IHS
Making cities work

IHS is the international institute of urban management
of Erasmus University Rotterdam

MSc Programme in Urban Management and Development

Rotterdam, The Netherlands

September 2015

Thesis

Title:

The influence of Multi-actor Coordination on urban household Water Access: The Case of Kawangware Informal Settlement in Nairobi City

Name: **Michael Omondi Okok**

Supervisor: **Alberto Gianoli**

Specialization: **Urban Environmental Management and Climate Change**

UMD 11

MASTER'S PROGRAMME IN URBAN MANAGEMENT AND DEVELOPMENT

(October 2014 – September 2015)

Title

The influence of Multi-actor Coordination on urban household Water Access: The Case of Kawangware Informal Settlement in Nairobi City

Name

Michael Omondi Okok

Country

Kenya

Supervisor:

Alberto Gianoli

UMD 11 Report number: 807

Rotterdam, September 2015

Summary

This thesis brings into perspective the role of coordination in a multi-actor system; how its nature and level can influence governance outcomes, and the need for a coordination framework in an environment that involves multiple actors.

The objective of this thesis is to provide an insight on how the nature and level of coordination among multiple actors in water provision affect urban household water access, knowledge which can facilitate the development of best coordination practices and improved service delivery in urban informal settlements. The research questions of this thesis are: What is the nature and level of actors' coordination in the provision of water in Kawangware informal settlement? What is the existing state of household water access in Kawangware informal settlement? In which ways has the nature and level of coordination of multiple actors contributed to the state of water access in Kawangware informal settlement in Nairobi?

The research strategy was a case study that focused on Kawangware, an informal settlement in Nairobi city characterised by persistent water scarcity despite active involvement of multiple actors undertaking water provision actions. Data collection methods employed were interviews and household survey using interview guide and questionnaires respectively. In addition, secondary data from reports and policy documents was also used to a lesser extent to triangulate information. The informants for the study were derived from different institutions and organizations including government, non-governmental and private sector actors working on water provision in the area. Households in the informal settlement were also sampled and formed part of the respondents.

The thesis framework has been conceptualized based on a detailed review of literature. The literature discusses the rising climate induced urban water scarcity, the need for adaptation and the position of coordination of actors in the climate adaptation governance process. A review of multi-actor system and the sub-activities of coordination provides the conceptual framework for understanding the relational dynamics and its influence on governance outcome which is improved household water access in this context.

This study reveals that coordination influences water governance outcomes by acting on the intermediate factors such as resource pooling and mobilization, service delivery efficiency, technology and knowledge transfer, conflict resolution, spatial equity and ability to influence public policy and planning. As a consequence, low level of actors' coordination in Kawangware has led to poor household water access when bench marked with national and international standards, with majority of residents lacking piped water within their household vicinity. They also experience irregular water availability, low flow rates and long waiting times before collecting water.

Generally, the findings and analysis are synthesized into the following areas:

1. Nature and levels of coordination among actors covering communication, organization, planning, commanding, executing and controlling;
2. State of household water access in Kawangware informal settlement including quality, quantity and quality;
3. The role that the nature and level of coordination has played in shaping the existing state of household water access

Cities around the world are becoming more water scarce, a situation that is worsened by the impacts of climate change. Therefore adaptation, in the water sector requires joint efforts of

multiple actors. However, attainment of goals in joint action environment with multiple actors is partly dependent on coordination that exist among them.

This thesis therefore argues that coordination of multiple actors is a critical component of urban climate adaptation governance and should be considered with the same seriousness as institutions, actors, decision making and participation if expected outcomes are to be realized. Otherwise, poor or lack of coordination may increase vulnerability or even cause maladaptation.

Keywords: Actors, Coordination, Governance, Multi-actor system, Household water access

Acknowledgements

Writing of this thesis would not have been possible without the support of certain people who played a role at one stage or another during the process. First and most importantly I thank God for without Him, nothing would make sense. I also thank IHS for giving me the opportunity to pursue the Master's degree in the institution and the support I received from both academic and non-academic staff.

More specifically, I acknowledge; my thesis supervisor Dr. Alberto Gianoli for his intellectual insights and guidance throughout the exercise; the various organizations and households in Kawangware who through trust accepted to participate in this study as respondents; Dickson and Reuben who gracefully and with passion helped me to collect data as research assistants; my dear and close friend Irene for her keen eyes on the questionnaires that ensured no mistakes were made and right data collected, as well as walking with me in the scotching sun and choking dust in Kawangware despite her condition at the time; and my love Susan for her constant emotional support and encouragement and braving the loneliness during my absence.

Foreword

Settling for this thesis topic is probably one of the several difficult choices I have made in my life. When I joined this Masters programme, I was so certain about my specialization interest but I had no idea of a research topic to work on. After going through a series of lectures and workshops during the course, so many interesting ideas kept creeping in my mind. Actually, every lecture had its interesting insights that I could easily relate to in the context of my country.

At the end I had a very long list of topic ideas all which were interesting yet I had to make a choice, and I chose this topic. Reason? I found climate change governance very exciting and relevant. Looking back at Nairobi, I saw a vibrant climate change adaptation governance framework; the policies, the actors and the legislations. I wondered what we are not doing right as a city and realized it could be that actors' coordination framework was lacking. That was the conception of this topic. The motivation has been my desire to be among the people who contribute towards the filling of the knowledge gap on coordination of multiple actors.

I must admit that this paper brings to the end a long process which though exciting, has been strenuous and tedious. And with the professional guidance of my supervisor, Alberto Gianoli, and the support of my fellow students, the thesis is finally delivered.

I hope that the thesis will not only provide an interesting read but also elicit critical questions in academia and provide a reference for some policy.

Abbreviations

CBOs	Community Based Organizations
CSO	Civil Society Organization
GOK	Government of Kenya
IPCC	Intergovernmental Panel on Climate Change
IHS	Institute for Housing and Urban Development Studies
IWRM	Integrated Water Resource Management
KIWASNET	Kenya Water Civil Society Network
KNBS	Kenya National Bureau of Statistics
MOU	Memorandum of Understanding
NGOs	Non-Governmental Organizations
NWSC	Nairobi Water and Sewerage Company
SPSS	Statistical Package for Social Sciences
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN-Habitat	United Nations Human Settlements Programme
WHO	World Health organization
WRMA	Water Resources Management Authority
WSB	Water Services Board

Table of Contents

Summary iii

Acknowledgements v

Foreword vi

Abbreviations vii

List of Tables x

List of Charts x

List of Figures x

Chapter 1: Introduction 11

1.1 Background 11
1.2 Problem Statement 12
1.3 Research Objectives 13
1.4 Provisional Research Questions 13
1.4.1 Main Question 13
1.4.2 Sub-questions 13
1.5 Significance of the Study 13
1.6 Scope and Limitations of the Study 13

Chapter 2: Literature review 15

2.1 Water security, urban water provision and climate change 15
2.1.1 Urban water scarcity 15
2.1.2 Urban water provision, water security and its elements 15
2.1.2.1 Defining water Security 15
2.1.2.2 Elements of water security 16
2.1.3 The impact of climate change on urban water provision 17
2.1.4 The need for climate adaptation in the water sector 17
2.2 Conceptualizing coordination in public governance and the link between coordination and governance 18
2.2.1 Governance 18
2.2.2 Analytical perspectives on governance: regulation and coordination process 18
2.2.3 Networks and the place of coordination 19
2.3. Coordination 19
2.3.1 What is coordination? 19
2.3.2 Theoretical development and understanding of the concept of coordination 20
2.3.3 Motivation for coordination: The theories 21
2.3.4 Multi-actor system and the multi-actor theory 21
2.3.5 Key elements or sub-activities in coordination 22
2.4 Contextualizing coordination in water and climate adaptation governance 22
2.4.1 Water governance 22
2.4.2 Climate change adaptation governance 23
2.4.3 Institutional fragmentation, multiplicity of actors and the need for coordination in water and adaptation governance 23
2.5 The influence of multi-actor coordination on urban household water access in informal settlement: The Conceptual Framework 25

Chapter 3: Research Design and Methods 27

3.1 Revised Research Questions 27
3.1.1 Main Question 27
3.1.2 Sub-questions 27
3.2 Operationalization: Variables and Indicators 27
3.3 Research Strategy and Methodology 33

3.4 Data Collection Methods 34
3.4.1 Data type 34
3.4.2 Participants and sources of data 34
3.4.3 Data collection Methods and instruments 34
3.5 Sample Size Selection 35
3.5.1 Sample selection for semi-structured interviews 35
3.5.2 Sample selection for questionnaires 35
3.5.2.1 Sample Size 35
3.5.2.2 Sampling 36
3.7 Limitations of the data collection methods, and data Validity and Reliability 36
3.8 Data Analysis methods 36
Chapter 4: Research Findings 37
4.1 Study Area 37
4.2 Sample Characteristics 38
4.2.1 Interview sample characteristics 38
4.2.2 Questionnaires sample characteristic 39
4.3 The Nature and level of Coordination of multiple actors involved in household water provision in Kawangware Sub-location 41
4.3.1 Actors involved in water provision actions in Kawangware Sub-location 41
4.3.2 Nature and level of various elements of coordination among the actors 43
4.3.2.1 Communication 43
4.3.2.2 Organizing 45
4.3.2.3 Planning 46
4.3.2.4 Commanding 48
4.3.2.5 Execution 48
4.3.2.6 Controlling 48
4.3.3 Levels of coordination 49
4.3.4 Conclusion on the nature and level of coordination among the actors 49
4.4 State of household water access in Kawangware informal settlement 49
4.4.1 Holistic view of state of water access for the Sub-location 49
4.4.1.1 Availability of water 49
4.4.1.1.1 Source of domestic water 49
4.4.1.1.2 Distance to water source and Collection time 51
4.4.1.1.3 Regularity of water availability 51
4.4.1.1.4 Availability of alternative sources 52
4.4.2.2 Water quantity 53
4.4.2.2.1 Daily water per capita sufficiency 53
4.4.2.2.2 Rate of water flow and line of people at the source 54
4.4.2.2 Water Quality 54
4.4.3 Comparative water access across villages in the sub-location 55
4.4.3.1 Comparison of water availability 55
4.4.3.1.1 Sources of water 55
4.4.3.1.2 Distance to water source and collection time 55
4.4.3.1.3 Regularity of water availability 56
4.4.3.1.4 Availability of alternative sources of water 57
4.4.3.2 Comparison of Water Quantity 58
4.4.3.2.1 Daily per capita water sufficiency 58
4.4.3.2.2 Rate of water flow and line of people 58
4.4.3.3 Comparison of Water Quality 59
4.4.4 Conclusion on the state of household water access 59
4.5 How the nature and level of coordination of multiple actors involved in water provision influenced the state of household water access in Kawangware informal settlement of Nairobi 59
4.5.1 Conclusion on the how nature and level of coordination has influenced household water access in Kawangware 62
4.6 Discussion and Conclusion on Findings 62
Chapter 5: Conclusions and recommendations 65
5.1 Conclusions 65

5.2 Recommendations 66
Bibliography 67
Annex 1: Interview Guide 71
Annex 1: Household Survey Questionnaire 77

List of Tables

Table 1: Operationalization; Variables and Indicators 28
Table 2: Interview Sample characteristics 38
Table 3: Participants background Information (N=160) 40
Table 4: Summary of the nature of engagement among actors in planning water projects 47
Table 6: Water flow rates rating 54
Table 7: Distance to water source and respective percentage within village of respondents 56
Table 8: Frequency of water availability per week at a source and the respective percentage of village respondents . 57
Table 9: Respondents'' responses on the various aspects of water flow rate at the source 59

List of Charts

Chart 1: Respondents awareness of other actors 42
Chart 2: Frequency of respondents on aspects of communication 45
Chart 3: Water sources and respective percentage of respondent that use them in Kawangware 50
Chart 4: Water availability in Kawangware 51
Chart 5: Availability of alternative sources of water 52
Chart 6: Difference across the villages in terms of water sources 55
Chart 7: Water availability in the week 57
Chart 8: Daily per capita water availability 58

List of Figures

Figure 1: Elements of household water security 16
Figure 2: Conceptual Framework 26
Figure 3: GIS Map of the study area 37
Figure 4: Interrelations of Multiple actors in water provision in Kawangware 42
Figure 5: Illustration of influence of coordination on household water access 64

Chapter 1: Introduction

This chapter introduces the topic of this thesis by providing the background of the research topic, the academic problem that has motivated the study, the aim of the study and the main questions to which the inquiry sought to answer. It also gives the rational of the research and its importance to academia and policy.

1.1 Background

Climate change is an environmental problem that requires not only efforts in mitigation but also in adaptation. Extreme heat, sea level rise, flooding and storm surge are some of the adverse impact of climate change that continue to affect various parts of the world. The effects of climate change, though diverse in terms of spatial distribution and scale are experienced in all continents (IPCC, 2014).

Due to their low adaptive capacity, high exposure and sensitivity, developing countries will be the most affected by climate change impacts. According to Omambia et al (2012). East Africa is among the regions most vulnerable to climate change with remarkable evidence including repeated droughts and increase in drylands affecting water and food availability for humans and livestock. Kenya, as a developing country in East Africa and whose population is dependent on natural resources is vulnerable to climate change. Erratic rainfall, droughts, floods, landslides, mudslides and heat waves have resulted to crop failure, reduced hydroelectric power generation and escalated water shortages among other adverse effects (Mutunga, Zulu, et al., 2012).

These impacts are not just felt in the rural parts of the country, but also in the urban areas and Nairobi is among the urban areas already facing adverse effects of climate change. The city is the second largest in East Africa and is considered the economic hub of the region. The city also hosts a population of 3.138 million which is 37.7 percent of the countries urbanites (UN Data, 2015). However, the city is challenged by high population growth rate, high density slum dwellers in risky areas, poverty, worsening traffic congestion, urban sprawl and environmental degradation. These challenges coupled with the impacts of climate change particularly flooding and declining water supply are making the city more and more unlivable.

Drinking water for Nairobi city comes from Ndakaini, Susuma and Ruiru dams and Kikuyu springs. These sources are supplied mainly by rivers that originate in the Aberdare Range and the Mount Kenya water catchment area. However, Nairobi city has recently been facing severe water scarcity where water demand exceeds water supply by about 200,000 m3 per day (Crow and Odaba, 2010, WWF, 2011). This deficit has been attributed to illegal connections, leakages due to poor infrastructure and most importantly to reduced flow from the river to the reservoir because of declining precipitation over the years. This context means that climate change adaptation and water governance, and particularly the coordination of the multiple actors, is of importance if the city is to improve and sustain the water access for its residents and cope with impacts of climate change on water sector.

1.2 Problem Statement

Effective adaptation governance in the water sector is required in cities because it is only through this that cities will improve their adaptive capacity and reduce their vulnerabilities to the imminent impacts of climate change on water quantity and quality. For instance, declining water supply is one of the climate change impacts that Nairobi city has to adapt to. With its rapid population growth which is expected to reach six million by 2025 (GOK, 2013) and high concentration of slum dwellers with limited access to safe drinking water, the city is very vulnerable to the risk of severe water shortage and the associated challenges like poor sanitation and diseases.

However, according to Tropp (2007), water governance in many developing countries is characterized by a state of confusion and dysfunction with little responsiveness or accountability to citizens. This is a phenomenon characteristic of Nairobi where adaptation governance in the water sector involves a large pool of actors. The "Water Act 2002" provides a comprehensive institutional and regulatory framework with several institutions, management bodies at national, regional and local levels. These bodies were initially meant only for water governance. But since the emergence of climate change and its impacts on the risk of water scarcity in the city, these actors had to go beyond water governance and mainstream climate change adaptation in the sector. Kenya's climate change response strategy 2010 and climate change action plan outlines ways in which the water sector should address climate change adaptation and mitigation and also establishes more institutions to deal with climate change.

Climate change impacts and risks are localized in nature and therefore management and planning both cross levels and inter-level coordination is required to ensure that adaptation of local actors and communities is not compromised by processes at any level. Effective coordination has been identified in many literature as one of the elements of good governance not only in adaptation but also in the water sector governance as a whole (Sehring, 2009a). However effective coordination in a multi actor environment is a challenge due to the diverse interests, problem perceptions, and problem solution by individual actors.

Governance is an old concept that has been studied in details over the years. However, governance in the context of climate change adaptation is an emerging perspective in policy environments. Existing literature on adaptation governance have mainly focused on characteristics and challenges, levels of governance, actors, and roles of various actors in governance (Carmin, Dodman, et al., 2013b, Leck and Simon, 2013a, Mees, Driessen, et al., 2013, Bulkeley, 2010) However, the role of coordination in a multi-actor environment and its influence on governance outcomes have very limited academic attention.

Coordination, which includes the relational dynamics between various levels of governments and non-governmental networks, is vital for good governance in the context of current urbanization, environmental and sustainability concerns. Despite this, little attention has been given to the importance of such kind of relational dynamics and characteristics of the shifting global governance (Leck and Simon, 2013b). Even more specifically, the effect that coordination of multiple actors in water sector has on adaptation to water scarcity has not been explained in practice. This is a problem because lack of effective coordination may even increase vulnerability of particular units or maladaptation due to activities of another (Ivey, Smithers, et al., 2004).

This study therefore sought to add into the knowledge and understanding of the role of coordination in a multi-actor water sector and how this can be exploited to enhance water provision and improve urban household water access in light of rising water scarcity due to climate change.

1.3 Research Objectives

To explain how the nature and level of coordination of multiple actors in water provision affect urban household water access in the face of climate change induced water scarcity in Kawangware informal settlement, Nairobi city.

1.4 Provisional Research Questions

1.4.1 Main Question

How does the nature and level of coordination of multiple actors involved in water provision influence urban household water access in Kawangware informal settlement in Nairobi city, in the face of water scarcity due to climate change?

1.4.2 Sub-questions

I. What is the nature and level of actors' coordination in the provision of water in Kawangware informal settlement?

II. What is the state of household water access in Kawangware informal settlement?

III. How does the nature and level of actors' coordination affect the state of water access in Kawangware informal settlement?

1.5 Significance of the Study

Climate adaptation governance in the water sector, particularly in water provision, is important if urban dwellers are to be assured of access to safe and sufficient even in the face of scarcity induced by climate change. This process of governance requires joint efforts of multiple actors if it has to be effective and this raises an important aspect of coordination among them. The nature and level of coordination among these actors could have influence on governance outcomes as to whether water access is improved or compromised.

This study gives an insight on how the relational dynamics among actors influence water access especially in the area of study and as such may be important to the government, not for profit non-governmental organizations and private sector to review the manner in which they work with one another. In this perspective, the research is vital for policy, project planning and management.

In addition, this study contributes to the field of academics by bringing into focus coordination as an element of governance, a subject that has not received much attention in climate adaptation governance.

1.6 Scope and Limitations of the Study

The scope of this research is to understand the nature and level of coordination in the multi-actor environment and the influence it has on governance outcome. Specifically it looks at how coordination among multiple actors in Kawangware informal settlement has contributed to the existing state of household water access in the area. The study does not however explain the factors that contributed to the nature and level of coordination among the actors or other factors which might have acted together with nature and level of coordination to shape the state of water access.

This research has two major limitations. Being a case study research, these findings may not necessarily reflect how other systems, whether similar or different, would behave under similar nature and level of coordination environment. This limits the ability to generalize these findings to the entire population or to explain other cases. Secondly, the interviews on the nature and level of coordination were not conducted to saturation point as planned meaning that all the possible perspectives on the variables of study may not have been captured. This might have had implications on the reliability of the results. However, care was taken to ensure representation of all the categories of actors in the area and in-depth interviews conducted to get as much information as was possible.

Chapter 2: Literature review

The chapter provides a state-of-the-art literature review upon which the study has been constructed. It is in this chapter that key concepts, ideas and theories have been defined and discussed and a theoretical framework of the study developed. The chapter also provides the conceptual framework for the research.

2.1 Water security, urban water provision and climate change

2.1.1 Urban water scarcity

Human wellbeing is dependent on safe, reliable, affordable and easily accessible water supply among other factors. Water is important in agriculture, industries, and households as well as in environmental and recreational applications. Household or domestic uses of water include drinking, cooking, general sanitation and hygiene. According to World health organization, lack of or poor access to domestic water can cause severe health problems including dehydration and water borne disease like cholera, and generally affect household livelihoods. However, many parts of the world are already faced with excess water demand and this trend is expected to spread to more areas in the near future (Vairavamoorthy, Gorantiwar, et al., 2008). It is estimated that 768 million people globally do not have access to improved source of water (UNESCO, 2014) yet the demand for freshwater is only expected to continue rising due to the growing population and changing lifestyle and consumptions patterns. The world water report (2014) further states that domestic water demand will increase by 130% by 2050, a period during which fresh water availability will also be experiencing more strain and causing 40% of the world's population to live in areas with severe water stress.

