex 12 :Kicukiro District Zoning Plan 2013

MAINSTREAMING FACTORS	DESCRIPTION	INDICATORS	FINDINGS
Focus	The plan should explicitly indicate its intention to mainstream climate change adaptation within its objectives. The perceptions of the key informants should also be precise on the status and direction of mainstreaming climate adaptation.	-Climate change adaptation mainstreaming -Spatial planning -Environmental management	-No mention, definition and address of mainstreaming. -Employment hub and cultural heritage -Environmental and Nature conservation -Urbanization and housing - transport and Infrastructure .
Defining mainstreaming	A precise terminology used to imply the definition of mainstreaming	-Adaptation mainstreaming -Adaptation integration	-No mention, definition and address of mainstreaming. -no mention of adaptation integration and or mainstreaming
Operationalizing mainstreaming	Was the concept of mainstreaming operationalized?	-Yes -No	Not addressed
Mainstreaming types/strategies	Did the plans demonstrate the nature of mainstreaming to be	-Dedicated/stand alone -Integrated approach -Not mentioned	-Blue green plan to protect forests, rivers and wetlands
Sectoral focus	What is the main focus of the plans?	-Housing development -Nature conservation -Urban planning and land use -Infrastructure -Risk management (flood, land slides) -Urban forestry	-Housing -urban Planning -Road Infrastructure -Job creation
Climatic risks addressed	The plan should adequately indicate the types of risks it is tackling or adapting to	-Flooding -Landslides -Extreme events -Heatwaves -Temperature rise	- No flood risk assessment conducted - storm water management
Plans' outputs (proposals)	Evidence of frameworks or procedures for planning and or institutional re-organization to implement the proposed mainstreaming strategies	-Steps towards modifications to address climate change adaptation in spatial plans	-Road networks -Wetland and forest protection - Stormwater management (Bioswales, vegetated swales, constructed wetlands) -Drainage planning -Protected areas and parks
Quality of plans' mainstreaming proposals	The plan should demonstrate the proposed procedure for re-organizing the institutional setup or planning process for effective mainstreaming of adaptation.	Regulatory or institutional restructuring frameworks to mainstream adaptation	-Missing

Plans' actual adaptation mainstreaming projects	The mainstreaming should lead to actual implementable projects on the ground	Actual actionable steps undertaken to realize the mainstreamed aspects of adaptation eg local adaptation plans/projects	-Zoning guidelines (no-go zones) -
Quality of the actual mainstreaming projects	The plans should describe comprehensively the mainstreaming projects on the ground.	Actual implemented projects on the ground towards flood risk mainstreaming.	Missing

