AN ASSESSMENT OF ACCESS TO HOUSEHOLD WATER SUPPLY IN KISENYI INFORMAL SETTLEMENT IN MBARARA MUNICIPALITY, UGANDA

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DECLARATION

I declare that this research project is my original work and has not been presented for a degree in any other university

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DEDICATION

This project is dedicated to my enabler the Almighty God and my friends who assisted me in different ways during my stay in Kenya.

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LIST OF ABBREVIATIONS

GoU	Government of Uganda
JMP	Joint Monitoring Program
LPCD	Liters Per Capita per Day
MWE	Ministry of Water and Environment
MNAUSS	MwalimuNyerere Africa Union Scholarship Scheme
NWSC	National Water and Sewerage Corporation
PEAP	Poverty Eradication Action Plan
SDGs	Sustainable Development Goals
SPSS	Statistical Package for Social Sciences
UBOS	Uganda Bureau of Statistics
NRW	Non- Revenue Water
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNICEF	United Nations International Children Education Fund
UGSH	Ugandan Shillings
WHO	World Health Organization
WUP	Water Utility Partnership

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ABSTRACT

Access to clean and safe water is vital for human survival and good health. It's one of the ways to reduce death and increase human productivity. Conversely, consumption of unsafe water cause diseases and in most cases leads to death. Shortage and scarcity of water means that the slum dwellers to have be charged exorbitant prices which implies that they remain captive in the pool of poverty. Inadequate supply and unreliability for safe water pose as real challenge in Uganda and in particular in the informal settlements. Even though the Ugandan government has made a stride in water reforms, the poor and slum dwellers remain unsupplied with adequate water which implies that they continue to face a myriad challenges as far as access to safe water is concerned. This study was set to investigate access to household water supply in Kisenyi informal settlement in Mbarara Municipality, Uganda. Simple random sampling was used to sample 200 households in Kisenyi slum. The study exploited triangulation method to collect data in relationship to research objectives under the study. The study also gathered further information from key informants who included National Water and Sewerage Corporation officials and water vendors. The quantitative data was analyzed using cross-tabulations whereas qualitative was subjected to content analysis. The study revealed that NWSC had extended water supply in the area. Water was accessible through stand pipes (75.5%) and water kiosks (18%), which had minimized residents' reliance on unprotected water sources. The study also indicated that residents spent less time and covered less distance to fetch water since 53 percent had water on plot; the price per 20 liter jerry can was still relatively high at 100UGSH and above which led to low quantity of water consumed per household. The study further revealed that some challenges are still being faced which include among others: low quantities consumed per household, water rationing, unreliable water supply and illegal connections. To overcome the challenges the residents have come up with coping strategies towards water scarcity which include:- storage water in containers (37.8%),purchasing water from vendors(20.1%), fetching water from bore holes, rivers and spring wells (16.8%),begging water from neighbors (5%) and efficient use of water (5%). The study recomends that pro-poor strategies which was piloted in Kampalas informal settlements need to be replicated in other informal settlement of intermediate urban centers.

CHAPTER ONE: INTRODUCTION

1.1Background of the Study

Uganda, like other sub-Saharan African countries is experiencing quick urbanization that is occurring in the face of poverty, shrinking peasant economies and inadequate resources for local authorities. Uganda's urban growth rate is 5.4% per annum (Mukwaya*et al*, 2012) and it is estimated that by the year 2050, the country will be among the most urbanized in Africa (UN Habitat, 2012). It is also estimated that about 60 percent of Uganda's urban population reside in informal settlements and sub-standard housing conditions, exposing them to a number of health risks (UBOS, 2002; Sheuya, 2008; Mukiibi, 2012).

Furthermore, these settlements have inadequate access to clean water and other public services (UBOS, 2016). For example, whereas on average, 70% of Kampala's households had gained access to safe piped water, the statistic is only 17% in the informal settlements. As such, residents in these settlements have to rely on alternative sources of water charged at very high prices and are more-often-than-not unsafe (Jones *et al*, 2004; Canon *et al*, 2003; WSPR, 2006; Kiman-Murange and Augustine, 2007; African Water Facility, 2010).