Urban areas are not spared this increasing water demand. The Intergovernmental Panel on Climate Change (IPCC, 2014) estimates that 150 million people currently live in cities with perennial water shortage, defined as less than 100 litres per person per day of sustainable surface and groundwater flow within their urban extent; while McDonald (2011) forecast that 993million people will live in cities with perennial water shortages within their urban extent by 2050.

More than half of city dwellers in developing countries live in informal settlements which lack portable water supply and experience constant scarcities (Habitat, 2008). In the slums of Nairobi for example, increasing water scarcity and cost is negatively affecting households. Residents make multiple trips searching for water from vendors and making long queues at water points. They spend between an hour to several hours searching and collecting water. Furthermore, in some instances they reduce clothe washing and postpone bathes when water becomes unavailable and unaffordable (Crow and Odaba, 2010). Water distress also result into sanitation problems and associated health risks such as cholera outbreak.

2.1.2 Urban water provision, water security and its elements

2.1.2.1 Defining water Security

Even though there is no universal definition of water security, it has always been presented as a situation where everyone is able to access and afford sufficient and safe water to enable them live a clean, healthy and productive life without affecting environmental wellbeing (Siwar and Ahmed, 2014). Water security has five key dimensions namely; household water security, economic water security, urban water security, environmental water security and resilience to water-related disasters (Cook and Bakker, 2012).

According to Siwar and Ahmed (2014), household water security defines the ability of households to access piped water and improved sanitation and hygiene. Household water security is critical because it has an influence on household livelihoods and can facilitate poverty eradication efforts. The second dimension of water security which is economic water security refers to access to productive water such as agricultural and industrial water. Productive water is the water used to sustain economic growth through food production and industry and energy economy. Thirdly, urban water security is the measure of the management of water resources to enhance livability of cities and include adequate water supply, wastewater management, and proper drainage systems in urban areas. Environmental water security on the other hand indicates the conditions of water resources and the general environment that impact on water resources. This may include water quality in rivers and lakes. The last component of water security which is the resilience to water related disasters refers to the ability of communities to adjust to and overcome risks from water related disasters like drought and floods. From these components of water security, this review focuses on urban water security particularly for households which is referred to as urban household water security.

2.1.2.2 Elements of water security

Three elements as identified by the United Nations University Institute for Water, Environment & Health (UN Water, 2013) are water access, Water affordability and Water safety. Water access refers to availability of water in sufficient quality and quantity at all times. Households should have water services within their vicinity and the quantity and quality should not be compromised at any time of the year. World Health Organization (WHO) recommends that to ensure basic needs are met with limited health concerns, between 50-100 litres of water is required per capita per day, and one should not cover more than 1,000 meters and collection time should be within 30 minutes (Kayser, Moriarty, et al., 2013). The WHO also emphasize that everyone should be able to access water facilities without discrimination and this includes physical, economic and information accessibility. On water safety, it is about the quality of water. Water should be of good quality that does not pose any significant risk to human health. Lastly, water affordability defines the cost of water. Households should be able to access water in sufficient quality and quantity at an affordable cost in order to meet their basic needs (Cook and Bakker, 2012).

Actors who are involved in urban water provision undertake initiatives and measures towards facilitating the achievement of the three elements of water security by exploiting and managing water resources, water treatment and putting up water supply infrastructures.

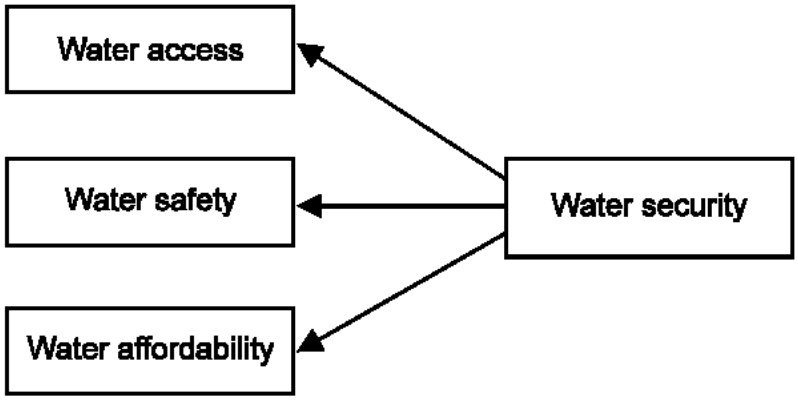

Figure 1: Elements of household water security

2.1.3 The impact of climate change on urban water provision

Urban areas including major cities around the word are experiencing changing climatic conditions and patterns especially shifting temperatures and precipitation. As result, all urban sectors such as infrastructure, buildings, biodiversity, environmental quality, and local services will be affected if not already affected (Carmin, Dodman, et al., 2013a). There is agreement among most scientists that urban dwellers will have to cope with a number of climate hazards including incidences of heatwaves, storm surges, floods, and water shortages among others, due to the changing climatic conditions (Carmin, Dodman, et al., 2013b).

Urban water provision is one of the challenges facing urban authorities especially in developing countries. Urban fresh water provision consist of three components: water availability which implies whether there is enough water nearby; water quality referring to the level of water treatment needed before it is clean enough for use; and water delivery which defines whether there are systems in place to bring water to users (McDonald, Green, et al., 2011). Water scarcity is a situation that results when any or all of the components are undermined or are ineffective. This is the definition held by the arguments of this study.

Various studies have demonstrated that even though urban population growths continue to stress urban water provision causing serious water scarcities, this situation is execrated by climate change (Valdés-Pineda, Pizarro, et al., 2014) which affects the hydrological systems. Rising temperatures increases evaporation which also significantly affect precipitation. Changing precipitation in terms of intensity and frequency alters run off patterns, and also causes flooding and increased erosion and loading of water resources. These processes affect the quality and quantity of water available in water resources as well us water delivery systems, and ultimately water provision (O'Hara and Georgakakos, 2008).

2.1.4 The need for climate adaptation in the water sector

Because of the impacts of climate change on the water sector which may continue to get even worse, it is important that measures to adapt are considered in the sector. IPCC (2007) defines climate adaptation as the "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities." Consideration for climate change adaptation in the water sector, urban water managers and actors can influence both the supply and demand of water (O'Hara and Georgakakos, 2008). This means that adaptation is supposed to aim at ensuring that urban water provision is not curtailed, or that communities are able to adjust and be able to survive within the available quantity and quality. But since the latter is not easily achievable, the former becomes the most appropriate strategy.

Adaptation to climate impacts in the water sector may include measure to enhance more efficient water use, creating or expanding water storage capacity of reservoirs, rain water harvesting technologies, water recycling and improved water resource conservation and management. These are strategies that aim at ensuring continued water provision even in the face of climate change. In this regard, different actors, working separately or jointly, are developing and implementing such adjustments and transitions at different societal scales and levels. However, due to the uncertainties about climate change impacts, these actors are faced with the challenge of implementing these adaptation measures as well as improving adaptive capacity of societies to cope with future changes (Termeer, Dewulf, et al., 2011).

In addition, due to increasing water scarcities and uncertainties associated with climate change, governments and other actors are reviewing water management and governance approaches appropriate for adaptation in the sector (Rijke, Farrelly, et al., 2013).

2.2 Conceptualizing coordination in public governance and the link between coordination and governance

2.2.1 Governance

Governance is an old concept in social sciences and has been defined differently and by various scholars. Fukuyama (2013), defines public governance as the process of formulating and enforcing rules and policies to deliver services to the people. In public administration, the concept of governance has evolved over the years since the 1800s through phases that can be explained by the so called public administration theories (Pedersen, Sehested, et al., 2011).

Traditional theory of public administration is based on the understanding that decisions, policies enforcement and steering process was the mandate of a higher authority. In this context governance was conceived as a vertical, top down, hierarchical and bureaucratic process in well-designed and formal arrangement. In fact governance and government or state were synonymous (Rhodes, 1996). The traditional theory of public administration, with its state-centric view, placed no emphasis on the role that citizens and other actors play or could play in in the process of governance (Isett, Mergel, et al., 2011).

Due to the realization of the challenges of traditional approach to public administration including policy implementation resistance, inefficiencies and negative policy outcomes, new concepts known as governance theories emerged in the 1990s (Pedersen, Sehested, et al., 2011). Proponents of new governance theories argue that public administration should be visualized as a disordered complex process characterized by multiple actors including public and private actors negotiating within formal and informal settings to make decisions and authorize implementation of those decisions. Among these theories is the governance network theory.

Klijn and Koppenjan (2012) have discussed the theory of governance network in details. They explain the theory as a complex interactive process characterized by multiplicity of actors. Termeer, Dewulf et al (2011) define network governance as the interactions between public and/ or private entities ultimately aiming at the realization of collective goals, that encompasses economic, communicative, and regulatory steering mechanisms and embraces both structure and process. As such, this definition in its broader sense implies that governance brings together activities of different actors including governments, businesses, and civil societies. It takes into account different actors and networks that facilitate formulation and implementation of policies, instruments and programs at different scales. In this definition, a distinction is made between government and governance where the former refers to the authority of the state while the later means self-organizing, inter-organizational networks. This kind of governance can be studied by analysing its various characteristics such as actors, games, arenas, actor strategies, meta-governance, and networks.

2.2.2 Analytical perspectives on governance: regulation and coordination process

According to Shreng (2009b), governance can be viewed in two perspectives; normative and analytical meanings. In its normative meaning, he argues that governance is an applicable concept that can be exercised or is being exercised in reality with substantive outcomes. On the other hand, he postulates that governance refers to distinct analytical perspective on regulations and

coordination processes. This perspective analyses dynamic and processes of normative governance in practice including institutions and actors, decision making, participation, coordination and outcomes. This study adopts the normative meaning of governance with particular focus on coordination in water and adaptation governance and its influence on governance outcomes which in this context is urban household water security.

2.2.3 Networks and the place of coordination

According to Isett et al (2011), networks (or policy networks) refer to a set of public agencies, institutions and private sector actors such as civil societies, non-governmental organizations and corporations, that are interested in a particular area of policy decision making, because they are interdependent and as such have a common end. Some of the most important current stream of literature on network governance focuses on networks in provision and production of goods and services to the public in different sectors. The networks are built up by organizations with certain interests of acquiring resources such as information, finances and technical expertise, from one another since they cannot operate in absolute independence (Rhodes, 1996).

In water governance, Tropp (2007) points out that there are linkages and interactions between and within organizations and institutions participating in decision making. This linkages and interactions occurs horizontally across sectors and institutions as well as vertically from local to international levels. When a collection of government agencies, non-profit and corporate entities work together, (independently or interpedently while maintaining their autonomy) to provide public goods and services, the arrangement is known as collaborative network (Isett, Mergel, et al., 2011). The process that create the linkages among the actors with the aiming of achieving a collective action is known as coordination.

Based on network governance theory, this study considers coordination within the broader umbrella of networks and how these networks are 'manipulated' and adjusted to achieve a collective action of providing water to urban dwellers in the face of climate change impacts on the water sector. The focus here is on the coordination of the various actors who participate in water provision actions.

2.3. Coordination

2.3.1 What is coordination?

Coordination has been a subject of interest for a long time now and several theories developed to explain it. However, there is no one agreed definition or understanding of its meaning. Even making the debate more complex is the fact that some scholars interchangeably use governance and coordination as if they were synonymous. Although closely related on the basis of theories that explain them, coordination should be looked at as a subset of governance in the sense that it is only one component of governance besides institutions and instruments of achieving policy outcomes. Pedersen et al (2011), whose work partly inspires the framework of this study, refer to coordination as the process that adjusts actions of some actors with respect to actions of others, towards the achievement of a collective action; while they look at governance as the act of guiding these actions towards a given direction. Coordination is also defined as "the additional information processing performed when two or more connected actors pursue a goal that a single actor pursuing the same goal would not perform" (Hossain and Uddin, 2012). In other words it refers to the process of managing the dependencies between actors and activities.

Coordination may be a process that occurs within an organization or among different organizations. Intra-organizational coordination refers to the mutual influence between two or more entities operating within the same organization and aiming towards attainment of a given objective. On the other hand, according to Kapucu (2005), inter-organizational coordination, which is the interest of this study, involves management of different capacities of various organizations and the many forms of relationships such as teams, partnerships, alliances and networks. It may occur as a voluntary or forced process of cooperation while maintaining the autonomy of the individual organizations

In the analysis of coordination as a concept in governance, scholars have drawn two distinctions in coordination. First distinction is made between vertical and horizontal coordination. Vertical coordination occurs in a one directional tiered adjustment across different levels of authority while horizontal coordination takes place among contiguous actors of the same tier of institution (Leck and Simon, 2013b). Addressing issues related to climate change like water scarcity require collaboration between national, regional and local government institutions. Vertical coordination highlights the importance of relational dynamics between these different levels of governance (Leck and Simon, 2013b). Horizontal coordination on the other hand focuses of the relational dynamics among "peer" organizations hence facilitating the interactions between local government with private sector, civil society and other non-profit entities.

The degree of coordination is the second type of distinction used to analyse coordination concept, and in which different degrees of coordination are distributed in a continuum from a low level coordination that only ensures actions of the multiple actors do not undermine each other, to a higher level coordination in which the type and content of specific actions by actors in the network are adjusted to facilitate the achievement of common goals.

2.3.2 Theoretical development and understanding of the concept of coordination

Despite the distinction between coordination and governance, the theoretical development and changes in understanding of coordination are based on the evolution and theories of governance. These include the public administration theory, organizational theory and planning theory (Pedersen, Sehested, et al., 2011). The developments and changes in these conceptualizations also took place within the framework of governance development stages.

With due recognition that the concept of coordination has evolved concurrently with governance through the first stage (old-institutional stage), second stage (neo-institutional stage) and the third stage (relational stage), it is the current (third) stage that forms the framework for this study. In the relational stage of theory development, coordination is visualized as a non-centralized process with temporal orders and efforts, with each of the many actors seeking to direct a whole or some part of the network like structure of interaction (Pedersen, Sehested, et al., 2011). The form of coordination is characterized by interaction and relationships among actors and in all directions without any actor taking the central position of influence.

The three theories of coordination offer various perspectives on coordination at this relational stage of theory development (Klijn and Koppenjan, 2012). The public administration theory points to a new form of vertical coordination where public authorities do not act alone as absolute centre of coordination but rather work interactively with other actors in a network through communication and negotiated efforts and that public authorities majorly play the role of metagovernance. Metagovernance is the act of improving the interactions between actors by facilitating and mediating interactions and changing relationships, resources and rules (Klijn and Koppenjan,

2007). The organization theory on the other hand reflects coordination at this stage as being propelled through the story telling and story work process which occurs cross and intra-organizationally. Lastly, the planning theory conceptualizes coordination at this stage as both top-down and bottom up creative communicative dialogue in the constantly changing planning strategies, and is undertaken through strategic selection and facilitation.

2.3.3 Motivation for coordination: The theories

Coordination as a process in network governance is motivated by a number of factors. These factors can be explained from the inter-organizational coordination theories which are discussed in details by Alexander (1993). First, there is the exchange theory which is anchored on the fact that organizations are not absolutely independent but have to depend on others for more or less resources. It argues that relationships between organizations is inspired by the need to exchange resources. These can be in the form of voluntary exchanges, power dependencies or legal-political requirement for the exchanges (Alexander, 1993).

Secondly, inter-organizational coordination is also explained by contingency theory and organizational ecology, which postulates that organizations are characterized by commensalism and symbiotic relationships within their environment. This means that organizations are motivated to coordinate for mutual benefit or one can benefit from the other without necessarily affecting it negatively.

Finally, the transaction cost theory is the other theory explaining the motivation for coordination. This theory has its origin in the private sector and it explains that organizations cooperates (and sometimes integrate) horizontally and vertically and may have a centralized management as a way of minimizing the relative external and internal hierarchical transaction costs.

2.3.4 Multi-actor system and the multi-actor theory

A multi-actor system is a system characterized by a group of independent entities working in cooperation, and the relational dynamics, sign structures and objects within the wider organization. A multi-actor system can be explained by multi-actor theory which aims at explaining the cooperation of independent entities and the resulting forms of organizations (Gazendam, 2005).

Multi-actor theory identifies four components in a multi-actor system which are linked by the process of coordination. The first component is the autonomous actors. Autonomous actors are independent and intelligent entities that have the ability to perceive and act. This means that they are not just able to operate without external guidance, but also able to interpret, determine goals, reason and make decision. Actions of actors also form part of the multi-actor system. Networks bring together multiples actors, who even though intend to achieve a common goal, undertake different actions and employ diverse strategies. The multi-actor theory views these actions as the roles or responsibilities played by the autonomous actors. In water provision, there are actors involved in policy and legislation, water catchment management, water treatment, water infrastructure development and water delivery.

Thirdly, multi-actor system is also characterized by Interdependencies or motivations for coordination since interaction of actors only occurs when there are interdependencies between them. This is also known as the motivation for cooperation which are explained by the three theories previously discussed above which motivate coordination (Alexander, 1993).These interdependencies may be due to conflicting interests, limited resources and capacities among individual actors and/or diversity but complimenting specialized knowledge and capacities

(Gazendam, 2005). Finally, a shared goal or expected common outcome is another component of a multi-actor system. Coordination becomes only necessary when at least two actors works towards a common goal. The common goal is the shared objective which an autonomous actor cannot achieve by their effort alone but require actions of other players as well. Achieving water security through water provision is common goal of actors in this context.

There is an agreement among scholars that the outcome (which is also the shared goal) of a multi-actor system, is influenced by degree and nature of alignment and harmonization of actions of actors, a process which actually defines coordination (Raju and Becker, 2013).

2.3.5 Key elements or sub-activities in coordination

The multi-actor theory in explaining the key elements or sub-activities in coordination, borrows from the Fayolian theory of management which was formulated by Henry Fayol between 1916 and 1946. It identifies six main sub-activities involved in the process of coordination as follows:

i) Communicating which is the process of information and knowledge sharing among actors. Communication is a central activity in a multi-actor system because it is the enabling means with which all the other activities in coordination are undertaken.

ii) Organizing which involves designing tasks and laying out the chains of authority and responsibilities. It also include building the material and human structures of the network. This can be looked at as to whether or not the actors undertake it together and if not, who does it.

iii) Planning referring to laying out the actions to be undertaken, the timing and sequence of activities and the allocation of resources to facilitate the undertaking of actions. When reviewing the network, it is important to analyse the planning process as to whether there is common planning for actions or individual actors undertake their own planning.

iv) Commanding simply meaning ordering the operationalization of the plan. This includes negotiating where actors discuss the actions and make decision on the best way to perform them, and improvising where actors chose what activities to put into action as per the existing situation.

v) Executing which means implementation of actions by actors whether individually or jointly.

vi) Controlling implying the process of monitoring and making corrections to make sure everything is undertaken in line with established procedures, rules and command.

2.4 Contextualizing coordination in water and climate adaptation governance

2.4.1 Water governance

The increasing consciousness that water crisis is actually a reflection of crisis in governance manifested in institutional fragmentation, ambiguity in roles and responsibilities, poor financial management and low organizational capacity among others, led international organizations and policy makers to shift their focus on how governance can be applied in the water sector (Plummer and Slaymaker, 2007). As a result, the concept of water governance emerged.

Based on the definition of governance above, water governance thus includes all the social, political, and economic structures, formal as well as informal rules, and processes that influence

the development and management of water resources as well as the delivery of water services at different levels of society, and involves the government, private sector, civil societies and other actors (Sehring, 2009b, Tropp, 2007). It entails Water governance systems influencing the distribution of rights to water by determining water access procedure, quantity and time.

Just as the broader governance concept has evolved from the state to networks that include actors beyond the state, so has water governance. Due to complexities and challenges that surrounded the traditional water governance approaches, new ideas such as integrated water resource management (IWRM), river basin management, decentralization and privatization emerged. The new forms of water governance have moved from state centred to more inclusive and participatory approaches in decision making in the water sector and now incorporates the civil society and private corporate institutions (Tropp, 2007).

The quest for good water governance has been an international, national and local debate. Outcomes such as equitable, sustainable, democratic and efficient water governance has been identified as elements that define good water governance (Plummer and Slaymaker, 2007). Sehring (2009b) further states that achievement of these results require democratic and coherent coordination and regulation processes.

2.4.2 Climate change adaptation governance

As previously stated, the need for climate adaptation in the water sector is a necessity for most cities because of the potential and real risks posed by climate change. Dealing with climate change adaptation is not only a matter of complex technical interventions, but also requires effective governance.