Annex 13: Nyarugenge District Zoning Plan 2010

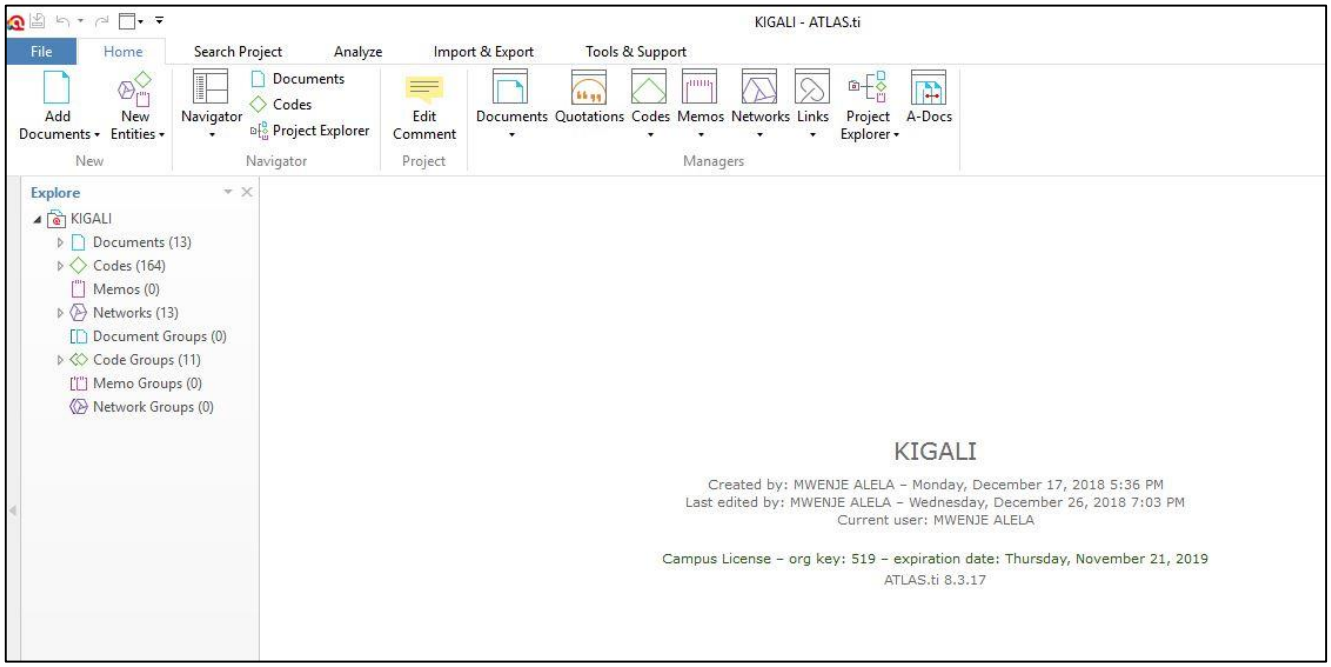
MAINSTREAMING FACTORS	DESCRIPTION	INDICATORS	FINDINGS
Focus	The plan should explicitly indicate its intention to mainstream climate change adaptation within its objectives. The perceptions of the key informants should also be precise on the status and direction of mainstreaming climate adaptation.	-Climate change adaptation mainstreaming -Spatial planning -Environmental management	-No mention, definition and address of mainstreaming. -Employment hub and cultural heritage -Environmental and Nature conservation -Urbanization and housing - transport and Infrastructure .
Defining mainstreaming	A precise terminology used to imply the definition of mainstreaming	-Adaptation mainstreaming -Adaptation integration	-No mention, definition and address of mainstreaming. -no mention of adaptation integration and or mainstreaming
Operationalizing mainstreaming	Was the concept of mainstreaming operationalized?	-Yes -No	Not addressed
Mainstreaming types/strategies	Did the plans demonstrate the nature of mainstreaming to be	-Dedicated/stand alone -Integrated approach -Not mentioned	-Blue-green plan to protect forests, rivers and wetlands
Sectoral focus	What is the main focus of the plans?	-Housing development -Nature conservation -Urban planning and land use -Infrastructure -Risk management (flood, land slides) -Urban forestry	-Housing -urban Planning -Road Infrastructure -Job creation
Climatic risks addressed	The plan should adequately indicate the types of risks it is tackling or adapting to	-Flooding -Landslides -Extreme events -Heatwaves -Temperature rise	- No flood risk assessment conducted - storm water management
Plans' outputs (proposals)	Evidence of frameworks or procedures for planning and or institutional re-organization to implement the proposed mainstreaming strategies	-Steps towards modifications to address climate change adaptation in spatial plans	-Road networks -Wetland and forest protection - Stormwater management (Bioswales, vegetated swales, constructed wetlands) -Drainage planning -Protected areas and parks
Quality of plans' mainstreaming proposals	The plan should demonstrate the proposed procedure for re-organizing the institutional setup or planning process for effective mainstreaming of adaptation.	Regulatory or institutional restructuring frameworks to mainstream adaptation	- Nyabugogo transit Hub and Market redevelopment plan

Plans' actual adaptation mainstreaming projects	The mainstreaming should lead to actual implementable projects on the ground	Actual actionable steps undertaken to realize the mainstreamed aspects of adaptation eg local adaptation plans/projects	-Zoning guidelines (no-go zones) -
Quality of the actual mainstreaming projects	The plans should describe comprehensively the mainstreaming projects on the ground.	Actual implemented projects on the ground towards flood risk mainstreaming.	Missing