Adequate clean water supply is globally considered a basic human need as well as a measure of quality of life. However, millions of inhabitants in the developing world do not have ready access to sufficient and safe water supply (Cherutich*et al*, 2015). The number of people lacking access to clean water in urban areas has risen steadily in low income countries as a result of speedy urbanization, much of which is happening in peri-urban and slum areas (Gleick, 1998; Kiman-Murange and Augustine, 2007). Consumption of unclean water continues to be one of the main causes of diarrheal disease and deaths arising annually, mostly in children (WHO, 2000; UBOS and ICF International, 2012). In developing countries, as much as 80% of poor health is associated to unsafe water and sanitation situations (United Nations, 2003).

The Government of Uganda has taken the wide range of urban water sector reforms since the formation of Poverty Eradication Action Plan (PEAP) in 1997. The PEAP, which was updated in 2000 and 2004, provides strategies and programs to ensure (among others) equitable allocation of water resources in urban centers by increasing the amount of water available to households, and especially for those living in informal settlements (World Bank, 2014). Uganda Vision 2040 acknowledges that the country is rich in water resources to guarantee that every citizen has clean and adequate water for consumption (VISION PSRC 2040, 2013; Ayah *et al*, 2014; Kiggundu, 2017). Even then, a number of households in Uganda still have inadequate access to clean piped water (Gooloba-Mutebi, 2012; Telly*et al*, 2015).

This is because of the increasing population, reduction in per capita availability of water and rainfall variability (Nsubuga*et al*, 2014). Rainfall variability has escalated water scarcity problem and has resulted in increased water prices (Gasper *et al*, 2011). Coupled with other challenges related to housing, increased food prices, increased cost of living and other household expenditures, the high price of water causes the urban poor to remain mostly affected by lack of inadequate clean water (Namayanja, 2009).

Inadequate access to clean water in informal settlements affects livelihoods, human health, children's education and gender equality. Poor health caused by lack of portable water hasnegative impacts on the lives of the people. Furthermore, sick people are very unproductive. To get away from such poor health, they have to treat unexpected illnesses which need a lot of money that the low income earners cannot afford. These expenditures on income and the ineffectiveness to clear the fee of treatment can propel families further into debt pressing them into the vicious cycle of poverty (Abayawardana, *et al*, 2003).

According to McGranahan (2002), informal settlement dwellers are subjected to informal water markets which in most cases supplies contaminated water that cause ill health and worsens poverty situation among the slum dwellers. As such, the desire for advanced water facilities for example prepaid water meters, on plot stand pipes, public water taps, water kiosks and protected spring wells should not be taken for granted. Access to safe

water facilities is no longer a luxury but a basic need (Akanchalabey, 2015). However, the forms of water availability in low-income urban centers is usually complex with a diversity of different sources offering different qualities, amounts, reliability, accessibility and prices (Thompson *et al*, 2000; Howard *et al*, 2002; Kariuki& Schwartz,2005;Brain *et al* 2014).

1.2 Statement of the problem

The Sustainable Development Goal (SDG) 6 stresses the desire for the provision of safe water to the populace as well as sustainable management of water resources (Griggs *et al*, 2014; Le Blanc, 2015; Larsen *et al* 2016), However, in most countries safe water is mostly accessed in terms of stand pipes and water kiosks instead of private in house water connections. Additionally, inadequate interventions and insufficient resources by stakeholders for example land owners, urban planners and water utility agencies to tackle the challenge of safe water access remain evident. Provision of sufficient safe water to blossoming urban population in Uganda is a major problem for service providers. Available sources of water are becoming more cumbersome and costly to exploit, and there is a substantial need to commit more finances for water treatment to make it safer for human consumption. In addition to such problems of water infrastructures, climate variability and unplanned cities evidenced by overcrowded slums makes it often hard for slum dwellers to access portable water on timely basis. Water consumers in slums in most cases pay 20 times more that those who own piped connections (Fasakin&Olajuyigbe, 2010).