Climate adaptation governance is a continuous process that needs timely decision making (Rijke, Farrelly, et al., 2013). This implies that actors continue to interact indefinitely while making decisions and implementing actions that are geared towards enhancing adaptation. As a result, the process occurs in an environment of several actors operating in multiple levels and networks, and in which the actors in different institutional settings play different roles in policy development and implementation. In such a setting, the importance of non-state actors and the private corporate actors is recognized as they participate in the formulation and implementation of policies and programs which ideally are meant to co-exist with mainstream government policy processes. Pahl-Wostl (2009) argues that by appreciating the multiplicity of actors, climate change governance should thus also be considered as incorporating coordination and steering processes to influence behaviours of formal and informal actors.

2.4.3 Institutional fragmentation, multiplicity of actors and the need for coordination in water and adaptation governance

Water governance the world over has for a long time been characterized by institutional fragmentation and multiplicity of actors. This is because water has many aspects such as water quality, water safety and water supply, responsibilities which are distributed among different organizations and sectors (Edelenbos and van Meerkerk, 2015). In addition, there are also private sector, non-profit and civil society players involved in different aspects and at different levels. Complicating the matter further is the fact that in some instances these actors have conflicting interests on different aspects of water.

Traditionally, water governance has been a centralized process with dominance of government actors (Pahl-Wostl, 2009). This kind of arrangement took a hierarchical approach to governance

in which decisions were made from national to local authority level. However, revolution in water governance has led to the recognition of the potential contribution of non-governmental entities like corporate organizations and community organization is water resources management and water delivery.

Multiple actors and institutional fragmentation complicate water governance process by fragmenting water provision and adaptation actions among actors, sectors and levels and undermine joint efforts for collective action and integrated performance (Lubell and Lippert, 2011). This is because of the difficulty in achieving cooperation, synchronization of responsibilities and integration in such an environment. Netherlands and Kenya are some of the examples of countries where multi-actor, multi-sector and multi-level context has been a problem due to bureaucracy, administrative burdens, fragmentation and conflicts over competencies and division of roles (Termeer, Dewulf, et al., 2011).

As a response to this kind of complexity, new water management approaches such as multi-sector approach have evolved (Tropp, 2007), with increased focus on network governance characterized by partnerships, a wide range of actors and more horizontal decision making (van Buuren, Klijn, et al., 2012). Under these kinds of arrangements, formal and informal networks emerge among different actors. Climate adaptation in the water sector is now characterized by multiple agencies, institutions and systems with complex patterns of linkages and interactions leading to coordination problems (Tropp, 2007).

Coordination plays a critical role in water and climate adaptation governance. Bakker and Cook (2011), state that three major issues that pose challenge to water managers and prove difficult to address are the competing water users and uses; non-coinciding geopolitical and administrative boundaries with hydrological boundaries; and vertical coordination across the multiple scales of water use and management. In Canada, failure in water governance is associated with the lack of politically legitimate and coordinated governance framework and the inability of the government to harmonize different stakeholder perspectives and resulting conflicts (Bakker and Cook, 2011). Similarly, Valdés-Pineda et al (2014) argues that water governance in Chile can only be improved by enhancing coordination among governance institutions, better policies and research.

These challenges can only be countered by adopting an effective coordination model and framework. Through coordinated actions, multi actor system can be viewed as a strength rather than a challenge. First, actors are able to perform tasks which otherwise are beyond the capacity of individual actor. Furthermore, economies of scales can be exploited where optimal utilization of capacities and resources with some tasks undertaken with minimal resources. Rijke et al (2013) argues that coordination of capacity building and actions of different actors at the local level is important in enhancing resource efficiency by creating synergies through sharing relevant knowledge. Implementation of development or adaptation strategies should involve the collaboration and coordination of various actors. The actions of each actor should also be able to contribute to existing government strategy and programs through linkages and synergy and avoid duplications and conflicts.

In water governance networks, trust among actors has been observed to enhance and consolidate coordination and interaction of different organizations (Edelenbos and van Meerkerk, 2015). This is because trust facilitates more interaction and exploration enabling actors to develop positive perceptions and attitudes which in turn increases their confidence in investing financial, knowledge and human resources in a collaborative efforts to address an existing situation. Trust is an aspect

that is nurtured under network structures in which actors are able to interact informally (Folke, Hahn, et al., 2005). However, Sehring (2009a) observed in the case of post-soviet water governance that administrative fragmentation and poor organizational structured undermine coordination. In addition, he also notes that overlapping competencies and responsibility gaps also resulted into coordination problems.

2.5 The influence of multi-actor coordination on urban household water access in informal settlement: The Conceptual Framework

From the review of literature, urban water governance in the face of climate change comes out as a multi-actor process that brings together the government, private sector, non-profit organizations and civil society. Each of these entities function autonomously while striving to undertake actions aimed towards enhancing water provision to ensure urban household water security including water access, water safety and water affordability. However, these actors collaborate with one another in various ways and at different levels in some kind of network. Because of the relational dynamics among these actors, certain degree of coordination processes exist among them.

In building this conceptual framework, a multi-actor theory is applied where urban water provision is visualized as a multi-actor system. The government players, from national to local government, as well as private actors, non-governmental organizations and civil societies are autonomous actors in the system. These actors are all working towards a common goal or outcome which is improved water access to urban households. Because it is agreed among scholars that coordination is vital element that influence governance outcomes, the framework argues that coordination in water governance network also has an influence on urban household water access. What is not clear is how coordination, or lack of it affects the shared outcomes, and this is the focus of the study.

Coordination is conceptualized as consisting of six elements according to multi-actor system theory namely; organizing, planning, commanding, executing, controlling, and communication/knowledge sharing. The study then applies the analytical perspective of governance to understand how each of these elements of coordination are undertaken and how they influence actions that impact on water access (one element of urban water security). This include a qualitative analysis and explanation of the causal link and influence.

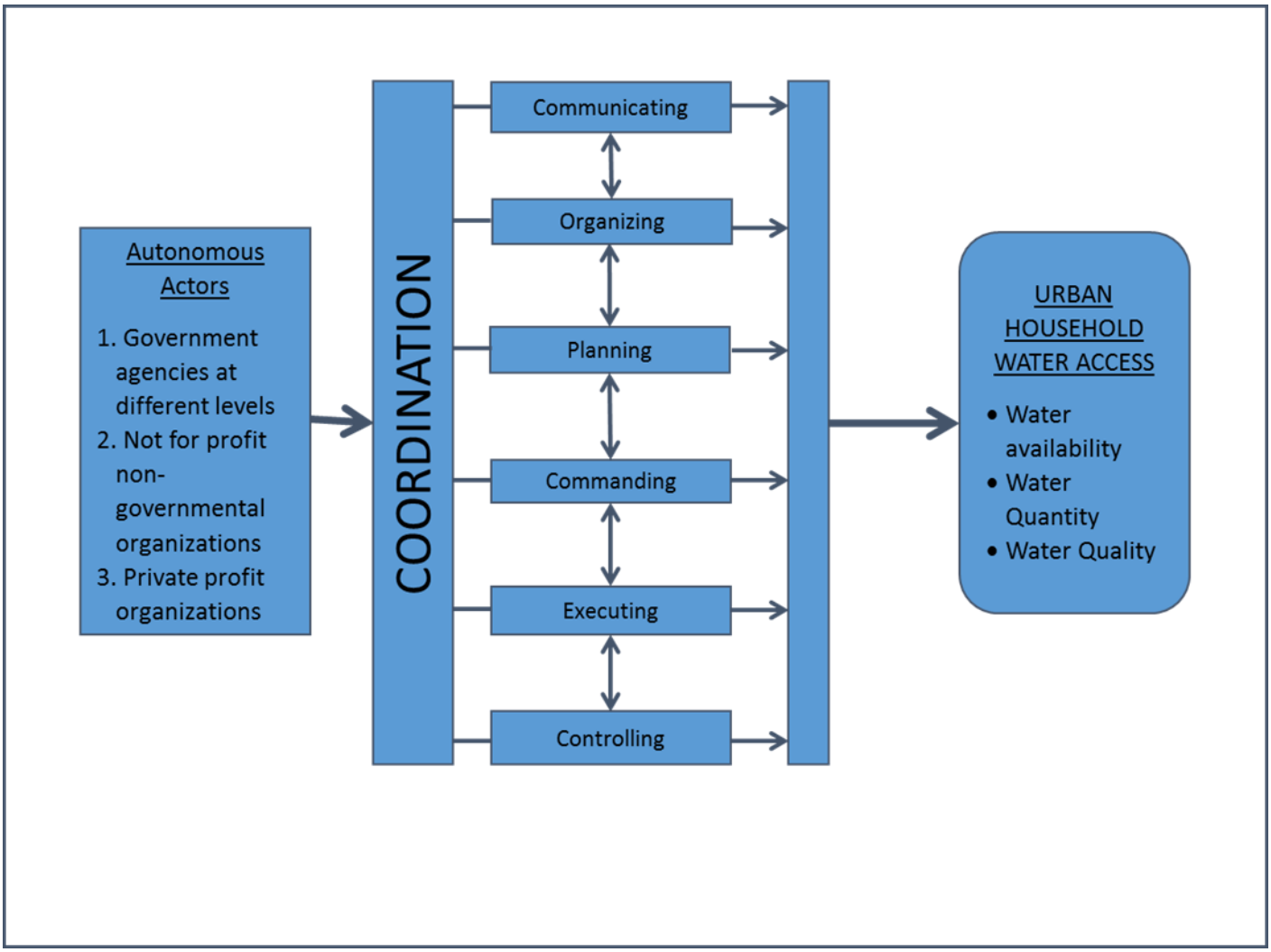

Figure 2: Conceptual Framework

Chapter 3: Research Design and Methods

This chapter explains the methodology of this research by highlighting the strategy and design of the research. Data collection methods and sample selection are also discussed in this chapter.

3.1 Revised Research Questions

3.1.1 Main Question

How does coordination of multiple actors involved in water provision influence urban household water access in Kawangware informal settlement in Nairobi city?

3.1.2 Sub-questions

I. What is the nature and level of multiple actors' coordination in the provision of water in Kawangware informal settlement?
II. What is the state of household water access in Kawangware informal settlement?
III. In which ways has the nature and level of coordination of multiple actors contributed to the state of household water access in Kawangware informal settlement of Nairobi?

3.2 Operationalization: Variables and Indicators

Various concepts have been adopted as part of the framework for this research as shown in the conceptual framework. All the terms have been defined in the literature review from different perspectives of various authors. In order to operationalize these concepts, the research borrows from these definitions and contextualizes them. Different variables and their respective indicators have also been developed based on the definitions. Table 1 below shows the independent and dependent variables and the definitions for key concepts adopted for this study.

Table 1: Operationalization; Variables and Indicators

Concept	Definition	Variables	Indicators	Data type	Source	Collection tool
Independent Variables						
Multiple Actors	Several independent organization or institution in water provision sector that have the ability to make and implement decisions. (Gazendam, 2005)	Independent institutions/ organizations	Number of organizations dealing with water provision	Quantitative	Local administrative authority	Interview
			Category of organization/institution (government, NGO, private corporate, CSO/CBO)	Qualitative	Actor organization Local administrative authority	Interview
			Role of the organization/institution in water provision	Qualitative	Actor organization Local administrative authority	Interview
Nature of coordination	The attributes of the instruments and mechanisms that aim to enhance the voluntary or forced alignment of tasks and efforts of organizations that are autonomous but working towards attainment of common goal.	**Attributes:**				
		Communicating	Frequency of information and knowledge sharing between actors	Quantitative	Actor organizations	Interview
			Type of information shared between actors	Qualitative	Actor organizations	Interview
			Method and effectiveness of information sharing	Qualitative	Actor organizations	Interview
		Organizing	Presence and effectiveness of standards, lines of authority and distribution of responsibilities among actors	Qualitative	Actor organizations	Interview

Concept	Definition	Variables	Indicators	Data type	Source	Collection tool
	(Pedersen, Sehested, et al., 2011, Rommel and Verhoest, 2014)	Planning	Joint participation of actors in developing common strategic plan and other plans	Qualitative	Actor organizations	Interview
			Presence and effectiveness of Mechanisms for actors consultation when developing water provision projects	Qualitative	Actor organizations	Interview
			Type and effectiveness of actor consultation	Qualitative	Actor organization	Interview
			Presence of synchronized schedule of activities undertaken by different actors	Qualitative	Actor organizations	Interview
		Commanding	Presence and effectiveness of central authority that gives order and direction	Qualitative	Actor organizations	Interview
		Executing	Presence and effectiveness of cooperation and coalitions during implementation	Qualitative	Actor organizations	Interview
		Controlling	Presence and effectiveness of authority that ensures conformity among actors, monitoring and giving feedback	Qualitative	Actor organizations	Interview
		Common goal	Presence of a shared strategic plan or objectives by actors	Qualitative	Actor organizations	Interview
Level of coordination	Level of coordination refers to the type of coordination, whether actors relations occur	Type of coordination	Presence horizontal interactions among NGOs, government and private sector or among government agencies of the same level (Horizontal coordination)	Qualitative	Actor organizations	Interview

Concept	Definition	Variables	Indicators	Data type	Source	Collection tool
	across actors of the same tier of authority (horizontal) or across difference actors with different levels of authority in the hierarchy or both relational dynamics can be identified (Leck and Simon, 2013c)		Presence of vertical interaction between local authority and higher level and lower levels of government agencies (vertical coordination)	Qualitative	Actor organizations	Interview
Independent Variables						
Household water access	Water access refers to availability of water in sufficient quantity and quality at all times. (UN Water, 2013, Cook and Bakker, 2012, Kayser, Moriarty, et al., 2013)	Availability of water	Average distance from household to nearest water point	Quantitative	Households	Questionnaires
			Time from household to nearest water point	Quantitative	Households	Questionnaires
			Number of hours of flow at the point (regularity)	Quantitative	Households	Questionnaires
			Surety of its availability (reliability)	Qualitative	Households	Questionnaires
			Water source/ technology/infrastructure type (“improved,” “unimproved,” community source, or on-plot water)	Qualitative	Households	Questionnaires
			Number of Water infrastructure in the neighbourhood	Quantitative	Local administrative authority	Interviews, Document review, Questionnaires,

Concept	Definition	Variables	Indicators	Data type	Source	Collection tool
					Actors in the water sector, Households	transect walk and observation
			The status (whether they are in good or bad condition, functional or non-functional) of Water provision infrastructure in the neighbourhood	Qualitative	Local administrative authority, Actors in the water sector, Households	Interviews document review questionnaires transect walk and observation
			Spatial distribution of the Water infrastructure in the neighbourhood	Qualitative	Local administrative authority, Actors in the water sector, Households	Interviews document review questionnaires transect walk and observation
			Number of water provision projects in the neighbourhood	Quantitative	Local administrative authority, Actors in the water sector, Households	Interviews Document review questionnaires transect walk and observation
			Spatial distribution of water projects in the neighbourhood	Qualitative	Local administrative authority, Actors in the water sector, Households	Interviews document review questionnaires transect walk and observation
			Concentration of similar water projects in one area	Qualitative	Local administrative authority,	Interviews document review questionnaires

Concept	Definition	Variables	Indicators	Data type	Source	Collection tool
					Actors in the water sector, Households	
		Quantity of water	Amount available per person per day	Quantitative	Households	Questionnaire
			Time taken to fill a 20 litres container	Quantitative	Households	Questionnaires
		Quality of water available	Effect of available water on human health	Qualitative	Households	Questionnaire
			Type of use of the water	qualitative	Households	Questionnaire

3.3 Research Strategy and Methodology

This research adopted a case study as a strategy with an explanatory design framework. As defined by Thomas (2011), a case study is an in-depth analyses of persons, events, decisions, periods, projects, policies, institutions, or other systems in a holistic way in order to understand or explain certain phenomena. In line with that definition, the aim of the study was to gain an in-depth insight on how coordination of multiple actors influence household water access in the context of; existing water scarcity in the informal settlement; efforts to address the scarcity; and the existing governance framework for water provision in the area. These attributes are part of the system and the variables being examined cannot be isolated from them. The object of the case study is the influence of coordination of multiple actors on urban household water access in informal settlements. The subject of the study, which provides the context and analytical frame of the study, is the informal settlement of Kawangware in Nairobi city. Single holistic case study approach was taken where focus of the inquiry was only on one subject and case-Kawangware informal settlement in the city, but which was studied in entirety. Furthermore, this was a typical case study of an illustrative nature since it describes a causal relationship between the relational dynamics among actors within the context of the city and the informal settlement (governance) and the outcomes of this which is the state of household water access.

The first step was to establish the state of household water access through a survey in the informal settlement which was to indicate whether or not the area is water secure using the water security benchmark of the United Nations University Institute for Water, Environment & Health (UN Water, 2013) and World Health Organization (WHO). A snapshot assessment of how the processes of coordination such as communication, organizing, planning, commanding, executing and controlling are being undertaken was conducted. This was done by extracting opinions, perceptions and knowledge from various actors involved in water provision, and households who are the beneficiaries of water provision. This information was then analysed, interpreted and used to explain its effect on the existing state of household water access.

Case study was selected as an appropriate strategy for this research because of a number of reasons. First, coordination as an independent variable is not an absolute single unit but constitutes of multiple sub-variables namely; communication, organizing, planning, commanding, executing and controlling. These are processes that cannot be isolated from their context because the context is relevant to the object of study and it is also not possible to manipulate the actions and behaviour of actors who undertake these processes. The experiences of actors have to be understood in the context of actions and governance framework of the area, and case study therefore becomes an appropriate strategy in such a situation (Baxter and Jack, 2008). According to Potter, Hellens et al (2010), case study is also relevant when the research focus is on ‘how’ which would basically result in an in-depth analysis, and such is the nature of the main question of this study. This research was intended to give a detailed, rich explanatory narrative on the relational dynamics among multiple actors and show how this has an influence on governance outcomes which is water access, and case study provides the open approach to this kind of inquiry (Thomas, 2011).

Although case study was the most appropriate strategy for this research, it comes with some practical challenges and limitations. Results from this case study may not be generalized to explain other similar cases. This undermines the external validity of the research because the results are strongly linked to the context. However, this may not be a big concern for this research since the main objective of a qualitative study like this one is to describe, understand

and explain the phenomenon and not to derive some general pattern that can be used to explain the same phenomenon in different cases. The second limitation of this strategy may be the difficulty to provide rigor due to the influence of the researcher on data collection and analysis and absence of statistical validation of data. In order to deal with this limitation, an in-depth description of case site and careful translation of interview extracts have been done when doing analysis and preparing the research report. A third challenge of this strategy is that it involves detailed qualitative analysis that resulted into large amount of data, some of which not only had the possibility of being lost, but also difficult to process. With a pre-emption of this problem, care was taken to ensure that all data was entered into a storage database as soon as it was captured and a back-up put in place. Fourthly, organizations and individuals are political and sometimes with personal goals and objectives. In this respect, the respondents from different actors may have attempted to influence the outcomes of the study through the information they provide. This challenge was managed by triangulation of information from different participants. Finally, this strategy required a lot of respondents' time and to adequately deal with this, advance appointments with the participants was made.

3.4 Data Collection Methods

3.4.1 Data type

Data collection method and technique is a critical part of a research process and this study recognizes this fact in the selection of the data type, sources sampling and collection instruments. The research was highly reliant on primary data which is an original first hand data extracted from the source and which has neither been processed nor interpreted (Hox and Boeije, 2005). The decision to use this kind of data is based on the fact that no data exists especially on the independent variables of this research. In addition the variables of the research are dynamic and it was important to gain an insight into the current state of the situation. Even though this study was based on primary data, secondary data which is defined by Westbrook (1994) as second hand data that has been changed from its raw form to a more refined form and stored in databases and records, was also used to a lesser extent, mainly for triangulation.

The primary data required was both qualitative and quantitative. Qualitative data is information that is descriptive in nature and cannot be numerically quantified. Information about the nature and level of coordination among actors, as independent research variable is qualitative. On the other hand the state of household water access has well defined indicators that can be analysed numerically and was therefore collected as quantitative data.

3.4.2 Participants and sources of data

Participants in this research were selected from the local actors undertaking water provision initiatives in Kawangware informal settlement and the households in the area. Primary sources of data or respondents were individuals working for government agencies, private sector and not for profit non-governmental organizations. Furthermore, households were the primary sources of data with regards to state of water access in the informal settlement. However, this was supplemented by field trip across the area to get a glimpse of the status of sources of water and hence triangulate information provided by households. For secondary data, reports and publication were requested from the actor organizations from which information was extracted through document reviews and notes taking.