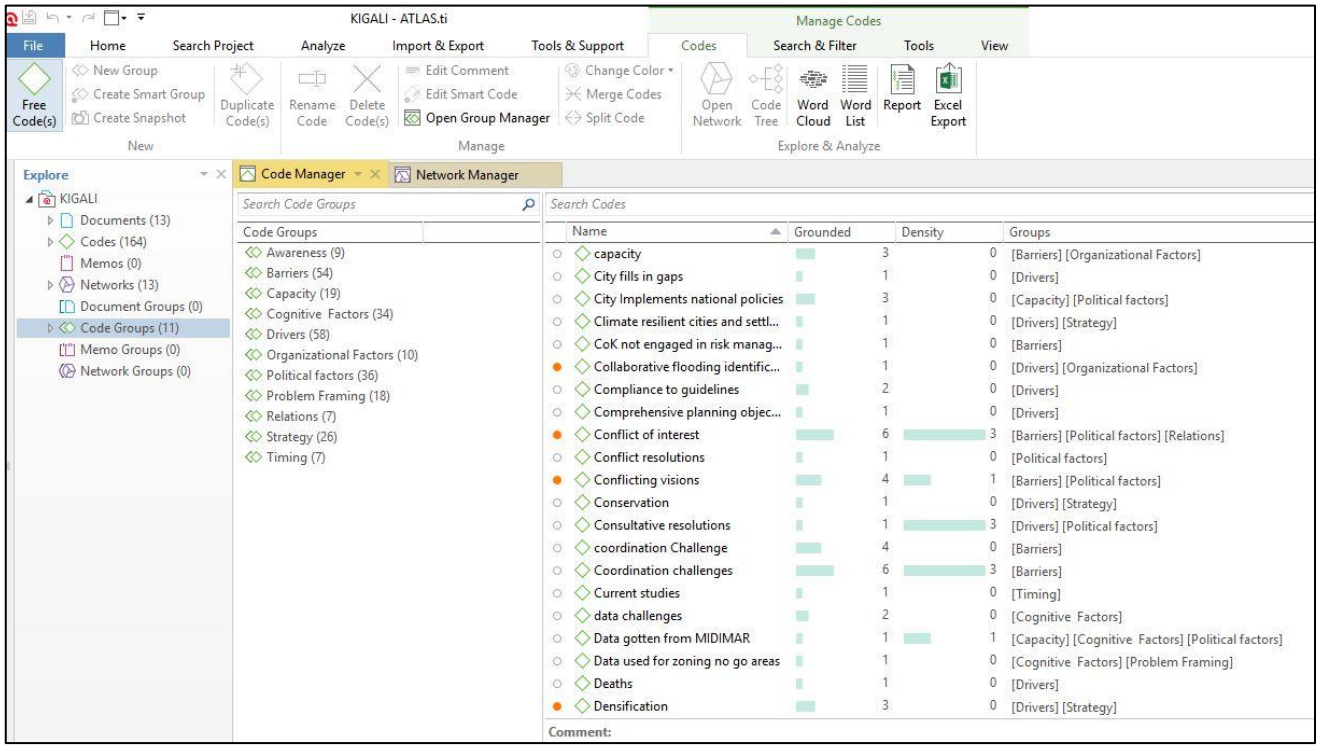
Annex 14.: GGCRS Programs

Programmes of Action	Sectors												
	Agriculture	Water	Land	Built Environment	Transport	Forestry	Mining	Energy	Industry	Health	Education	Local Government	Disaster Management
1. Sustainable intensification of small scale farming	✔	✔	✔			✔					✔	✔	✔
2. Agricultural diversity for local and export markets	✔	✔	✔		✔			✔	✔		✔		
3. Integrated Water Resource Management and Planning	✔	✔	✔	✔		✔	✔	✔	✔	✔	✔	✔	✔
4. Sustainable Land Use Management and Planning	✔	✔	✔	✔	✔	✔	✔	✔	✔		✔	✔	
5. Low carbon mix of power generation for national grid		✔	✔	✔	✔		✔	✔	✔	✔	✔		✔
6. Sustainable small-scale energy installations in rural areas	✔	✔	✔	✔		✔		✔	✔	✔	✔	✔	
7. Green industry and private sector investment	✔	✔	✔	✔	✔		✔	✔	✔		✔		
8. Climate compatible mining		✔	✔		✔		✔	✔	✔		✔	✔	✔
9. Efficient resilient transport systems	✔		✔	✔	✔		✔	✔	✔	✔	✔	✔	
10. Low carbon urban settlements		✔	✔	✔	✔			✔	✔	✔	✔	✔	✔
11. Ecotourism, Conservation and PES Promotion	✔	✔	✔			✔		✔	✔	✔	✔	✔	✔
12. Sustainable forestry, agroforestry and biomass energy	✔	✔	✔			✔		✔	✔	✔	✔	✔	✔
13. Disaster Management and Disease Prevention	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
14. Climate data and projections	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

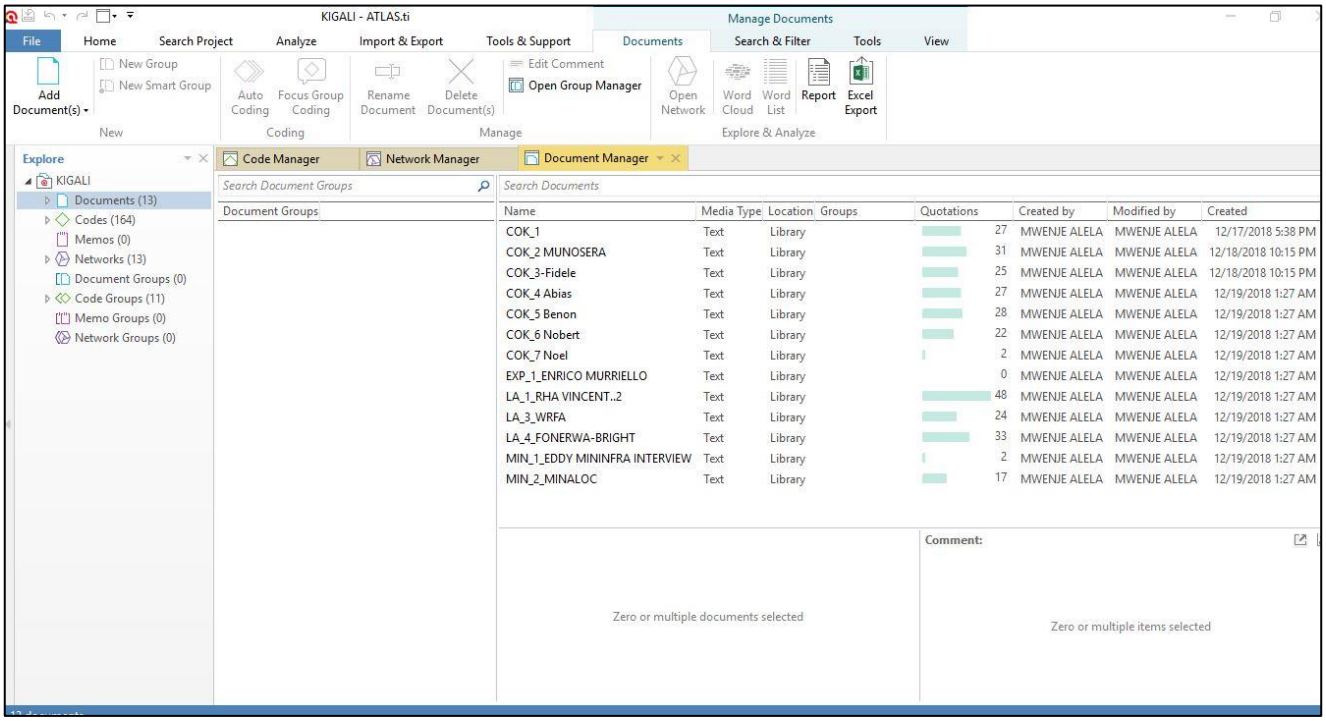
Annex 15 : Data Analysis Extracts from Atlas.Ti



Annex 16: Data Analysis Extracts from Atlas.Ti



Annex 17 : Data Analysis Extracts from Atlas.Ti



Annex 18: Flood extent Maps for return periods 1,10,50 1nd 100 years in a clockwise direction.