3.4.3 Data collection Methods and instruments

Personal semi-structured interviews and household surveys were the main data collection methods for this research. Semi-structured interviews captured predetermined issues with possible prompts to guide the discussion but still offer an open end for the respondent to add more information (Petty, Thomson, et al., 2012). By use of interview guide as a data collection

instrument, this method was applied to obtain information on the nature and level of coordination from respondents in different organizations. The method was selected because there was already some known dimensions on the variables upon which the inquiry was based to guide the interviews, only that more information was needed specific to this particular context (Westbrook, 1994). Interview is generally a flexible method to get detailed insight into a situation and provides vital information on individual perspectives and experiences through direct discussions. At the same time, it offers an opportunity to probe, to clarify and make new questions following the interviewees' responses (Westbrook, 1994). Since the research was a case study strategy of explanatory nature that required an in-depth understanding and analysis of phenomenon, this method was the most adequate choice.

A survey of households in Kawangware informal settlements was employed to collect primary data on the state of household water access. This was aided by questionnaires which were a mix of closed-ended and open questions, as collection instrument. This method was chosen because most of the data of interest on household water access is quantitative in nature and thus could be captured best by questionnaires. Secondly, the survey was able to facilitate collection of standardized information from large number of respondents within the limits of time and resources of this research. Additionally, it was easier and faster to analyse the data collected through this method.

3.5 Sample Size Selection

3.5.1 Sample selection for semi-structured interviews

There are several actors from government, not for profit non-governmental and private profit organizations undertaking various water provision actions in Kawangware. This provides a relatively large population which cannot all be interviewed given the limited time that was available. In this respect only a sample was selected from the population for interview.

Although, the research plan was to select as many actors as possible up to saturation point with minimum of nine organizations as target, the difficulty in getting appointments and the limitation of time only enabled consideration of ten actors. Non-probability, purposive sampling technique was employed to identify actors to form the sample. This means that the actor organizations were not selected by chance to be part of the sample but rather selection was subjective based on certain characteristics (Hox and Boeije, 2005). This was important because the interest of the research was to engage organizations that are knowledgeable and experienced with the nature and level of coordination that exist among actors in the area. As such, active organizations with at least three years working experience in the area were considered for the sample. In addition, quota sampling was used where the sample size was distribute across the three categories of actors: three government actors; four not for profit non-government; and three profit private organizations. One respondent was interviewed from each organization.

3.5.2 Sample selection for questionnaires

3.5.2.1 Sample Size

The sample size for the questionnaire survey was calculated using Yamane formula (1967) (Kasiulevičius, Šapoka, et al., 2006);

$$n = \frac{N}{1+N(e)^2}.$$ (Lubell and Lippert, 2011)

Where **n** is the sample size, **N** is the population size, and **e** is the margin of error.
For this research, a standard confidence level of 95% was used. Although a recommended margin of error is always 5%, this research used a margin of error of 8% in consideration of

limited time and resources that could not allow larger sample size that guarantees a smaller margin of error.
Therefore, given that the population (number of households in Kawangware sub-location) is 8,744, the sample size was calculated as follows:

$$Sample\ size, n = \frac{8{,}744}{(1 + 8{,}744(0.08 \times 0.08))}$$
$$= 153.5$$
$$\triangleq 160$$

3.5.2.2 Sampling

The respondents for the questionnaire survey were selected through probability random sampling technique. Stratified random sampling technique was applied to identify the required 160 respondents where the number was equally selected across all the four villages to ensure that households from all the four villages are captured in the sample size. The equal selection was because the number of households across the four villages are generally the same (Coas-2,220, Kabiro-2,187, Stage 2-2,152, and Magedonia-2,185). Forty respondents were selected from each village. The 40 respondents from each of the villages were selected using simple random sampling technique where households had equal chance of being part of the sample (Kothari, 2011).

3.7 Limitations of the data collection methods, and data Validity and Reliability

All data collection methods come with their limitations which ultimately have an influence on data validity and reliability (Marshall and Rossman, 2010). The first limitation of the structured interview is that data collected are context specific which undermines external validity and generalization (Westbrook, 1994). However, results of this research is meant to explain the case within its context and hence external validity is not a concern. Another challenge that was projected was the researcher bias and subjectivity. This was addressed through member check and ensuring a clear, coherent and transparent lay out of methodology used to collect data (Meurer, Frederiksen, et al., 2007). Thirdly, respondents may also have given biased and false information and efforts were made to validate information through triangulation from different sources and complementing data collection instruments.

Challenges associated with questionnaire survey included low literacy level of respondents and low response rate (Kothari, 2011). To manage these, two research assistants were engaged for the study and they personally visited sampled households to administer the questionnaires, translating where necessary and finally collecting back the filled questionnaires. In addition, the questionnaires were tested and necessary adjustments made to ensure all required data was captured and validity and reliability concerns are addressed before actual data collection was started.

3.8 Data Analysis methods

For analysis of qualitative data obtained through interviews, Atlas ti application was used to facilitate different analysis techniques including content analysis, direct interpretation and explanation building. This included thematic analysis and explanation of data. Quantitative data from the questionnaire survey was analysed and interpreted with support of the Statistical Package for Social Sciences (SPSS) where various analysis were conducted such as frequencies, percentages, means, standard deviations as well as statistical tests including ANOVA.

Chapter 4: Research Findings

In this chapter, the results of the study are analysed and presented. The chapter give the processed data from the field and explains their implications for the research questions. In the end, a brief summary of the findings and discussion is presented and a general conclusion on the implication of the data in relation to the conceptual framework is provided.

4.1 Study Area

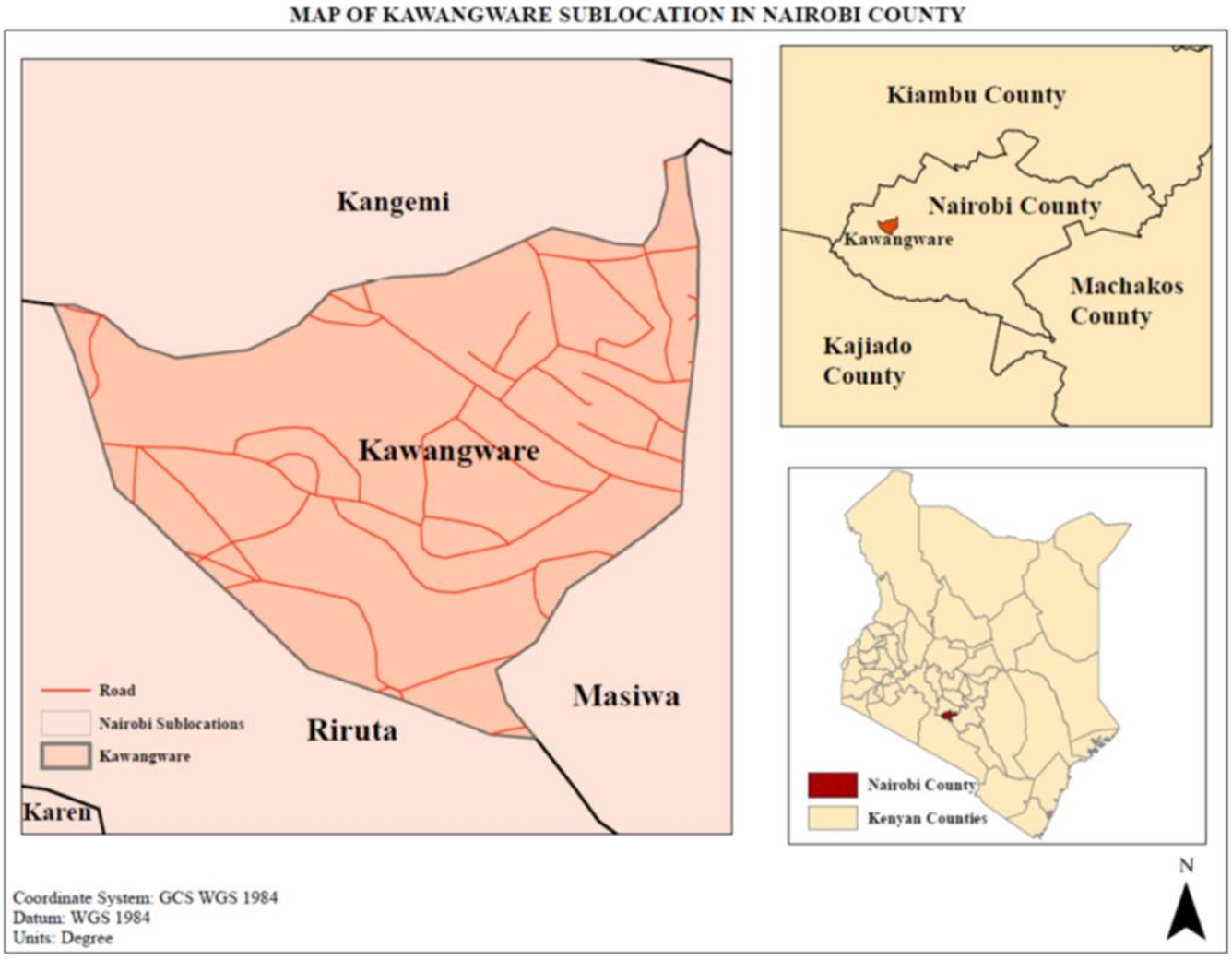

Figure 3: GIS Map of the study area

Kawangware sub-location is found in Kawangware location, Kawangware division and Dagoreti District in the western part of Nairobi County. It is part of the larger Kawangware informal settlement which is one of the fastest growing slums in Africa. The sub-location is located between Naivasha road, Kawangware road and Gitanga road and is made of four villages namely; Magedonia, Kabiro, Coast and Stage two.

According to Kenya National bureau of Statistics (2013), the population of the sub-location was 27,234 and with about 8,744 households (Coas-2,220, Kabiro-2,187, Stage 2-2,152, and Magedonia-2,185) by 2013. This population is characterized by poverty level of 46% (KNBS and SID, 2013), and high unemployment rate. Majority who engage in economic activities are self-employed as small scale business persons dealing with small kiosks, retail shops ad

wholesales, hawking and vending in the streets and are mostly men. Others are however, employed as casual labourers while few are salaried employees in different organizations.

Most of the land in Kawangware is privately owned by individuals who possess titles but do not themselves live in the area. The absentee landlords have built several rows of rooms, either concrete or iron-sheet walled, which are rented by the residents (Martin and Mathema, 2010). The area lacks in basic infrastructure, services and quality housing. Water supply and sanitation are major challenges in the area and this is aggravate by the impact of climate change which has resulted into water scarcity for Nairobi city in general (Crow and Odaba, 2010).

Water scarcity in the area has been partly because of lack of adequate water infrastructure and partly due to reducing water flow to the main city's water reservoir in Ndakaini. In order to address the water challenge in the informal settlement, different actors from government, private sector and non-profit non- government organizations have been undertaking various water projects in the area.

4.2 Sample Characteristics

Data collection method for this study were mainly interviews and questionnaires.

4.2.1 Interview sample characteristics

Sample size for the interview method consisted of ten water actor organizations working in Kawangware sub-location. These were three government organizations, four Non-governmental organizations and three private sector players. All these organization had at least three years active involvement and working experience in the area and had current running projects on the ground. From each organization, one respondent was selected. The selected respondents in the organizations were relevant people for the research based on their positions and responsibility in the organization. Nine of them had worked for their respective organizations for over two years. The details are showed in table 3.

Table 2: Interview Sample characteristics

Actor	Category	Year started operation in the area	Number of respondents	Respondent's Gender	Respondent's Position	Respondent 's duration in the position
A	Government	1963	1	Male	Kawangware ward administrator	2 years
B	Government	2003	1	Male	Informal Settlement coordinator	5 years
C	Government	2004	1	Male	Groundwater officer	3 years
D	NGO	2000	1	Male	Program Officer	5 years
E	NGO	2002	1	Male	Programs manager	3 months
F	NGO	2008	1	Male	Executive Director	5 years
G	NGO	2010	1	Male	Program coordinator	4 years
H	Private	2000	1	Female	Proprietor	15 years
I	Private	2010	1	Female	Salesperson	2 years
J	Private	2012	1	Male	Proprietor	5 years
Total			10			

4.2.2 Questionnaires sample characteristic

Questionnaires were distributed to 160 households with 40 questionnaires administered in each of the four villages namely Coast, Kabiro, Stage 2 and Magedonia, and in each household one respondent was considered.

Of all the respondents captured in the survey, 80% of them were female while 20% were males. This is due to the fact that in this society, more men go out to work, own shops or engage in other income generating activities away from the house than women who are left in the house to take care of household chores. Consequently it is mostly the women who were found in the house when the questionnaires were administered. This was an advantage to the study since the women in this society are more familiar with household water issues than their male counterparts based on gender roles in the context.

The larger proportion of the sample (94%) was also made of adults (18 years and above) who can be considered to understand the household's water situation and this added to the credibility of the information they provided. In the same light, the duration of stay of respondent in the sub-location was important because it shows the level of understanding of the area especially with respect to household water access.

The longer one has stayed in an area, the more familiar they can be considered to be with the water access situation. About 86% of respondents had lived in Kawangware for over one year and hence can be considered to have a good understanding of the area's water situation, 12% had lived for between three months and one year and have a fairly good understanding. Only 2% had lived in the area for less than three months hence may not be quite familiar with the status of household water access but again the proportion is too small to affect the findings.

In terms of house ownership among respondents, the results showed that almost 87% the respondents' households live in rented houses which are mostly iron sheet-walled structures. Only about 13% own the houses they live in.

Table 3 shows the data on various characteristics of the sample.

Table 3: Participants background Information (N=160)

		N	%
Gender	Male	32	20
	Female	128	80
	Total	160	100
Age	Less than 18 years	8	5
	18 year and above	150	93.7
	Missing	2	1.3
	Total	160	100
Duration lived in Kawangware	Less than 3 months	3	1.9
	3 months- 1 year	19	11.8
	Over 1 year	138	86.3
	Total	160	100
House ownership	Live in own house	20	12.5
	Live in Rented house	139	86.9
	Live in someone's house but do not pay rent	1	0.6
	Total	160	100

4.3 The Nature and level of Coordination of multiple actors involved in household water provision in Kawangware Sub-location

4.3.1 Actors involved in water provision actions in Kawangware Sub-location

From the interviews and secondary data, Kawangware Sub-location is characterized by multiple but independent actors working either directly or indirectly towards improving household water access. These organizations can be categorized into government, not for profit none government organization (NGOs), community based organizations (CBOs), private entities, multilateral and bilateral donor agencies.

On the government side, there are several institutions that are involved in water governance and each has special but different responsibility and mandate which are stipulated by legal and policy frameworks. Nairobi city county government is mandated to provide various services to the city residents including water and sanitation services. Besides, Water Services Boards (WSB) and Water Resources Management Authority (WRMA), under the national government's Ministry of Environment, Water and Natural resources, also play key roles in water provision. Athi Water Services Board which is one of the eight water service boards in Kenya is the body charged with the responsibility to develop, own and manage all water and sewerage assets/infrastructure within the city, and appointment of a viable water service provider. Water resources Management Authority is the national body that is tasked with the mandate to conserve and manage all the surface and ground water resources in the country.

In order to undertake its water and sanitation service provision responsibility, the Nairobi city county government has a subsidiary company known as Nairobi Water and Sewerage Company (NWSC). Although the Nairobi Water and Sewerage Company is the entity ultimately with the direct mandate to provide piped water and sewerage services, all the water resources are managed by the Water Resource Management Authority (WRMA) while all the water and sewer infrastructure is owned by Athi Water Services Board. Consequently, Nairobi Water and Sewerage Company has to pay to abstract water from the resources managed by Water Resources management Authority, and also be licensed by Athi Water Services Board to use its infrastructure in water service provision.

Because the government agencies cannot solely and effectively meet the water needs of the city residents including Kawangware informal settlement, not for profit non-governmental organizations for example Pamoja Trust and Maji Na Ufanisi, Community based organizations, faith based organizations and private entities have come in to supplement the water service provision efforts in Kawangware sub-location.

The interviews with respondents revealed that the NGOs and CBOs play a major role in advocacy for water rights and policies, research, development of water provision models and best practices, as well as funding of piped water connections and boreholes drilling. The main private players in water provision in Kawangware are water vendors who have water kiosks supplied by boreholes or piped water connections; water tanker trucks; and people pushing jerry cans in hand carts. Private entities require a business license from Nairobi city government in order to operate any water business. For private entities whose water supply are boreholes, they have to get approvals from water resources management authority not only to drill the borehole but also to verify that the water quality is suitable for human consumption before they can get a business license from Nairobi city county government.

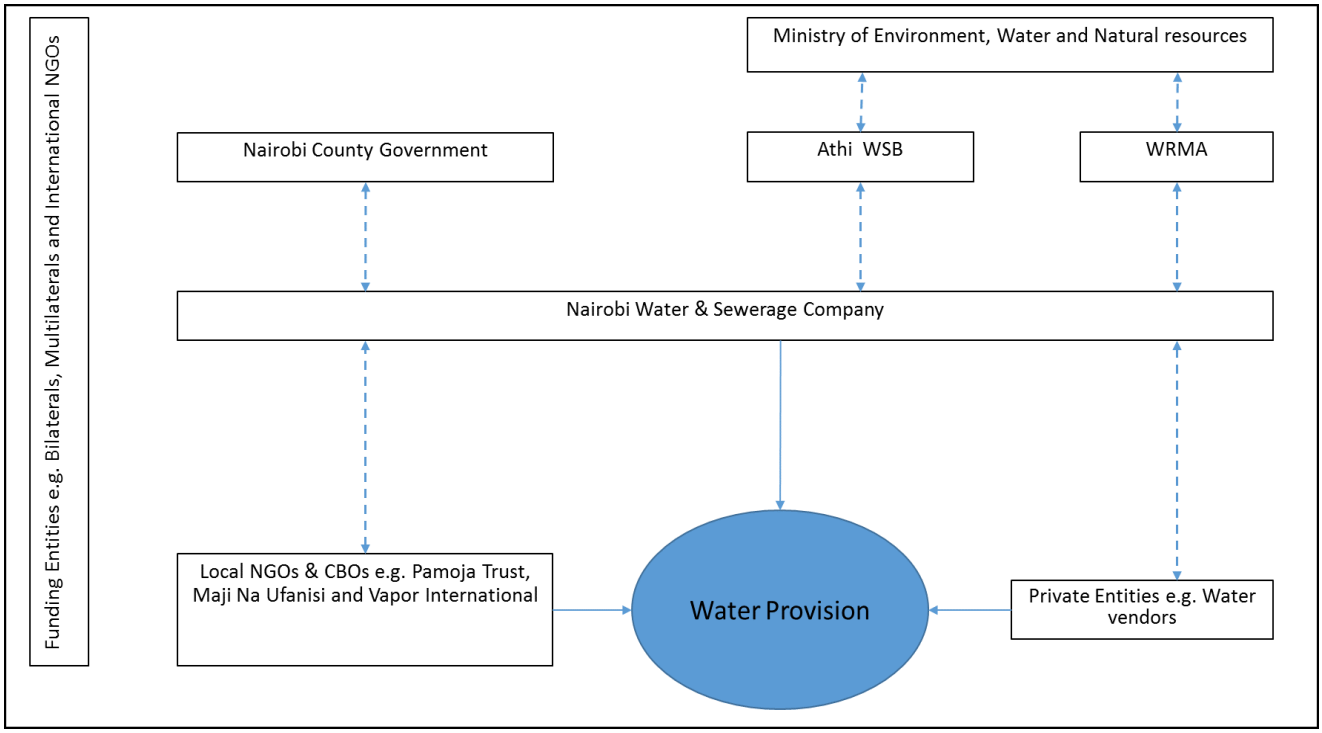

Figure 4: Interrelations of Multiple actors in water provision in Kawangware

The count of the number of interviewed respondents who said they are aware of the existence of other water actors in the area showed that all of them are aware of at least two other actors involved in water provision actions whether directly or indirectly and of which they were able to mention by name. However, only half of them were aware of the roles that those other organization undertake in water provision and could clearly explain. This demonstrates that even though the actors are aware of the presence of multiple actors in the system, the contact and interaction among them is limited if any. One interesting point was that a respondent from the county government institution and a key staff in Kawangware was not aware of the existence of any NGO working on water issues in the area.