Flood map for the 1 Year Return Period in Nyabugogo

Flood map for the 10 year Return Period in Nyabugogo

Flood map for the 100 year Return Period in Nyabugogo

Flood map for the 50 year Return Period in Nyabugogo

Annex 19: Codes, Drivers/Barriers and Code Groups

CODES/CODE GROUPS	BARRIERS	DRIVERS	COGNITIVE FACTORS	ORGANIZATIONAL FACTORS	POLITICAL FACTORS	PROBLEM FRAMING	TIMING	CAPACITY
1% of GDP lost	Barrier	Driver						
GGCR Programs		Driver			Political factor			
Additionality funding		Driver			Political factor			
Alternative cooking energy		Driver						
Autonomous city		Driver						
Autonomy of CoK		Driver			Political factor			Capacity
Bad drainage	Barrier							
Topography	Barrier							
Broad conceptual master plan	Barrier							
Budgetary modification		Driver			Political factor			
building code		Driver						
Capacity	Barrier			Organizational Factor				
City fills in gaps		Driver						
City Implements national policies		Driver			Political factor			Capacity
Climate resilient cities and settlements		Driver						
CoK not engaged in risk management	Barrier							

Compliance to guidelines		Driver						
Comprehensive planning objectives		Driver						
Conflict of interest	Barrier				Political factor			
Conflict resolutions	Barrier				Political factor			
Conflicting visions	Barrier				Political factor			
Conservation		Driver						
Consultative resolutions		Driver			Political factor			
coordination Challenge	Barrier							
Coordination challenges	Barrier							
Current studies		Driver					Timing	
data challenges	Barrier		Cognitive Factor					
Data gotten from MIDIMAR	Barrier		Cognitive Factor		Political factor			Capacity
Data used for zoning no go areas	Barrier	Driver	Cognitive Factor			Problem Framing		
Deaths		Driver						
Densification		Driver						
Destruction of property		Driver						
Different priorities	Barrier							
Donor climate funding		Driver			Political factor			
Economic Impacts	Barrier	Driver			Political factor			
Elevated roads		Driver	Cognitive Factor					

End users not observed	Barrier					Problem Framing		
Environment and hazards group		Driver						
Environmental damage	Barrier	Driver						
External funds		Driver						
FIP		Driver			Political factor			
Flood mapping		Driver						Capacity
Flood prone areas		Driver						
Flood risk assessment	Barrier					Problem Framing		
Floods	Barrier							
FONERWA		Driver			Political factor			
Food insecurity								
Funds for mainstreaming		Driver			Political factor			
Funds green growth strategy		Driver						
Gabions		Driver						
Government					Political factor			
Government subsidy		Driver			Political factor			Capacity
Government to bid for funds								
Green city to integrate Climate change		Driver						
Green growth and climate change strategy		Driver						
Green plot ratio		Driver	Cognitive Factor					

High precipitation	Barrier							
Improving infrastructure		Driver						
Inappropriate data	Barrier		Cognitive Factor					
Inappropriate spatial methods	Barrier		Cognitive Factor			Problem Framing		
Increased awareness		Driver	Cognitive Factor					
Increasing precipitation	Barrier							
Informal settlements	Barrier							Capacity
Infrastructure design challenges	Barrier		Cognitive Factor					
Integrated Development Project		Driver			Political factor			
Integrated flood management		Driver						
Jurisdictional challenges	Barrier				Political factor			
Lack of data	Barrier		Cognitive Factor					
Landslides	Barrier							
Limited awareness on risks	Barrier		Cognitive Factor			Problem Framing		
Limited capacity	Barrier							Capacity
Limited development space	Barrier							
Limited Funds	Barrier							Capacity
Local Planning by city		Driver						
Manholes								
Master plan review		Driver			Political factor		Timing	

Monitoring and evaluation								
Multi-agent planning	Barrier	Driver						
National coordination Meetings	Barrier	Driver			Political factor			
National dialogue platform								
National Government support		Driver						
National policy Frameworks		Driver			Political factor			
Need for anticipatory adaptation		Driver					Timing	
Need for Mainstreaming		Driver			Political factors		Timing	
NGO				Organizational Factor	Political factor			
No climate experts	Barrier		Cognitive Factor					Capacity
No climate projections in infrastructure designs	Barrier		Cognitive Factor					
No digital communication platform	Barrier							
No evaluation of strategies	Barrier		Cognitive Factor					Capacity
No go zones		Driver	Cognitive Factor					
No hazard focus in Previous Plans	Barrier		Cognitive Factor			Problem Framing		
No local budget for risk management	Barrier				Political factor			Capacity

No risk action plans	Barrier		Cognitive Factor			Problem Framing		Capacity
No Risk informed planning method	Barrier		Cognitive Factor			Problem Framing		
No sewerage								
Non communicating risk maps	Barrier		Cognitive Factor		Political factor	Problem Framing		
Non-participation in adaptation	Barrier		Cognitive Factor					Capacity
Not involved			Cognitive Factor					
Not pragmatic policy directives	Barrier				Political factors	Problem Framing		
Nyabugogo hotspot		Driver						
Onsite flood management		Driver	Cognitive Factor					
Orthophoto								
Outdated data	Barrier		Cognitive Factor					
Overlays	Barrier	Driver				Problem Framing		
Participatory Approach	Barrier	Driver		Organizational Factor				
Partnerships		Driver		Organizational Factor				
Pervious landscapes						Problem Framing		
Physical Identification	Barrier					Problem Framing		
Physical Vulnerability assessment	Barrier		Cognitive Factor			Problem Framing		Capacity
Political good will		Driver			Political factor		Timing	

Poor construction technology	Barrier		Cognitive Factor					
Previously haphazard developments	Barrier							Capacity
Prioritizing climate change		Driver		Organizational Factor	Political factor			
Private sector influence	Barrier	Driver						
public awareness		Driver						
Public perceptions	Barrier							
Rain water harvesting		Driver						
Rainwater Harvesting		Driver						
Reclamation		Driver						
Relocations	Barrier	Driver						
Responsibility of MIDIMAR	Barrier							Capacity
Responsibilities concerns	Barrier			Organizational Factor				
Retention ponds		Driver						
Risk maps to determine user needs	Barrier		Cognitive Factor					
Roles and responsibilities		Driver		Organizational Factor				
Sense of ownership	Barrier			Organizational				
Shelter focused policies	Barrier		Cognitive Factor			Problem Framing		
Slope Analysis	Barrier	Driver						
SPCR		Driver			Political factor		Timing	
Steep slopes	Barrier							
Steep slopes as high risk zones	Barrier		Cognitive Factor			Problem Framing		

Strict funding criteria	Barrier				Political factor			
subsidized climate loans		Driver			Political factor			Capacity
Surface runoff	Barrier					Problem Framing		
Technical advisory committee		Driver						
Temperature rise		Driver						
Thematic Focused Groups		Driver		Organizational Factor				
Too much paving	Barrier							
Top down influence	Barrier				Political factor			Capacity
Topography impedes infrastructure	Barrier							
Unaware of methods			Cognitive Factor					
Unaware of risk informed planning			Cognitive Factor					
Unaware of role of planning			Cognitive Factor					
Unclassified risk levels	Barrier		Cognitive Factor			Problem Framing		
Uncoordinated adaptation projects	Barrier			Organizational Factor	Political factor			
Underground Drainages		Driver						Capacity
Unreliable data	Barrier		Cognitive Factor					
Untimely funding	Barrier				Political factor			Capacity
Upgrading Drainage Channels		Driver		Organizational				
Urban wetland management		Driver						

Vulnerability reduction		Driver			Political			
Water contamination	Barrier							
Wetland encroachment	Barrier							Capacity
Wetland protection		Driver						
Wrong Response	Barrier		Cognitive Factor					

Annex 20:OECD (2016) Regulatory Mainstreaming Framework

Dimensions	Sub-Dimensions	Indicators
Analytical	Actors	Participatory approach to mainstreaming planning
		Participation framework
		Well defined roles
		Collective responsibility in planning and implementation
		Sense of ownership among the actors
		Prioritization by all actors
	Regulatory inter-linkages	Synergies and trade-offs are explicitly factored
		Inter-sectoral decision making
		Defining Inter-sectoral impacts
	Contextual issues	Identifying Positive enablers
		Identifying Possible inhibitors
	Funding	Identification of possible sources of funds
		Mechanisms to promote integrated funding
		Availability of incentives
	Inter-generational impacts	Identification of unintended negative impacts
		Factoring the vulnerable
		Projection of possible future impacts on livelihoods
		Identifying all possible risks likely to arise when implementing the regulation
Institutional	Awareness & comprehension	Widely known and accepted risk objectives
		Systematic and scientific risk assessment
		Evidence-based risk objectives
		Forecasted flood-risks
	Political commitment	Explicit endorsement of flood-risk management
		Political affirmative statements towards risk planning
		Effective communication and feedback system
		Identification and Prioritization of areas for interventions
	Priority setting	Pro-risk management plans
		Explicit Regulatory coherence
		National government support
	Strategic framework	National strategies informing local actions