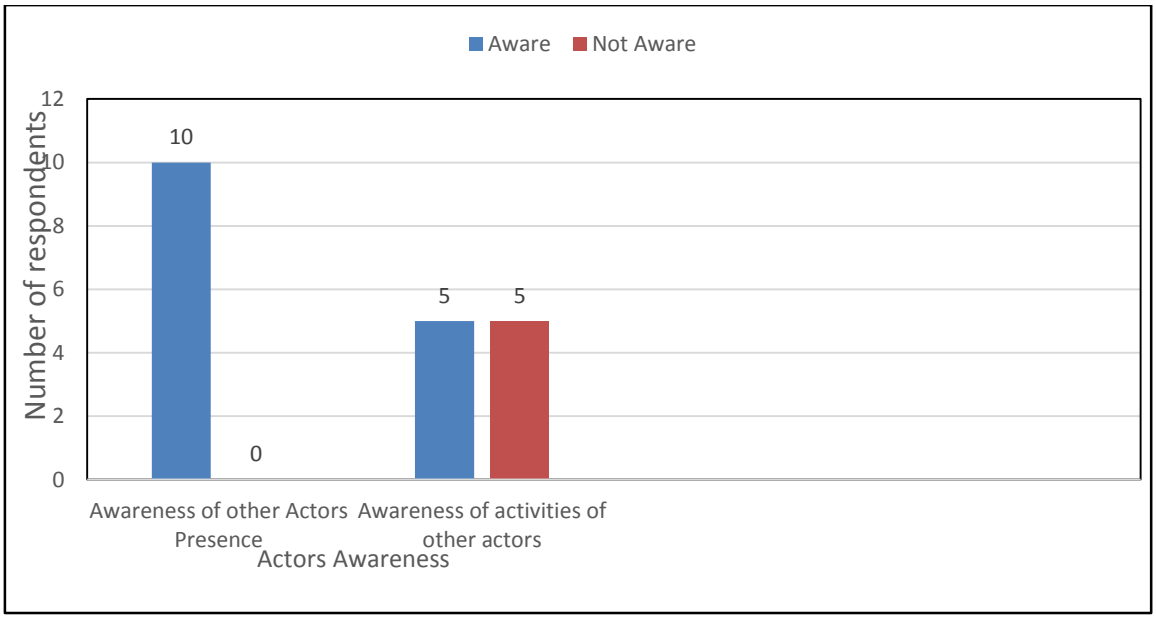

Chart 1: Respondents awareness of other actors

There was also an interesting observation by the respondents that most of the actors are concentrating water provision initiatives in two villages, namely Coast and Magedonia in Kawangware Sub-location than in Kabiro and Stage 2 areas.

4.3.2 Nature and level of various elements of coordination among the actors

4.3.2.1 Communication

Communication, as a key sub-activity in coordination, was pointed out by majority of respondents to be present among actors. When asked if they communicate with the other water actors they are aware of in Kawangware, eight out of the ten respondents' replies were positive suggesting some form of communication. This withstanding, the communication among the government actors was reflected as limited to necessity of law where the organizations are compelled to engage as a matter of legal requirement, and not due to the free will and appreciation of the need to share information with respect to programs and activities. The main modes of communication are emails, letters, memos, phone calls and face to face visits to the offices of the institutions. The kind of communication that happens revolves around follow ups on obligations of one institution to another. For example, the Water Resources Management Authority sometimes has to write a letter or email to Nairobi Water Company demanding for payment of water withdrawal fees owed to the authority. This implies that the communication is occasional and based on necessity. One respondent among the government actors observed:

> *"…there isn't some of these avenues and platforms where we can share ideas or communicate. The last time I met people from those organization is long time ago. I can't even remember the date. Because when there is a need for them to contact us that's when they contact us. When there is a need for us to contact them there is always the issues of long protocols…"*

Among the NGO actors, three out of the four interviews with them revealed not only the presence of, but also a more frequent and detailed communication among them especially those within a partnership, coalitions or members of same network organizations. These organizations constantly communicate through letters, emails, phone calls, personal office visits, meetings, forums and workshops. The contents of these communications include knowledge sharing, partnership development and updates on project progress. However other organizations that are not part of networks and partnerships seem not to be in frequent communication with the others. This kind of scenario is revealed in an interview with one NGO actor respondent:

> *"But with the other actors that we clearly engage with on specific projects, we do engage periodically, say quarterly. We have a coalition of water actors so we have may be quarterly meetings where we are supposed to meet and see what is to be done…."*

Interview with private sector respondents who were mainly water vendors with water kiosks or tanker trucks reveal a relatively limited or lack of communication among themselves. Most of them view one another as business competitors with nothing else to engage on. When asked if she communicates with other water vendors, one respondent commented:

> *"About what? No I don't. This is my private business and there is nothing I have to discuss with anyone. As long as I have my license from the County government and I pay my bills to Nairobi water, I have no business with them…"*

Of the three water vendors interviewed, only one reported that they communicate with another water vendor. However, this only happens when the vendor's tap is dry and she needs to check if the other vendor's water is flowing so that she can direct residents seeking water to the place. As such, the content of communication is less detailed.

Holistically, the interviews showed that there is constantly a network of information flow within the system both between government agencies and NGOs, government and private sector, and NGOs and private sector. These communications are both horizontal and vertical. Communication between the government mandated water service provider, Nairobi Water and Sewerage Company and NGOs comes out strongly in the interviews as more frequent and detailed. The interview analysis reveal that three of the four NGOs interviewed are in frequent communication with the company. This is because the company is a focal entity in the water sector in Kawangware and cannot be wished a way while undertaking water provision projects in the area. A respondent from the NGO sector said:

> *"We are in constant communication. With the water company you can say we are almost weekly because there are projects we are running with them. But with the other actors that we do not clearly engage on specific projects, we do engage periodically, say quarterly…..But with relevant authorities like the Water Company its weekly because there are issues that we need to follow up."*

The NGOs and government agencies share information mainly about their planned and ongoing projects, policy issues and new water provision models like in the case of Pamoja Trust and Nairobi Water Company. However, it was also noted from the interviews that the Nairobi County government has very minimal direct contact with the NGOs in the water sector in Kawangware. For instance, a respondent from the county government was not even aware of the existence of NGOs in the area working on water service provision.

Communication between water NGOs and private sector does not come out in any of the interviews conducted. However, for the government entities communication is limited to the fulfilment of legal obligations such as when seeking for water vending business permit, license to drill a borehole, approval for borehole water quality and water bills payment.

During the interviews, respondents who said they communicate with other organizations were also asked about their opinions on the effectiveness of communication that occurs between them and other actors. The general opinion was that the communication is not effective and most often characterized by significant number of challenges. The ineffectiveness of communication was described in form of lengthy bureaucratic processes, untimeliness and sometimes none responsiveness. Most of the respondents expressed dissatisfaction with the length of the structures information has to pass through before it gets to the rightful person. For instance, a respondent observed:

> *"..When there is a need for us to contact them there is always the issues of long protocols…you must do a letter that goes to the Chief Executive Officer then it goes to the guy you want to communicate to in that particular office. So in light of communication it is more or less poor."*

In addition, the respondents from the NGO actors pointed out that communication was much better among themselves than between them and the government. Communications with the government was depicted as having inherent inefficiencies, long channels, and sometimes none responses. A respondent from NGO actors said:

> *"Government operations and NGO operation are so different, there might be communications that are very quick but for some steps to be taken, it has to go through some bureaucratic processes and this takes time, especially in the government sector, for you to get even the response of what you want…"*

On the other hand, the government actors also expressed concern over the level of privacy and lack of trust from the NGO side, and which are barriers to effective and transparent communication between them. An example can be seen by the observation of a government respondent who noted:

"When it started it was very effective but somehow because of what we are asking the NGOs to give us…what they plan to do in terms of water and sanitation in informal settlements but now it is like some of them were feeling like…No….that that is too much information that we are giving to the company. You see these NGOs are funded by donors so there are those who are feeling we don't need to give so much information."

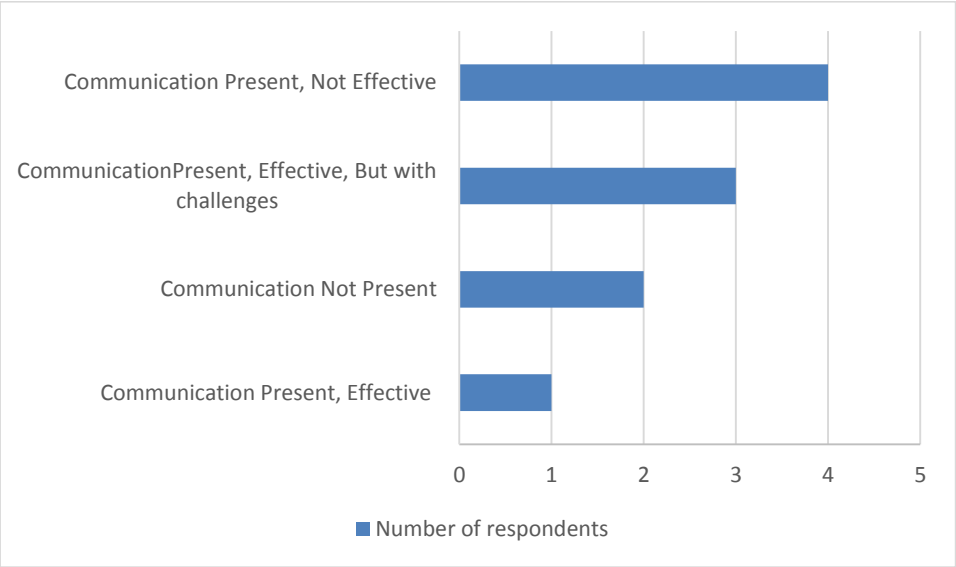

Chart 2: Frequency of respondents on aspects of communication

4.3.2.2 Organizing

Working relationship among the water actors in Kawangware is varied and depends on the organization and the role it plays in the water service provision. There seems to be a close working relationship among those actors who directly engage in actual water delivery action in communities, and among those who are in common networks or coalitions. The NGOs tend to work closely together than the government and private sector actors.

In terms of responsibility distribution among the different actors, secondary data review and interview with respondents indicates that government actors have clear and distinct roles in the water sector and water provision in general which are laid down in policies and legal frameworks. For example, while Water Resources Management Authority is responsible for the conservation and management of all ground and surface water resources, the role of water service provision is the mandate of Nairobi Water and Sewerage Company. Every actor thus has well organized role and each one sticks to their mandate. On the NGO side however, there are no laid down procedure, policies or standards that define the responsibilities of an independent NGO in the area. Consequently, most of them seem to be undertaking duplicative or closely related projects in the same locality. All the private actors on the other hand are all involved in direct water service provision to communities hence undertake similar businesses.

Working relationships among actors is majorly on temporary partnerships and coalitions which last for a duration of a water related project that the parties are jointly implementing. These relationships are usually anchored on memorandum of understanding (MOUs) and agreements which lay down the terms and procedures including the roles and responsibility allocation among the actors. These agreements however comes to an end at the end of the project. For example one interview indicated this:

"…I would say it is like a market place. If you have interest in a certain area and you find another organization be it NGO, CBO, a network organization or bilateral and they have

similar interest, then you can develop memorandum of understanding for that specific engagement..."

The respondents who are parties to various MOUs acknowledged that it is highly effective and helpful document that ensures smooth working relationship by minimizing potential conflicts. It is also important to note that there is no permanent working relationships among all the actors in the system.

4.3.2.3 Planning

All the actors that deal with water service provision in Kawangware are autonomous entities. All the respondents interviewed except the private entities, had their own organizational strategic plans as well as water related plan for Kawangware. The actors consider their strategic plans as organizational and do not incorporate any external participation in the development. Even though it is internally developed, some respondents indicated that after development, the strategic plans are shared with partners and relevant government bodies. However, most of them do not share the strategic plans with other actors at all.

When it comes to organizational water development plans, the interviews showed that there is a relative openness, and participation of other actors is higher. Two of the three government respondents and three of the four NGO respondents said that they invite other actors to participate in the development of the plans and that other actors invite them too. However, it also emerged that participation is only limited to actors considered friendly and mostly who are within a common network or coalition. The NGO respondents explained they are a bit liberal on sharing of their plans with other actors even if they never participate in the development. However, government actors are in the contrary opinion and indicates that the NGOs are secretive with their plans. For example one government respondent observed:

"…what we are asking the NGOs to give us…what they plan to do in terms of water and sanitation in informal settlements but now it is like some of them were feeling like…No….that that is too much information that we are giving to the company. You see these NGOs are funded by donors so there are those who are feeling we don't need to give these information."

A much higher level of joint planning is noted when it comes to planning of actual water projects where more stakeholders are engaged in the design of projects. The NGOs seemed to be involving all the other actors in project planning. However, the NGOs also raised concern over other NGOs who prefer to work independently and do not care about the existence of what other entities are doing or the projects being undertaken. This is captured in a respondent's statement:

"But another challenge is that there are some organizations that would want to do their things differently, they don't care if Nairobi water exists. Theirs is just to be independent and brand it as their thing…"

The private sector again comes out to be working in isolation with no engagement among themselves or with the government beyond legal obligation.

Table 4: Summary of the nature of engagement among actors in planning water projects

	Engage:		
When planning a water project:	Government	NGOs	Private Sector
Government	✓	✓	X
NGOs	✓✓✓	✓✓✓✓	✓
Private sector	X	X	X

Key:

✓-Number of respondents that engage others in project planning

X -No engagement at all with other actors when planning

There are various mechanisms for joint planning and sharing of the developed plans as revealed by the interviews. All the actors that engage others in planning mentioned workshops, conferences and meetings as platforms upon which they meet with other actors to discuss their plans and projects. Most of these mechanisms are mainly organized by the NGOs. There even exist certain NGO networks working in the water sector which provide platforms for engagement for example the Kenya Water Civil Society Network (KIWASNET). The KIWASNET is a coalition of NGOs that work in the water sector in the country and provides a forum in which the organizations meet and share plans and programs.

There have also been efforts from one government actor to establish a coordination platform with the NGOs which was named the NGOs Coordination Forum:

> *"…we had a NGOs Coordination forum where by we were calling all other NGOs and all other water actors and we meet in this forum so that we can be able to know what these institutions are planning in terms of water and sanitation in informal settlements."*

Despite its formation, the forum has not been effective due to a number of challenges including low number of NGOs who joined it and loss of interest by the members, some of who no longer turn up for the meetings or provide the required information. It is also interesting that the NGO actors interviewed were not aware of the existence of such a forum.

A similar initiative had also been started by private water vendors in Kawangware but was not successful. One respondent from the private sector alluded to it:

> *"Yes, we water sellers know each other…..there was even a time we tried to form an association but it did not work out……sometime last year, there was no water in this area and other sellers were selling water so expensively that residents started to complain. One of the water sellers called a meeting and we discussed the matter and agreed on a common price for water per Jerry can. However, this did not work. After a few days, everyone was selling at their own price again. That is the way it is now."*

Other than engagement in planning and development of water projects, aspect of constant consultation across the network was evident. The interviews showed that the government actors are mainly consulted by all the other actors on specific matters which they have expertise in such as legal and policies issues; water resource maps; populations data; and master plans. These kind of consultations happens between government actors themselves and between government and NGOs and private sector. For example one government actor indicated:

"Generally its Nairobi water, NEMA, we have National Water we work to great extent. We have Athi Water Services Board. Athi Water also just comes to us to maybe get data like how many boreholes are in an area and if they have a need to increase those services."

There was however limited evidence of the government actors consultation with the NGOs and private sector, except in one instance where Nairobi Water Company was indulging Pamoja Trust on the pre-paid meter technology for household water supplies.

4.3.2.4 Commanding

Within the network of water actors in Kawangware, the interviews revealed that each entity operates independently in its functions and there is no one central authority that orders and directs actions of all the actors. Each actor has its own leadership and management structure that is in charge of its decisions and operations and are not necessarily influenced by other actors. However, only when in a partnership, the MOUs outlines the structures that also lays down the authority to be charged with directing the operations of the coalition, but only over specified project and timeline.

Although in the government side the actors seem to be all under the larger umbrella of the Ministry of Environment, Water and Natural resources, there is an evident autonomy in individual entity's operations with minimal influence of the Ministry. The actors make their own decisions with regards to planning, projects development and executions. The ministry only plays a role of policy formulation but not operational direction.

4.3.2.5 Execution

During the interviews, respondents were asked to describe their project execution process and whether they form partnerships and coalition to execute them. The responses showed that no government actor considered for the study had any form of partnerships for their project implementations. All their projects are executed by the individual organization through its own staff. The NGOs on the other hand seem to take initiatives to seek for partnerships and coalitions not only among themselves but also with the government. A respondent from NGO actors observed as follows:

"We have different engagements. As I had earlier mentioned that all these works that we are doing within the informal settlements we do in terms of partnerships and collaborations because we discovered that as an individual entity we cannot supply or provide water in all the areas of Nairobi. But when we join our hands and collaborate we are able to. So we work in partnership with the Water Company and others…"

Nevertheless, not all NGOs execute projects in partnership with others and those who partner with others do not necessarily do so for all their projects.

While commenting on the effectiveness of the partnerships and coalitions, the respondents pointed out that some actors consider them (partnerships and coalitions) as inconveniencing and time wasting. The fear of being overshadowed by partners and losing recognition and identity was also raised as reasons for partnership avoidance. As a result they prefer independent execution. The private sector in Kawangware did not indicate the existence of any partnerships.

4.3.2.6 Controlling

Analysis of the interview and secondary data did not reveal the existence of any form of central authority that ensures all water actors undertake their mandates and missions effectively. There was also no such entity that undertakes holistic monitoring of actor activities in the water sector and relaying feedback on progress. But that withstanding, the actors have their own internal means of ensuring conformity of actions, monitoring and giving feedback. The interviews

showed that the pitfall of this arrangement is that it only captures the actions of the individual entity and feedback sometimes is manipulated to meet the interest of the actor.

4.3.3 Levels of coordination

Understanding the levels of coordination of water provision actors in Kawangware involved review of secondary documents and interview of the various respondents. From these, it was noted that water governance in Kawangware is characterized by multilevel governance arrangement with inherent features of vertical and horizontal coordination as defined in the literature by Leck and Simon (2013b).

Interactions between the actors at the national level and those of the local levels were identified. For example, Water Resources Management Authority and Water Services Board are national body entities that show interactions inform of consultations and partnerships with the city county government, Nairobi Water and Sewerage Company and NGOs, which are local level actors. Even among the national level agencies themselves they operate in hierarchical manner for example, the Water Resources management authority has a lower level agencies known as Athi Water Resources management authority which also further has a lower level body known as Nairobi region water management authority. The county government also has such a structure from the top county office, through the sub-county to the ward level. The respondents however indicated the ineffectiveness of these forms of coordination citing long protocols in the hierarchies which delay service delivery.

Forms of horizontal coordination is in the working relationships between the Nairobi city county government, Nairobi Water and sewerage, and the local NGOs that are reflected in partnerships and coalitions.

4.3.4 Conclusion on the nature and level of coordination among the actors

To conclude on the findings on this research sub-question, the general picture is that coordination among the actors that work towards improving water access in Kawangware is weak and of low level and more limited to legal obligation than appreciation of the value of inter-organizational coordination. Coordination is relatively higher among NGOs than among government agencies and weakest among private actors. This gives an overall impression of poor and ineffective coordination.

4.4 State of household water access in Kawangware informal settlement

4.4.1 Holistic view of state of water access for the Sub-location

This holistic view gives the general findings for the entire Kawangware sub-location without putting particular case by case focus per village.

4.4.1.1 Availability of water

4.4.1.1.1 Source of domestic water

There are five kinds of water sources on which the respondents' households depend on for domestic water. These are piped water connections in their houses; piped water or boreholes in their plots; water vendors which include water kiosks, water carriers and carts, tankers trucks and households reselling water from their utility connections; public piped water away from the plot; and public developed borehole away from their plot. Of all these water sources, only piped water in the house and piped water or borehole in the plot can be classified as within the vicinity of a specific household.

Piped water in the area is mainly provided by the mandated water service provider called Nairobi Water and Sewerage Company (NCWSC). Water vendors with water kiosks either

have boreholes or connection to the water service provider's pipelines. For example, one vendor said:

> *"This water is supplied by Nairobi water company….I did the necessary payments and bought the required materials and they did the connections. I pay the water bills every month."*

The respondents were asked where they get their domestic water which was described as water for drinking, cooking and washing in the household. About 60% of them stated that they get their domestic water from water vendors. Only about 8% of respondents have piped water connections in their households while 20% have the nearest water source within the plot they live in but not in their actual houses. Essentially this means that 72% of respondents do not have water within their vicinity hence not meeting the World Health Organization's recommended standards.

The bar graph below shows the various water sources and the respective percentage of respondents that depend on them.