		Inclusion of local Climate adaptation in national plans
		Distribution of roles for adaptation planning/response
	Coordination mechanisms	Formal system for interdepartmental engagement on CCA
		Conflict/crisis management
		Budgetary prioritization
	City specific flood risk objectives	Does the plan satisfy the expected risk reduction goals
		Data availability and reliability
		High and guaranteed Data accessibility
		Data usefulness
		Evidence-based mainstreaming goals
		Risk assessment framework
		Accurate Risk framing
	Budgetary process	Allocations to promote regulatory integration and cohesion
		Re-adjustments in budgeting to factor risk management
Monitoring	Strengthening monitoring and reporting mechanism	Presence of monitoring and reporting system on risk-informed planning.
		Transparent monitoring and reporting on CCA
		Improving Capacity for risk analysis, planning and evaluation
		Regulatory flexibility to address climate impacts
	Adapting monitoring systems to contemporary climate impacts	Setting of New objectives/strategies to address flood risk
		Monitoring system for the entire planning cycle management (risk identification, planning, implementation, and evaluation)
		Monitoring and responding to transboundary climate impacts
	Measuring policy interactions	Identifying critical cross-policy outcomes/effects
		Plan to address cross-sectoral cohesion
SOURCE: OECD (2016)		

Annex 21:Tearfund Mainstreaming Framework by Trobe (2005)

Mainstreaming level/dimensions	Level 1: No progress	Level 2: Awareness of needs	Level 3: Development of solutions	Level 4: Full mainstreaming
Policy/plans	-	a. General awareness within the of the significance of risk sensitive development objectives. b. Recognition of the need for development to be linked in a coordinated approach to CCA	i) Presence of a conceptual framework for flood risk mainstreaming ii.) Interdepartmental collaboration	i) SP includes CCA with realistic, achievable goals for mainstreaming. ii) CCA policy is fully endorsed by senior management. iv) Risk sensitive objectives are reflected in internal and external documents
Strategy	-	a. The organization recognises that ad hoc decision-making for disaster risk reduction is inadequate. b. There is widespread awareness of the need to develop risk sensitive strategies	A wide cross-section of staff are engaged in a consultative process to ensure that mainstreaming CCA is a component of the organization's existing strategy framework.	A. The organization has a comprehensive mainstreaming strategy based on the conceptual framework and policy (see dimension 1: Policy). B. The strategy is fully endorsed by senior management. C. The strategy is reflected in internal and external documents.
Geographical Planning	-	a. Widespread understanding of the risk dynamics b. considerations for risk-sensitive planning	Development of flood risk mainstreaming framework	a. Participatory flood Risk analysis b. Appropriate CCA strategies are developed integrated into new geographical plans as a matter of course.
Project Cycle Management		The organization recognises a need for reducing disaster risks within every aspect of project cycle management.	There is development of a risk sensitive planning, monitoring and evaluation framework.	a. Planning reviews routinely incorporate flood risks b. Monitoring and evaluation results inform new plans c. Where explicit flood risk programmes are established, these are linked to other departments
External Relations		The organization recognises that it cannot act alone in the field of disaster risk reduction.	a. All relevant stakeholders are being identified b. Linkages are being made with key stakeholders to raise awareness	a. there is willingness to budget for CCA b. Strong collaboration with other key players, and information, expertise and resources are shared as required...

Institutional Capacity		Recognition for need to develop appropriate capacity including sufficient resources to support the process of mainstreaming CCA	a. Plans are being made to develop a supportive institutional environment for mainstreaming disaster risk reduction. b. Tools are being developed to assess the progress of mainstreaming	a. Institutional capacity is sufficient to support all the processes : Financial resources, Skills and knowledge - Strong stakeholder commitment and ownership b.Plans are routinely used independently and comprehensively to assess the progress with mainstreaming.
Source:Trobe, (2005)				