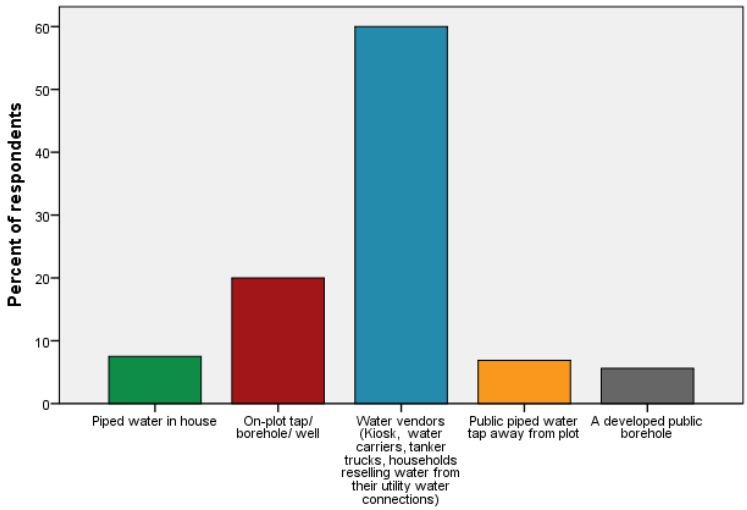

Chart 3: Water sources and respective percentage of respondent that use them in Kawangware

Photograph 1: (A) Water vendor's cart (B) Water vendor's tanker truck

4.4.1.1.2 Distance to water source and Collection time

All the respondents have the nearest water source within the 1,000metres with 8% of them covering no distance to collect water. In addition, the water collection time for all the respondents is not more than 30 minutes. It therefore implies that in terms of distance covered and collection time, all the responds are within the WHO recommend time and distance for a household to be considered water secure.

Photograph 2: Residents walking to a water collection point

4.4.1.1.3 Regularity of water availability

Appropriate water access means that water should not only be available in sufficient quantities and acceptable quality, but also available at all times. However in Kawangware, water availability in terms of regularity comes out as a challenge to many respondents. Over 72% of respondents said there is never water at their nearest sources throughout the week as shown by the pie chart 4 below. Majority (43%) of those who do not get water regularly from the nearest sources only gets it twice a week while still a significant number of 18% gets water only once in a week.

Chart 4: Water availability in Kawangware

The irregularity of water supply is mainly experienced by those respondents who have access to piped water supplied by the water service provider. This is a situation that affects most of the households especially those who do not have water storage containers to store enough water for use during the days of the week when the water is not supplied. An interview with the water service provider revealed that the irregularity of water supply in the area is due to rationing which is done because of reducing water levels at the city's main water reservoir in Ndakaini:

> *"...But when we talk about quantity, we don't have sufficient water supply because it is rationed. It is only supplied on Thursdays and Tuesdays. They are supplied with water twice a week....."*

Most of the respondents who said they receive their water every day of the week rely on borehole supplied sources of water. Such include water kiosks and plots with boreholes. However, some water vending kiosks that depend on piped water have large water storage tanks that are able to supply households with water even during the days when there is no piped water flow.

Photograph 3: Water vendor's storage tanks

4.4.1.1.4 Availability of alternative sources

In an area where piped water does not flow every day, availability of several different types of water sources is critical because it gives households alternatives when their nearest source is dry. The sample shows that about 77% of respondents know of at least one alternative source of water other than their nearest source. On average there were three alternative sources of water per respondents in the sample (M=3.12, Std. deviation = ±0.912)

The pie chart below shows the percentage of respondents with and without alternatives as per the study sample.

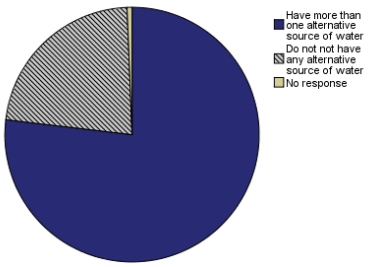

Chart 5: Availability of alternative sources of water

4.4.2.2 Water quantity

4.4.2.2.1 Daily water per capita sufficiency

Domestic water should be available to households in sufficient quantities to meet their daily needs. In order to obtain the daily per capita water deficit, the respondents were asked the amount of water they would consider sufficient for their daily domestic use and the amount they are usually able to get from the nearest water source. During the analysis, the sum of all household water requirement per day (THH_R), sum of all the water all households are able to get per day (THH_A) and the total of all household sizes in the sample (MHH_{size}) were obtained.

To get the per capita daily water requirement (R_w), and the daily per capita water available (A_w), and the daily per capita water balance DPC_b, the following formulas were used:

$$R_W = THH_R / THH_{size}$$

$$A_W = THH_A / THH_{size}$$

$$DPC_b = (A_W - R_W)$$

Where;

R_W = Daily per capita water requirement

A_W = Daily per capita amount of water that households are able to get.

DPC_b= Daily per capita water balance

THH_R = the sum of all household water requirement per day

THH_A = the sum of all the water that all households are able to get per day

THH_{size} = the total of all household sizes in the sample

Therefore;

R_W = 12,470/496 = 25.14 liters

A_W = 9,980/496 = 20.12 liters

DPC_b = (20.12-25.14) = -5.02 liters

The calculations revealed that the mean daily per capita water balance was negative meaning that the respondents were not getting sufficient water for their needs. The average daily per capita water requirement of respondents was 25 liters (M=25.14) while they were only able to obtain 20 liters/ capita/ day (M=20.12). There was therefore a water deficit of five liters per capita per day.

It is interesting to note that the per capita daily water availability does not only fall below the actual requirement of the respondents, but also falls below the WHO recommended standard of between 50-100 liters/ capita/ day for one to be able to meet their basic domestic and hygiene needs, with a deficit of between 30-80 liters/capita/day. To explain why the water they obtain is never sufficient, the main reason given by most (43%) respondents was that they do not have sufficient storage to store enough water to sustain the households throughout the days when there is no water at the source. A respondent from the county government noted as follows during an interview:

> *"…They are supplied with water twice a week. So those who do not have sufficient storage can have a problem within the course of the week…"*

Some respondents also highlighted high water cost from vendors (36%) and lack of time to collect water (14%) and long lines of people at the water source 5%. Only 2% of the

respondents cited long distances to water source as the reason explaining why they never have adequate water.

4.4.2.2.2 Rate of water flow and line of people at the source

Quantity of water that is available in an area can also be indicated by rate of water flow and the existence of a line of people at the water source. The study sample indicate that a large number (80%) of respondents have to wait in line at the water source before they can collect water with 21% of respondents describing the rate of water flow at their nearest water source as slow and 54% describing it as average. An analysis of the mean shows that in average it takes approximately three minutes to fill a 20 liters jerry can (M=2.83, std. deviation = ± 1.34). The larger standard deviation is an indication of the large variation in the number of minutes it takes to fill a 20 liter jerry can across the study sample with analysis of the minimum and maximum being one and eight minutes.

Table 5: Water flow rates rating

Rating of water flow rates by respondents	Number of respondents	Percentage of Respondents
Slow	34	21.3
Average	87	54.4
Fast	39	24.4
Total	160	100

According to the actor respondents interviewed, the rate of water flow is a challenge in some parts of the informal settlement because the water is supplied by gravity hence the pressure is affected by higher elevations. Secondly, low pressure has also been due to increased connections on the main supply pipes which were not designed for such number of connections.

4.4.2.2 Water Quality

Good water quality as an aspect of water access came out as a strong point according to the respondents in the study sample. All the ten interviewed actor respondents agreed that the water quality in Kawangware is good and that there are sufficient and effective quality control measures undertaken by different actors to guarantee quality. Piped water supplied by the water service provider goes through acceptable standards in a conventional water treatment plant. The water service provider also has field officers who, who together with county government health officers, regularly sample water from various taps at households, plots and water vendors for laboratory test to ensure the quality is not compromised between the treatment point and the tap. This is illustrated by a comment of one water vendor during the interview:

> *"Normally the public health officers from the county government take samples from the tap and go to test it. The have been here twice. The unfortunate thing is that in those two occasions they have never told me the results so I assume my water is safe……otherwise they would have closed this place."*

Not only is the quality of piped water ensured but also the borehole water. Before any new borehole (whether for private or public water supply) is approved by the Water Resources Management Authority (WRMA) and consequent licensing by the county government, water sample from the borehole has to be tested for suitability for human consumption.

However, three interviewed respondents from different actor organizations revealed there are instances when the piped water quality gets compromised when there is a burst on a pipe that

runs next to a sewer line. This is an occasional occurrence which normally receives immediate attention from the water service provider company. Nevertheless, water quality has been generally good with 93% of respondents surveyed stating that they do not have any health concern with the water at their nearest source. Only 6% expressed health concern and 1% did not give their response.

4.4.3 Comparative water access across villages in the sub-location

This analysis compared the four villages within Kawangware informal settlement in terms of water availability, quantity and quality to detect if there exists any significant differences.

4.4.3.1 Comparison of water availability

4.4.3.1.1 Sources of water

In order to compare the villages in terms of water sources, a frequency analysis was done which showed that Coast and Magedonia villages had larger share of respondents who access piped water indoors. About 18% of the respondents in Coast and 10% of respondents in Magedonia had access to piped water indoors as compare to only 3% of respondents in Kabiro while no respondent had access to piped water inside their house in Stage 2. Similarly, more respondents in Coast and Magedonia still had access to piped water in the plot at 45% and 23% of respondents within the village respectively, as compared to only 8% and 5% of respondents in Kabiro and Stage 2 villages respectively. This means that larger proportions of respondents in Coast and Magedonia are able to get water within their vicinity while the reverse can be said of the other villages. In General, respondents from Coast and Magedonia have better water access in terms of water sources than the rest of the areas in the informal settlement.

This difference by frequencies in water sources is shown in chart 6 below.

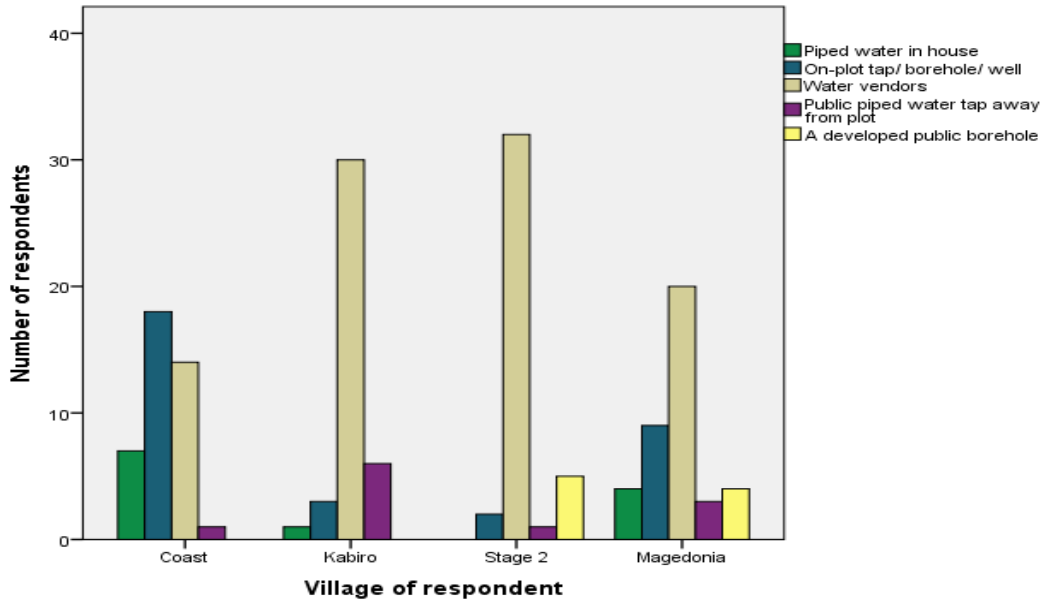

Chart 6: Difference across the villages in terms of water sources

4.4.3.1.2 Distance to water source and collection time

The difference between the villages is also indicated by the percentage of respondents that cover given distances to collect water and the average collection time. Over 18% of the respondents in coast village do not travel any distance to the water source as compared to only 3% and zero in Kabiro and Stage 2 respectively. Magedonia also had larger proportion (10%) of respondents within the village who do not travel any distance. It is interesting that the largest

proportion of respondents (50%) in the study sample who have piped water in house and hence do not travel any distance to collect water are from Coast village.

Despite these differences shown by frequency analysis, statistically the difference is not significant among the villages in terms of distance to water source based on a one way ANOVA test, $F(0.35, 10.75) = 1.69$, $p = 0.171$

Table 6: Distance to water source and respective percentage within village of respondents

	% of respondents within village that cover given distance to water point			Total
Village	0 meters	1-1,000 meters	Over 1,000 meters	100
Coast	12.5	87.5	0	100
Kabira	2.5	97.5	0	100
Stage 2	0.0	100	0	100
Magedonia	10.0	90	0	100

With regards to water collection time, both one way ANOVA test and frequency analysis shows that there is no difference among all the four villages since all respondents in the sample said they take less 30 minutes to and from the water point in total.

4.4.3.1.3 Regularity of water availability

Frequency analysis showed that more than half (55%) of respondents in Magedonia village have water flowing at their nearest source throughout. Coast had about 23% of its respondents who received water throughout the week, stage 2 had 20% while Kabiro had the lowest proportion of its respondents who receive water throughout the week.

Of the portion of respondents who do not receive water throughout the week, coast and Magedonia showed a relatively better frequency of water availability with 29% receiving water three times a week as compared to Stage 2 where only 9.4% of the respondents in the village receive water at the same frequency per week with all the others receiving water at a frequency lesser than three times in a week.

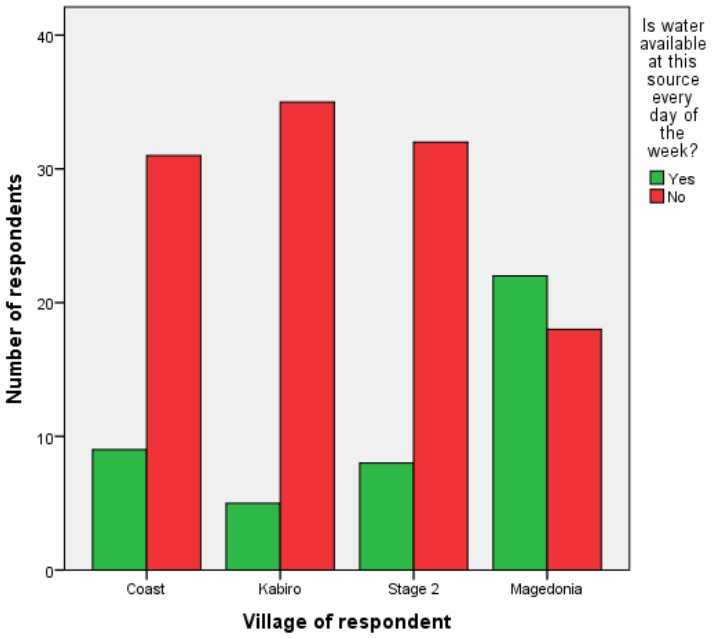

Chart 7: Water availability in the week

It is also notable that minimal number of respondents (2.9%) in Kabiro received water at the highest number of frequency of six days per week. This could be because these respondents get water from water vendors who sell water from boreholes or have storage tanks that store water sufficient to supply residents for most days of the week.

Table 7: Frequency of water availability per week at a source and the respective percentage of village respondents

	Frequency per week and respective % of respondents within village sample						
Village	1 day	2 days	3 days	4 days	5 days	6 days	Total
Coast	3.2	67.7	29.0	0.0	0.0	0.0	100
Kabiro	31.3	40.0	22.9	2.9	0.0	2.9	100
Stage 2	28.1	62.5	9.4	0.0	0.0	0.0	100
Magedonia	0.0	77.8	22.2	0.0	0.0	0.0	100

4.4.3.1.4 Availability of alternative sources of water

The data showed that the four villages also had a difference in terms of availability of alternative water sources. For instance, there are more respondents in Stage 2 village (98%) who have alternative water sources than in Magedonia (50%). This could be most likely because water vendors are more common in areas with fewer people who access piped water in-house and in the plot and as a result more respondents have alternative sources than in areas where respondents have these utilities. However, with regards to number of alternative water sources, the one way NOVA test shows that there is no significant difference across the four villages, $F(5.87, 103.30)$, $p = 0.068$. The average number of available alternative water sources in Coast, Kabiro Stage 2 and Magedonia are 3 (M=3.17. std. deviation=1.014), 3 (M=2.83. std. deviation=0.791), 3 (M=3.38. std. deviation=0.963) and 3 (M=2.95. std. deviation=0.669) respectively.

4.4.3.2 Comparison of Water Quantity

4.4.3.2.1 Daily per capita water sufficiency

Using the same approach used to calculate the daily per capita water requirement, per capita water availability and per capita water balance, the same aspects were calculated for each village. The results indicated that daily per capita water requirement and per capita water availability for the four villages were just slightly different from one another where all the villages experience daily per capita deficit with Coast, Kabiro, Stage 2 and Magedonia having deficits of 7, 4, 4, and 4 liters/capita/day respectively.

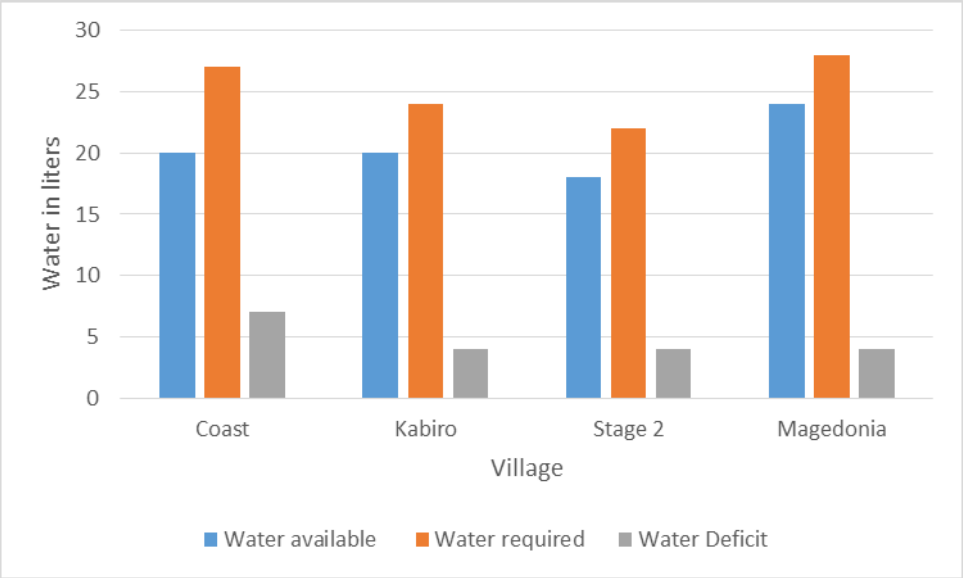

Chart 8: Daily per capita water availability

4.4.3.2.2 Rate of water flow and line of people

To compare the four villages in terms of whether or not the respondents have to wait in line before collecting water and the rate of water flow across the four villages, a frequency analysis was done which indicated that relatively fewer respondents in Coast (62%) and Magedonia (65%) have to wait in line before collecting water as compared to Kabiro (95%) and Stage 2 (97%).

Additionally, there were fewer respondents in Coast and Magedonia who rated the flow rate of water as slow while more people rated the rate of water flow as fast in the same villages, as compared to Kabiro and Stage 2.

The difference across the four villages is also observed on the time it takes to fill a 20 liters jerry can where a one way ANOVA test also revealed a significant difference, $F(29.80, 67.53) = 6.033$, $p = 0.001$.

These differences on the various aspects of water flow rate across the villages are clearly shown in Table 8 below.

Table 8: Respondents'' responses on the various aspects of water flow rate at the source

Village	Responses on Line of people at water source (%) within village			Responses on rate of water flow within village				Average time it takes to fill 20 liters jerry can in minutes
	Yes	No	Total	Slow	Average	Fast	Total	
Coast	62.5	37.5	100	22.5	55.0	22.5	100	2.82
Kabiro	95.0	5.0	100	22.5	57.5	20.0	100	2.97
Stage 2	97.5	2.5	100	30.0	57.5	12.5	100	2.18
Magedonia	65.0	35.0	100	10.0	47.5	42.5	100	3.38

4.4.3.3 Comparison of Water Quality

Water quality across the four villages is good. Over 90% of respondents from each village did not have any health concern with the water at their nearest source, while those who had health concern were not more than 3% for each village.

4.4.4 Conclusion on the state of household water access

From the analysis presented on the state of household water access it can be concluded that households in Kawangware are water insecure in terms of water availability and quantity when bench marked with national and international standards. A very significant majority do not have access to piped water within their vicinity while water availability in most source is unreliable and insufficient. In addition the findings point out to a spatial disparity in water access in terms of water availability and quantity across the sub-location with Coast and Magedonia villages being better than Kabiro and Stage 2 villages. However water quality is acceptable across all the four villages in the sub-location.

4.5 How the nature and level of coordination of multiple actors involved in water provision influenced the state of household water access in Kawangware informal settlement of Nairobi

To explain how the nature and level of coordination that exist among actors in Kawangware has shaped the state of household water access in the area, analysis of direct responses from interview respondents, relational building and direct interpretation were applied. The findings showed that the various sub-activities in coordination have influenced household water access in various ways, both positively and negatively.

First, coordination particularly in terms of the nature of communication emerges as factor in the time efficiency in service delivery. Although communication was mentioned by respondents as present among actors, it was displayed as ineffective and thus affecting smooth planning and implementation of water projects. Delayed response to letters, emails, and calls as well us failure to quickly act on requests by an organization greatly slow down the initiation and implementation of water delivery projects by some actors. This has undermined water availability and quantity for the Kawangware community. Private water vendors expressed frustrations with the delayed feedback from relevant authorities when it comes to approval of borehole drillings and water quality testing. One of the respondents from these relevant authorities noted that such delays are due to the lengths of time it takes to communicate from one organization to another while undertaking necessary checks before a borehole drilling project is approved. Another scenario is described by a respondent as such:

"…there was a time when there was an organization which needed an MOU to be signed from our side and it took some time. So for them it was delaying what they were supposed to initiate from the ground. And also even from our side there were somethings we expected from the organization to submit to us like their company profile before we signed the MOU and engage in anything. And you find that the company profile was not forthcoming and hence the delaying of that project…"

The only instances in which communication was noted to positively influence household water access was a case where on several occasions the Water Resources Management Authority took the initiative to inform Water Sewerage company, of sewer bursts that threaten surface, ground and piped water quality. The water and sewerage service provider had in return was able to act fast to repair the systems and secure water quality.

The relationship among water vendors is another case that illustrates how poor coordination inform of communication can affect regularity and cost of water to households. The fact that water vendors neither have any platform that brings them together nor communicate with one another, there are occasions when all water vendors within a certain area of the sub-location close their kiosks at the same time. This leaves the community around that place with no source of water hence affecting frequency of water availability. One respondent from the private water providers commented:

"There is no such arrangement. If I get busy I just close and go to my business. Sometimes you find almost every kiosk around here is closed. That means the residents will have a problem with finding water. So they really have to go long distances to search for water."

Nature of coordination among actors in Kawangware also explains the large disparity in the state of household water access across the villages in the sub-location. The results showed that Coast and Magedonia villages have better water access in terms of water availability and water quantity than Kabiro and Stage 2 villages. More people had piped water indoors or a water source within the plot of residence, fewer people experienced long lines at the water source, faster flowrates and more alternative sources in the two former villages than the later.

When a respondent was asked to comment on this, he explained that household water access in Coast and Magedonia was so poor at some point. Almost all actors concentrated in undertaking water projects in these areas to address this need while in the process doing very little or nothing for Kabiro and Stage 2 villages. After sometimes, the whole situation had been altered yet more and more organizations kept focusing in the same areas. This scenario indicates how lack of coordination reflected in poor organization and planning in a network can lead to duplication of efforts and resources as well as spatial disparity in service delivery to communities.

Respondents also highlighted lack of coordination as a factor that undermines the ability to pool financial resources for water delivery projects. Sometimes individual actors initiate separate yet similar projects in the same area while they do not have sufficient resources to adequately fund them. In the end these projects are halted for long periods of time or permanently abandoned before completion because of inadequate funding. Four respondents gave examples of such projects in the area. The implication for this is that fewer functioning water sources are available for households. This is situation that would otherwise be overcome if actors worked together and pooled resources to focus of fewer or even one project but ensure its completion.

Other than just pooling resources, organizations that coordinate with one another are able to combine their specialized skills, harness the benefits of division of labor and create synergies in water provision in Kawangware. As a respondent observed:

"…Athi water service board has the capacity to look for funding…securing aids to implement mega projects within the informal settlements such as sewer lines, major water infrastructure lines…the trunk lines. But they do not have the capacity to mobilize and find space within the informal settlements. It is that moment that we are brought on board through partnerships to mobilize because we have a touch with the communities…we have a constituency within all informal settlements that we work with…"

However, the findings indicate that majority of actors do not coordinate in this manner in Kawangware and as a result are unable to exploit these leverages. Consequently, the efforts of the different single entities become ineffective hence undermining water service provision.

On the same note, organization as an aspect of coordination among actors has an effect on the ability of those actors to attract external funding. Majority of the respondents made an observation that external donors prefer investing money in systems where organizations work together especially in partnerships and coalitions because this ensures resource efficiency. In the contrary, this approach to resource mobilization is lacking in Kawangware with only fewer actors practicing it. Such actors that demonstrate this strategy have displayed significant success in mobilizing financial resources. For example, the partnership between Pamoja Trust, Nairobi Water Company and National Water Trust Fund enabled them to attract funding from the World Bank for informal settlement water access improvement to the tune of Ksh. 600, 000,000 (€ 5,300,000).

There was also an observation that lack of coordination among the NGOs themselves and with the county government has undermined the NGOs participation in the local governments planning and budgeting. The organizations have not been able to mobilize and organize themselves to lobby for their inclusion and involvement in decision making regarding water service delivery policies, planning and budgetary allocation. As a consequence the government has given less attention to the water access challenge in the informal settlement.

Nature and levels of coordination reflected in low levels of communication and absence of vibrant partnerships and coalitions have also undermined sharing of knowledge and technology that have potential to improve water service provision and ultimate household water access. Kawangware shows very limited knowledge and technological transfer across the network. Even though some organizations seem to have better approaches and models to water service delivery to communities, other actors are continuously implementing strategies that are ineffective. When asked about their opinion on this, half of the respondents expressed a feeling that it is due to limited interactions among actors which also seem to create a lot of mistrust. Organizations, especially the NGOs and private sector, act like they are in competition with one another rather than having a view that they are all working towards improving household water access for the same community. As a result they do not share ideas, models and technologies that would otherwise increase the water service delivery process to communities.

Nevertheless, few organizations who show aspects of coordination among themselves have been able to achieve a lot of success in improving household water access through sharing of technology and innovation. For example, the cooperation between an NGO called Pamoja Trust and the Nairobi Water Company facilitated the adoption of a new water service delivery model and water metering technology that not only reduced the cost of water for the target community, but also improved revenue collection by the water service delivery company. This is how one respondent described it:

"Our interactions within the informal settlement has helped such that water that was being sold at Ksh. 20 per 20 liter jerry can is now being sold at 50 cents. Our minimal involvement and partnership has influenced the water company to change their approach and attitude and now have a total focus with dedicated staff and a department that oversees water supply within the

informal settlements. And we can also say that within the informal settlement you will find that like now Mathare we have almost 30 water kiosks and there is no area that is underserved. And we have even now moved from the water kiosk to prepaid meters at every cluster. People can just buy tokens and access water and get into the house. We have now moved from portable water stationed at a place, someone can now take his token from their house and get water in their house directly without going to the kiosks. Service delivery has improved."

Finally, lack of coordination comes out in the study as a barrier to inter-organizational understanding and conflict resolution. When organizations do not closely work together, they fail to develop familiarity with one another in terms of operations and challenges, making it difficult to resolve any conflicts when they arise and consequently affecting water service delivery. For instance, at some point Nairobi Water and Sewerage Company, due to financial constraints they were going through, failed to pay their water abstraction bills to the Water Resources Management Authority for a period of six months. But since the authority was not familiar with the financial challenges faced by the water service provider, they not only blocked the company from abstracting water from the main river, but also sued it. For the entire two weeks when the conflict was on, Nairobi residents did not have water flowing in their taps hence undermining water availability.

4.5.1 Conclusion on the how nature and level of coordination has influenced household water access in Kawangware.

The nature and level of coordination has partly shaped the current state of household water access in Kawangware. Ineffective coordination among the multiple actors is a driver of factors such as duplication of efforts, resource inadequacies and conflicts which have ultimately compromised performance in water service delivery processes. Consequently the area has not only been characterized by minimal level of household water access but also disproportionality in access across the sub-location.

4.6 Discussion and Conclusion on Findings

The findings of this study gives a synopsis of the state of household water access in Kawangware sub-location and how the nature and level of coordination among the actors in water provision has shaped it.

Water governance in Kawangware exhibits characteristics of network and multi-level governance. The results have indicated that water provision in Kawangware involves several autonomous actors who are working towards the attainment of one objective: to improve and sustain household water access to households. The actors, which range from government institutions, non-governmental organization to private actors, are working as independent entities where some have differentiated roles while others are playing similar roles. This is a reflection of a multi-actor system as displayed by literature and the conceptual framework.

Other than just working towards a similar goal, there exist relational dynamics across the network in terms of communication, organization, planning, executing, commanding and controlling. These are key elements or sub-activities in coordination as defined in different literature in chapter two. Communication is the most prominent sub-activity undertaken in the systems at a slightly higher level.

However, planning, joint organizing and execution are happening at very low levels while there were no significant indicators of central commanding and controlling of operations among the actors. These are indications that even though there is existence of coordination within the network, the overall pattern is that its degree is very low and much restricted to only a few actors. Coordination among actors is faced with a number of challenges including duplicity of roles, lack of trust, structural and operational bureaucracies and perception of competition.

Despite the efforts of the multiple actors undertaking water provision actions in Kawangware, general picture revealed by the findings is that the area is water scarce and can be categorized as water insecure basing on national and international standards. Although all the households are able to get water within a distance of 1,000 meters from their houses and within 30 minutes of collection time which are acceptable standards, very significant percentage of households do not access piped water within their vicinity as recommended by the WHO. Most households depend on water sources away from their residence especially from water kiosks, tanker trucks and vendors with carts. Secondly, the water flow rate is low due to low pressure and people have to wait in long lines before they can fill their containers. Furthermore, not only do the households fail to obtain daily per capita water quantity recommended by international standards, but also fail to get quantities that meet their actual domestic needs. These findings also show that there is spatial disparity in water access across the villages in terms of availability and quantities with Coast and Magedoni having an advantage over Kabiro and Stage 2 villages.

The poor water access condition in Kawangware has been partly influenced by the various aspects of coordination. First, the poor communication among actors have been a cause of inefficiencies in service delivery in the area resulting into frustrations of actors as well as delayed and sometimes collapse of water delivery projects. Failure to pool resources together due to poor coordination explains why there are so many water projects which have been initiated and left uncompleted. This also relates to the fact that disorganization and lack of coalition building has undermined the ability of the actors to attract external funding for water projects in the area. The NGOs also lack joint approach to influence government policies, planning and budgetary allocation towards water service delivery and consequently government priorities and budget has not been focused on water service delivery for the informal settlement. Water service delivery has also been affected by conflicts among actors, which otherwise would be avoided if there was close cooperation and understanding among water actors.

The spatial disparity in water access across the sub-location can also be attributed to poor coordination. Because organizations do not engage and consult one another, most of them concentrate projects in one side of the sub-location while ignoring another side. As a result, the community in the advantaged side of the sub-location has better water access than the ignored side.

Additionally, it is interesting that almost all residents of Kawangware seem to access good quality water that does not pose any health challenge to them. Even the disproportionate access across the villages in terms of water availability and quantity is not reflected in quality. All the villages receive good quality water with no health concern. This showcased the potentials that can be achieved through coordinated water provision actions. The players working on the water quality aspect demonstrate a well-coordinated approach to water quality control in the entire area. There is a close working relationship the private players, county government health officers, water resources management authority and Nairobi Water Company's water quality department.

In general, the results show that the state of household water access in Kawangware informal settlement is below national and international standards. The situation is partly attributed to the nature and level of coordination of the multiple actors working on water provision in the area which the study has revealed as poor.

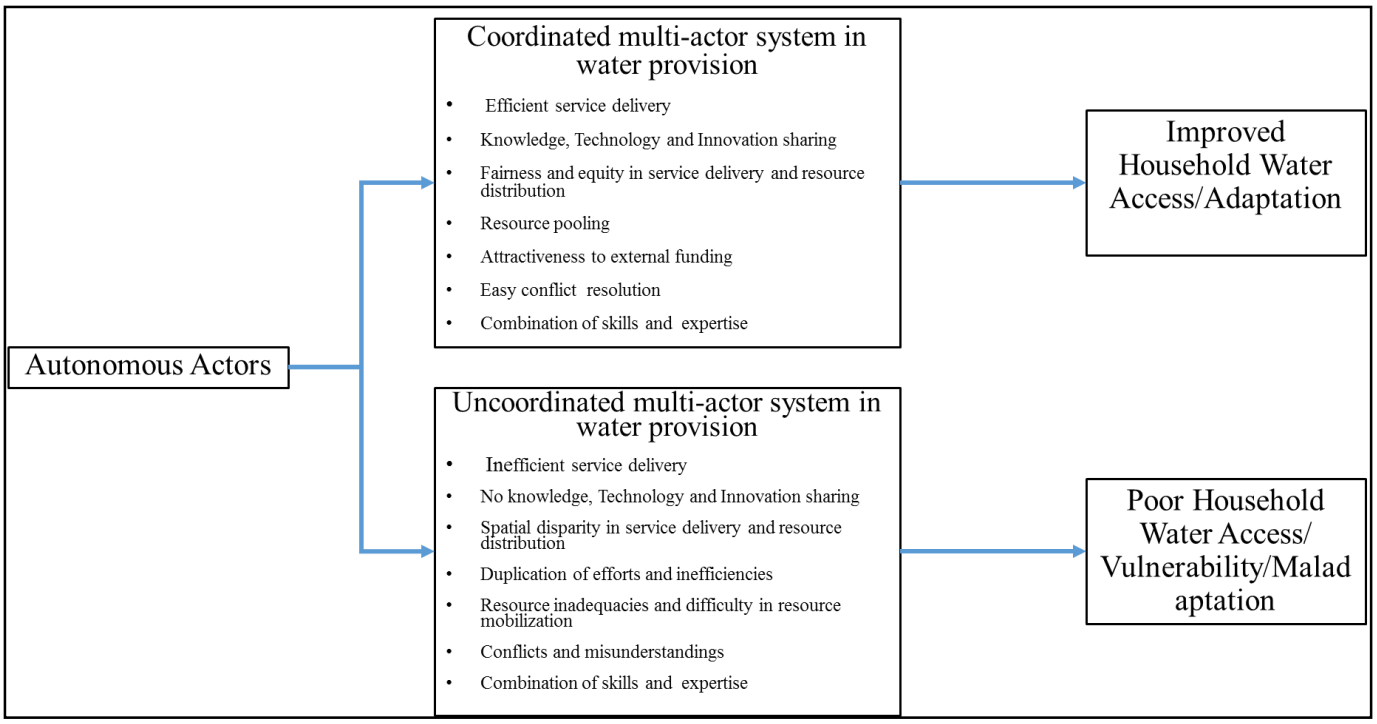

Figure 5: Illustration of influence of coordination on household water access

Chapter 5: Conclusions and recommendations

This is the final chapter of this thesis and it gives summary of the thesis and a reflection on the implication of the findings as well as recommendations for further research and for policy consideration.

5.1 Conclusions

Despite coordination being a key element in governance, or more specifically in climate change governance, it has received less academic attention and how it shapes the outcomes of governance is less understood. This research aimed at contributing to the bridging of this gap by explaining how the nature and level of coordination of multiple actors in water provision has shaped the state of household water access in Kawangware informal settlement. The main research question was 'How does the nature and level of coordination of multiple actors influence the state of household water access in Kawangware informal settlement?'

A case study research was adopted as a strategy appropriate to answer the question and Kawangware was selected as an appropriate area that can give a deeper insight into the study variables. This is an informal settlement characterized by persistent water scarcity for households despite the efforts of several actors working on water provision in the area. This is a situation that has been worsened by the impacts of climate change that have reduced the quantity of water available at Ndakaini dam, which is the main water reservoir of the city.

A conceptual framework for the study was formulate by integrating the ideas of multi-actor system and multi-actor theory proposed by Gazendam (2005) and theory of management by Henry Fayol (1916-1946). The framework has been effective in understanding the network system of multiple actors in Kawangware and how the relational dynamics among the actors has influenced the governance outcome which is household water access.

The households in Kawangware informal settlement are portrayed by the findings as generally water insecure with respect to water availability and quantity, a situation that has been persistent for a long time despite the efforts of several organization to mitigate the water scarcity. Detailed analysis of the relational dynamics among the organizations has revealed that the nature and level of coordination among the actors has partly shaped this state of water access to a greater extent. In other words, the results highlight the important role of coordination in governance and the ultimate achievement of governance outcomes in a multi-actor system.

The findings shows that the nature and level of coordination of multiple actors can influence efficiency in service delivery; resource pooling and mobilization; knowledge and technology sharing; spatial distribution of services and resources; conflicts management; and public policy and planning. All these are factors that have ultimate consequence on the outcome of shared goals.

Poor coordination in Kawangware is reflected in communication, organizing, planning, commanding, executing and controlling of actor activities. This has caused a lot of inefficiencies which delays the commencement and implementation of water delivery projects. Because of ineffective coordination, actors have also had challenges with pooling finances which has led to incomplete or abandonment of initiated projects. At the same time, the organizations have not been able to effectively attract external funding for water projects in the area because of their poor organization and failure to approach resource mobilization with a coordinated strategy. Furthermore, over concentration of water provision projects in two villages while other villages in the area are underserved is a reflection of poor coordination that

has resulted into duplication of efforts in one area at the expense of another. Additionally, the findings have showed that poor coordination can undermine conflict management because of lack of familiarity and understanding as in the case of certain actors identified during the study. Finally for NGOs, lack of coordination can hinder their effective participation in influencing public policy and planning as well as knowledge and technology sharing.

On a broader perspective, this study has put into perspective the significance of coordination in urban water provision in the face of climate adaptation governance. It highlights the need to have a coordination framework in a multi-actor system if expected outcomes are to be realized effectively and efficiently. Effective relational dynamics can enhance urban climate adaptation while poor coordination undermines the process or even lead to maladaptation as postulated by Ivey, Smithers, et al (2004).

In the whole theoretical debate and tensions between the different forms of governance, this study takes a neutral perspective with recognition of the cross-cutting nature of the concept of coordination. Therefore, despite the study conveniently demonstrating the critical influence of coordination in a network governance arrangement, it is important to highlight that coordination is important in whatever environment, nature and form of water adaptation governance whether linear, network, hierarchical, horizontal, vertical or multi-level.

5.2 Recommendations

Although this study gives an insight into the influence of nature and level of coordination on urban household water provision, being a case study makes it difficult to make general conclusions on broader scale beyond the study case. The single holistic approach has also eliminated the ability of comparative analysis that would have enhanced the ability to assume that a different case would also respond the same way. A multiple comparative case study that looks at more than one case is therefore recommended. In addition, further research on motivation for coordination and the factors that influence inter-organizational coordination in a multi-actor system is necessary. This would enable policy makers and actors to exploit the opportunities and derive the benefits of effective coordination.

For policy makers and project planners, this study brings into perspective the role of coordination in a multi-actor environment. Based on these findings, it is important that policy makers and planners develops a multi-actor coordination framework that would facilitate coordination practices among actors that work towards similar goals to enable faster, efficient and effective achievement of goals.

Bibliography

Alexander, E. R., 1993. Interorganizational coordination: Theory and practice. *Journal of Planning Literature,* 7 (4), pp. 328-343.

Bakker, K. and Cook, C. 2011. Water governance in Canada: Innovation and fragmentation. *Water Resources Development,* 27 (02), pp. 275-289.

Baxter, P. and Jack, S. 2008. Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report,* 13 (4), pp. 544-559.

Bulkeley, H., 2010. Cities and the governing of climate change.

Carmin, J., Dodman, D. and Chu, E. 2013a. *Urban Climate Adaptation and Leadership: From Conceptual Understanding to Practical Action, .*

Carmin, J., Dodman, D. and Chu, E. 2013b. Urban climate adaptation and leadership: from conceptual understanding to practical action. *OECD Regional Development Working Papers, 2013/26, .*

Cook, C. and Bakker, K. 2012. Water security: debating an emerging paradigm. *Global Environmental Change,* 22 (1), pp. 94-102.

Crow, B. and Odaba, E. 2010. Access to water in a Nairobi slum: women's work and institutional learning. *Water International,* 35 (6), pp. 733-747.

Edelenbos, J. and van Meerkerk, I. 2015. Connective capacity in water governance practices: the meaning of trust and boundary spanning for integrated performance. *Current Opinion in Environmental Sustainability,* 12 pp. 25-29.

Folke, C., Hahn, T., Olsson, P. and Norberg, J. 2005. Adaptive governance of social-ecological systems. *Annu.Rev.Environ.Resour.,* 30 pp. 441-473.

Fukuyama, F., 2013. What is governance? *Governance,* 26 (3), pp. 347-368.

Gazendam, H. W., 2005. Coordination mechanisms in multi-actor systems. *Planning: Its Aspects, Motivations, and Methods.New York: Wiley, .*

GOK, 2013. Kenya Population situation Analysis. (Kenyas population ovver the years ; Nairobi: Government Printers. Available at: http://countryoffice.unfpa.org/kenya/drive/FINALPSAREPORT.pdf [Accessed 15-11-2014].

Habitat, U., 2008. State of the world's cities 2008/2009: Harmonious cities.

Hossain, L. and Uddin, S. 2012. Design patterns: coordination in complex and dynamic environments. *Disaster Prevention and Management: An International Journal,* 21 (3), pp. 336-350.

Hox, J. J. and Boeije, H. R. 2005. Data collection, primary vs. secondary. *Encyclopedia of Social Measurement,* 1 pp. 593-599.

Intergovernmental Panel on Climate Change. Working Group II, 2014. Climate Change 2014: Impacts, Adaptation, and Vulnerability.

IPCC, 2007. Climate change 2007: impacts, adaptation and vulnerability; contribution of working group II to the fourth assessment report of the Inter-governmental Panel on Climate Change. London: Cambridge University Press.

IPCC, 2014. . Climate Change 2013. The Physical Science Basis: Working group contribution to the fifth assessment report of the Intergovernmental Panel on Climate Change. London: Cambridge University Press.

Isett, K. R., Mergel, I. A., LeRoux, K., Mischen, P. A., et al., 2011. Networks in public administration scholarship: Understanding where we are and where we need to go. *Journal of Public Administration Research and Theory,* 21 (suppl 1), pp. i157-i173.

Ivey, J. L., Smithers, J., de Loë, R. C. and Kreutzwiser, R. D. 2004. Community capacity for adaptation to climate-induced water shortages: linking institutional complexity and local actors. *Environmental Management,* 33 (1), pp. 36-47.

Kapucu, N., 2005. Interorganizational coordination in dynamic context: Networks in emergency response management. *Connections,* 26 (2), pp. 33-48.

Kasiulevičius, V., Šapoka, V. and Filipavičiūtė, R. 2006. Sample size calculation in epidemiological studies. *Gerantologija.2006; 7 (4): 225,* 31 .

Kayser, G. L., Moriarty, P., Fonseca, C. and Bartram, J. 2013. Domestic Water Service Delivery Indicators and Frameworks for Monitoring, Evaluation, Policy and Planning: A Review. *International Journal of Environmental Research and Public Health,* 10 (10), pp. 4812-4835.

Klijn, E. H. and Koppenjan, J. F. M. 2007. Governing Policy Networks: a Network Perspective on Decision Making in Network Society. In: G. Morcul ed., 2007. Handbook of Decision Making. New York: CRC Press, Taylor and Francis. pp. 169-187.

Klijn, E. and Koppenjan, J. 2012. Governance network theory: past, present and future. *Policy and Politics,* 40 (4), pp. 187-206.

KNBS and SID, 2013. Exploring Kenya's inequalities: pulling apart or pooling together? Available at: http://inequalities.sidint.net/kenya/wp-content/uploads/sites/2/2013/09/Nairobi.pdf .

Kothari, C. R., 2011. Research methodology: methods and techniques. New Age International.

Leck, H. and Simon, D. 2013a. Fostering multiscalar collaboration and co-operation for effective governance of climate change adaptation. *Urban Studies,* 50 (6), pp. 1221-1238.

Leck, H. and Simon, D. 2013b. Fostering multiscalar collaboration and co-operation for effective governance of climate change adaptation. *Urban Studies,* 50 (6), pp. 1221-1238.

Leck, H. and Simon, D. 2013c. Fostering multiscalar collaboration and co-operation for effective governance of climate change adaptation. *Urban Studies,* 50 (6), pp. 1221-1238. [Accessed 4/27/2015 6:40:08 AM].

Lubell, M. and Lippert, L. 2011. Integrated regional water management: a study of collaboration or water politics-as-usual in California, USA. *International Review of Administrative Sciences,* 77 (1), pp. 76-100.

Marshall, C. and Rossman, G. B., 2010. Designing qualitative research. Sage publications.

Martin, R. and Mathema, A., 2010. Development Poverty and Politics: Putting Communities in the Driver's Seat. Routledge.

McDonald, R. I., Douglas, I., Revenga, C., Hale, R., et al., 2011. Global urban growth and the geography of water availability, quality, and delivery. *Ambio,* 40 (5), pp. 437-446.

McDonald, R. I., Green, P., Balk, D., Fekete, B. M., et al., 2011. Urban growth, climate change, and freshwater availability. *Proceedings of the National Academy of Sciences of the United States of America,* 108 (15), pp. 6312-6317.

Mees, H. L., Driessen, P. P., Runhaar, H. A. and Stamatelos, J. 2013. Who governs climate adaptation? Getting green roofs for stormwater retention off the ground. *Journal of Environmental Planning and Management,* 56 (6), pp. 802-825.

Meurer, W. J., Frederiksen, S. M., Majersik, J. J., Zhang, L., et al., 2007. Qualitative data collection and analysis methods: the INSTINCT trial. *Academic Emergency Medicine,* 14 (11), pp. 1064-1071.

Mutunga, C., Zulu, E. and De Souza, R., 2012. Population dynamics, climate change, and sustainable development in Africa. Population Action International.

O'Hara, J. K. and Georgakakos, K. P. 2008. Quantifying the urban water supply impacts of climate change. *Water Resources Management,* 22 (10), pp. 1477-1497.

Omambia, A. N., Shemsanga, C. and Hernandez, I. A. S. 2012. Climate Change Impacts, Vulnerability, and Adaptation in East Africa (EA) and South America (SA). Climate Change Impacts, Vulnerability, and Adaptation in East Africa (EA) and South America (SA). 2012. Handbook of Climate Change Mitigation. Springer. pp. 571-620.

Pahl-Wostl, C., 2009. A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change,* 19 (3), pp. 354-365.

Pedersen, A. R., Sehested, K. and Sørensen, E. 2011. Emerging theoretical understanding of pluricentric coordination in public governance. *The American Review of Public Administration,* 41 (4), pp. 375-394.

Petty, N. J., Thomson, O. P. and Stew, G. 2012. Ready for a paradigm shift? Part 2: Introducing qualitative research methodologies and methods. *Manual Therapy,* 17 (5), pp. 378-384.

Plummer, J. and Slaymaker, T., 2007. Rethinking governance in water services. Overseas Development Institute.

Potter, L. E., Von Hellens, L. and Nielsen, S. 2010. The Practical Challenges of Case Study Research: Lessons from the field.

Raju, E. and Becker, P. 2013. Multi-organisational coordination for disaster recovery: The story of post-tsunami Tamil Nadu, India. *International Journal of Disaster Risk Reduction,* 4 pp. 82-91.

Rhodes, R. A. W., 1996. The new governance: governing without government1. *Political Studies,* 44 (4), pp. 652-667.

Rijke, J., Farrelly, M., Brown, R. and Zevenbergen, C. 2013. Configuring transformative governance to enhance resilient urban water systems. *Environmental Science & Policy,* 25 pp. 62-72.

Rommel, J. and Verhoest, K. 2014. Exploring effects of coordination on the autonomy of regulators: energy regulators in Belgium. *International Review of Administrative Sciences,* 80 (2), pp. 298-317.

Sehring, J., 2009a. Path dependencies and institutional bricolage in post-soviet rural water governance. *Water Alternatives,* 2 (1), pp. 53-60.

Sehring, J., 2009b. Path dependencies and institutional bricolage in post-soviet rural water governance. *Water Alternatives,* 2 (1), pp. 53-60.

Siwar, C. and Ahmed, F. 2014. Concepts, Dimensions and Elements of water scarcity. *Pakistan Journal of Nutrition,* 13 (5), pp. 281-286.

Termeer, C., Dewulf, A., van Rijswick, H., van Buuren, A., et al., 2011. The regional governance of climate adaptation: a framework for developing legitimate, effective, and resilient governance arrangements. *Climate Law,* 2 (2), pp. 159-179.

Thomas, G., 2011. A typology for the case study in social science following a review of definition, discourse, and structure. *Qualitative Inquiry,* 17 (6), pp. 511-521.

Tropp, H., 2007. Water governance: trends and needs for new capacity development. *Water Policy,* 9 pp. 19.

UN Data, 2015. Nairobi Population. Available at: https://data.un.org/Data.aspx?q=nairobi+population&d=UNAIDS&f=inID%3a5%3bcrID%3a351 [Accessed 2015].

UN Water, 2013. Water security and the global water agenda: a UN-water analytical brief. *Hamilton, ON: UN University,* .

UNESCO, 2014. The United Nations World Water development report 2014: Water and Energy. (The report gives an overview of the relationship between energy and water and the current and future trends of these resources ; 1), Paris: UNESCO CLD;.

Vairavamoorthy, K., Gorantiwar, S. D. and Pathirana, A. 2008. Managing urban water supplies in developing countries–Climate change and water scarcity scenarios. *Physics and Chemistry of the Earth, Parts A/B/C,* 33 (5), pp. 330-339.

Valdés-Pineda, R., Pizarro, R., García-Chevesich, P., Valdés, J. B., et al., 2014. Water governance in Chile: Availability, management and climate change. *Journal of Hydrology,* 519 pp. 2538-2567.

Van Buuren, A., Klijn, E. and Edelenbos, J. 2012. Democratic legitimacy of new forms of water management in the Netherlands. *International Journal of Water Resources Development,* 28 (4), pp. 629-645.

Westbrook, L., 1994. Qualitative research methods: A review of major stages, data analysis techniques, and quality controls. *Library & Information Science Research,* 16 (3), pp. 241-254. Available at: http://www.sciencedirect.com/science/article/pii/0740818894900264 .

WWF, 2011. Big Cities. Big Water. Big Challenge. (The report discusses the status of water resoures and water access in major world cities ; Berlin: World Wide Fund for Nature.

Annex 1: Interview Guide

The influence of Multi-actor Coordination on urban household Water Access: The Case of Kawangware Informal Settlement in Nairobi City

INTERVIEW GUIDE

Date: …….

Introduction:

My name is Michael Okok, a master's student at Erasmus University in the Netherlands. I study Urban Management and Development and currently doing a research for my thesis. My thesis topic is on how coordination of multiple actors in water provision influence household water access in Kawangware sub-location. As one of the people working for an organization active in the water provision sector in this area, you are better placed to give an insight that can help me understand this relationship. All the information I need is merely for academic purpose and will be treated as confidential. I would also like to inform you that this interview is dependent on your will and you are free to answer only questions you feel comfortable with.

Since I do not want to continuously interrupt you in the middle of the interview in order to take notes and also to make sure I capture everything correctly, I request you, if it is possible for me to record the interview. The recording will also only be used for the purpose of this research and treated confidential. The recordings will be disposed within one week after the analysis.

If you are okay with this, we may commence the interview.

Questions:	**Indicators check list**
Information about the interviewee	
1. What is your position in the organization? 2. What are some of your duties and responsibilities in the organization? 3. For how long have you worked with the organization in this position?	Position, role and duration of service in the position
Independent institutions/ organizations working on water provision	
4. Tell me about your organization? 5. What role does your organization play in the process of water provision in Kawangware? 6. Other than this organization, are you aware of other NGOs, private actors and government agencies that also undertake water provision related activities in Kawangware?	• Category of organization/institution (government, NGO, private corporate, CSO/CBO) • Role of the organization/institution in water provision • Number of organizations dealing with water provision

7. What do these other organizations do?	
State of household water access	
Could you please tell me about the current state of household water access in the area in terms of water availability, quantity and quality?	• Average distance from household to nearest water point • Time from household to nearest water point • Number of hours of flow at the point (regularity) • Surety of its availability (reliability) • Water source/ technology/infrastructure type ("improved," "unimproved," community source, or on-plot water) • Number of Water infrastructure in the neighbourhood • The status (whether they are in good or bad condition, functional or non-functional) of Water provision infrastructure in the neighbourhood • Spatial distribution of the Water infrastructure in the neighbourhood • Number of water provision projects in the neighbourhood • Spatial distribution of water projects in the neighbourhood • Concentration of similar water projects in one area • Amount available per person per day
Communicating	
8. Do you communicate with these other organizations working in the area?	• Frequency of information and

9. Could you explain the kind of communication that happens between you and the other organizations? Probes: • How often do you communicate? • What do you communicate about? 10. What is your comment on the effectiveness of communication between your organization and the other organizations also working on water provision in the area? 11. In your opinion, how does communication between your organization and the other organizations influencing your efforts in water provision and does this improve or undermine household water availability for households in the area? 12. In your opinion, how does communication between your organization and the other organizations influencing your efforts in water provision and does this improve or undermine water quantity accessible to households in the area? 13. In your opinion, how does communication between your organization and the other organizations influencing your efforts in water provision and does this improve or undermine water quality accessible to households in the area?	knowledge sharing between actors • Type of information shared between actors • Method and effectiveness of information sharing
Organizing	
14. Do you have a close working relationship with the other organizations involved in water provision activities in the area? 15. To what extent would you say you work with the other organizations? 16. How are responsibilities distributed among the different organizations? 17. Which lines of authority existing in your interactions with the other organizations? 18. Which are some of the existing procedures, regulations and standards that govern how you interact with the other organizations?	• Presence and effectiveness of standards, lines of authority and distribution of responsibilities among actors

19. How effective are these procedures, regulations and standards?	
Planning	
20. Does your organization has a strategic plan that covers this area? 21. Can you explain to me your strategic plan development process? Probe: o How do you involve the other organizations when you develop your strategic plan? o What are the mechanisms for this involvement? o How effective is the mechanisms? 22. How do the other organizations involve you in their strategic plan development process? 23. To what extent do organizations working on water provision measures in this area consult one another when developing water projects? Could you give an example? 24. How are the schedules of implementation of water projects initiated by different organizations synchronized? 25. Would you say that the manner in which planning and development of water projects by different organization is done has an influence on water provision efforts and the current state of water availability for households in the area? Please explain 26. Would you say that the manner in which planning and development of water projects by different organization is done has an influence on water provision efforts and the current state of water quantity for households in the area? Please explain 27. Would you say that the manner in which planning and development of water projects by different organization is done has an influence on water provision efforts and the current state of water quality? Please explain	• Joint participation of actors in developing common strategic plan and other plans • Presence and effectiveness of Mechanisms for actors consultation when developing water provision projects • Type and effectiveness of actor consultation • Presence of synchronized schedule of activities undertaken by different actors
Commanding	
28. When working with other organizations, how is implementation of actions initiated? Probe: • Which authority orders the commencement?	• Presence and effectiveness of central authority that gives order and direction

• Is the authority effective?	
Executing	
29. How do you implement water projects in the area? 30. Can you explain if there are coalitions and partnerships among different organizations implementing water projects in the area? Give me some examples. 31. To what extent would you say organizations work together when implementing water projects in the area? 32. How do you think the manner in which projects are implemented by different organizations is influencing water provision efforts and the current state of water availability in the area? 33. How do you think the manner in which projects are implemented by different organizations is influencing water provision efforts and the current state of water quantity in the area? 34. How do you think the manner in which projects are implemented by different organizations is influencing water provision efforts and the current state of water quality in the area?	• Presence and effectiveness of cooperation and coalitions during implementation
Controlling	
35. While working with other organizations on the same projects, how is it ensured that each organization is doing what should be done? 36. How is monitoring done and feedback given?	• Presence and effectiveness of authority that ensures conformity among actors, monitoring and giving feedback
Common goal	
37. Which are some of the existing common documented goals and objectives you would say all these organizations are working towards?	• Presence of a shared strategic plan or objectives by actors
Type of coordination	•
38. Are there working relationships among organizations that can be considered to be in the same level of authority? Which are some examples?	• Presence horizontal interactions among NGOs, government and private sector or among government agencies of the same level

39. Can you comment on how this relationship influence water provision efforts and the current state of water availability in the area? 40. Can you comment on how this relationship influence water provision efforts and the current state of water quantity available for households in the area? 41. Can you comment on how this relationship influence water provision efforts and the current state of household water quality in the area? 42. Are there working relationships among organizations that can be considered to be of different levels of authority? Which are some examples? 43. How does this influence water provision efforts and the current state of water availability in the area? 44. How does this influence water provision efforts and the current state of water quantity available for households in the area? 45. How does this influence water provision efforts and the current state of water quality for households in the area?	(Horizontal coordination) • Presence of vertical interaction between local authority and higher level and lower levels of government agencies (vertical coordination)

Conclusion:

We have come to the end of the series of questions I prepared for this session. Since you are now familiar with of what this research is all about, do you think there is something else I should know? Something you would like to add?

Do you have any questions for me?

Thank you very much for the time you have accorded me and the important information you have given me. I really appreciate. This will be of great help for my thesis. I may also get back to you from time to time during the data collection process for clarification or additional information if you do not mind. As, I stated earlier, the information is purely for academic purpose and will be treated with a lot of confidentiality. Thank you once again.

Annex 1: Household Survey Questionnaire

QUESTIONNAIRE ON STATE OF HOUSEHOLD WATER ACCESS IN KAWANGWARE SUB-LOCATION

INTRODUCTION

Michael Okok is a student at Erasmus University in the Netherlands studying Msc. Urban Management and Development. He is currently undertaking a research for his thesis which is about how coordination of multiple actors in water provision influence household water access in Kawangware sub-location. In this respect, he is conducting a household survey in the area in order to establish the current state of water access.

As one of the resident of Kawangware sub-location you are in a better position to provide him with information that can assist him understand the situation. You are therefore kindly requested to help fill in this questionnaire. All the information you provide is merely for academic purpose and will be treated as confidential.

Instruction:

Kindly circle the number or numbers that correspond to the choice or choices that apply

Date of Survey	**Entry Number:**
Name of research assistant:	**Village:**

A. Respondent Demographic Data

Gender	1. Male		2. Female
Age:	1. Less than 18 years		2. From 18 years and above
How many years have you lived in Kawangware sub-location?	1. Less 3months	2. Between 3months to 1 year	3. Over 1 year
Does your household own the house you live in in this area?	1. Yes		2. No
If NO, what are the terms of your stay?	1. Pay rent 2. Paying a mortgage for it 3. Provided by employer 4. Owned by someone but I do not pay rent 5. Other:_____		

B. Availability of Water

1. Where do you get your domestic water (drinking, cooking, bathing and washing water)?

1. Piped water in house

2. On-plot tap/ borehole/ well
3. Water vendors (Kiosk, water carriers, tanker trucks, households reselling water from their utility water connections
4. Public piped water tap away from plot
5. Open public well
6. A developed public borehole 7. Other:

2. Approximately, what is the distance in meters between your house and the nearest water collection point?

1. 0 meters	2. 1-1,000 meters	3. More than 1,000 meters

3. How long does it take from the house to the water collection point and back including the waiting time?

1. 0-30 minutes	2. More than 30 minutes

4 (a). Is water available at this source every day of the week?

1. YES	2. NO

(b). If NO, how many times a week is it available?

5 (a). Other than where you get your water, do you know other water collection points around here?

1. YES	2. NO

(b). If YES, how many do you know?

(c). Do you think the water collection points are fairly distributed in the area?

1. YES	2. NO

(d). If your answer is YES or NO, briefly explain why you think so

6 (a). Are you aware of any water provision projects in the area?

1. YES	2. NO

(b) If YES, please mention them

(c). If you answered YES in 6 (a) above, do you think the projects are fairly distributed in the area?

1. YES	2. NO

(d). If your answer is YES or NO in 6 (c) above, briefly explain your answer

C. Quantity of water

7. How many people are currently living in this household?

8. Approximately how much water (in liters or number of 20liters Jerry cans) do you think is sufficient per day for the whole household?

9. Averagely how much water (in liters or number of 20liters Jerry cans) are you able to get from the nearest water source per day?

10. If the amount of water you are able to get per day is less than what is sufficient for the household, can you give reasons why you are not able to get enough?

11. Is there always a line of people waiting to collect water at the water source?

1. YES	2. NO

12. What do you think about the rate at which the water flows?

1. Slow	1. Average	3. Fast

13. How long does it take to fill one 20liters water jerry can at the water source?

D. Water Quality

14 (a). Do you have any health concern about the water you collect at that source?

1. YES	2. NO

(b). If YES, please explain why?

(c). If YES, how do you rate the level of health concern about the water?

1. Low	2. Moderate	3. High

E. Actors Coordination

15 (a). Do you know any organizations that deal with water provision projects in this area?

1. YES	1. NO

(b). If YES, please name them.

(c). If the organizations you named are more than one, in your opinion do you think they are coordinating with one another in their efforts to provide water in this area?

1. YES	2. NO

(d). If you answered YES or NO in 15 (c) above, please explain why you think so.

F. General Comments

16. Do you have any general comment about the state of water access in this neighbourhood?

G. Conclusion

This is the end of the questionnaire. If you have any questions, please write it here.

-THE END-