This means that the attempt to deal with in dwelling water connections for informal settlement is really circumscribed. The population of Mbarara Municipality, in western Uganda, has been experiencing rapid growth between 1984 and 2014 (Brain, 2016). However, this population trend has not been matching with public water utility infrastructures thus water deficit becomes serious and people in slums cannot meet their water needs which exposes them to informal water markets which are expensive. It is in this context that this study was initiated in order to assess the accessibility to household water supply in Kisenyi informal settlement in Mbarara Municipality, Uganda. Mbararais

among largest urban centers in Uganda's urban hierarchy and is believed to have a large percent of informal settlement dwellers. Mbarara has got 11 informal settlements with an estimated population of over 80,000 people living within these areas (Act Together, 2010). Kisenyi is one of the informal settlements in Mbarara Municipality. This study intends to contribute on the debate of access to safe and reliable water supply in urban informal settlements using Kisenyi in Mbarara municipality as a case study.

1.3 Research Questions

1. What is the access-to-safe water in Kisenyi informal settlement?
2. What are the challenges to provision of water in Kisenyi informal settlement?
3. What are the households coping strategies to water scarcity and options to improve water supply in Kisenyi informal settlement?

1.4 Research Objectives

1.4.1 General objective

The general objective of the study was to investigate access to household water supply in Kisenyi informal settlement in Mbarara Municipality, Uganda.

1.4.2 Specific objectives

The specific objectives were to:

1. Assess the access-to-safe water in Kisenyi informal settlement.
2. Determine the challenges to provision of water in Kisenyi informal settlement.
3. Establish households coping strategies to water scarcity and options to improve water supply in Kisenyi informal settlement.

1.5Research assumptions

1. Dwellers of Kisenyi informal settlement do not have adequate access to safe water
2. There are no major challenges in terms of water provision in Kisenyi
3. Households in Kisenyi don't have sufficient coping strategies to water scarcity

1.6 Justification of the Study

Most studies of informal settlements in Uganda have largely concentrated and focussed on Kampala – the capital city see for example (Howard *et al*, 2002; Mwebaza, 2010). Little is known about the informal settlements in Mbarara Municipality, especially in terms of access to safe water. Even though the National Water and Sewerage Corporation (NWSC) has tried to extend water to Kisenyi, a large number of households remain unconnected to water mains due to high connection fee and water unreliability, especially during the dry season. The results of this study will inform Mbarara Municipality officials on the access to safe water in Kisenyi informal settlement for appropriate policy intervention.

1.7 Scope of the Study

The research study was carried in Kisenyi, one of the informal settlements of Kakoba division Mbarara municipality in Mbarara district of western Uganda. Kisenyi is one of the slums occupied by slum dwellers which may lack one or more of the social services like poor housing conditions, lack of adequate and portable water. For this matter, this study focuses on safe water access in Kisenyi slum of Mbarara municipality, Uganda.

1.8 Limitations of the Study

During the research study a couple of limitations were encountered due to the innate characteristics of the area and time constraints. Some respondents refused to participate in the study due to suspicion and/or lack of time and incentives. Furthermore, the research was conducted during rainy season in Mbarara and such water access and availability would have been different during the dry season when water is scarce.

1.9 Definition of terms

Informal Settlement as defined by UN-Habitat (2006) to cover wide range of low-income settlements and/or poor human dwelling conditions. In view of this, this definition inadequately captures the very various forms of housing used by low-income earners (tenements, cheap boarding houses, shanty settlements, houses built on illegal

subdivisions) but it comprise of a short hand for places of concentrated disfavor. Slums are further characterized by the following properties: (i) lack of basic services like access to safe water and adequate sanitation facilities, (ii) deficient housing or un authorized and inadequate building structures, (iii) overcrowding and high density, (iv) unhealthy living conditions and risky locations, (v) insecure tenure and irregular or shanty settlements, (vi) impoverishment and social exclusion, and (vii) low limit settlement size.

Water Supply can be defined as to determine whether there have been advancements in quality and quantity of water or both. This can be where water supply intercessions have been made through initiation of new source of water or piped water supply or dwellings water connections has been offered for domestic purposes**.**

Water scarcity defined as an imbalance of supply and demand under prevalent institutional arrangements and/or prices; an excess of demand over available supply; a high rate of utilization compared with available supply, especially if the remaining supply potential is difficult or costly to obtain.

Coping Strategies is the term concerned with the ways by which "peopleor organizations utilize available resources and capacities to confront adverse effects that could result in to calamities."

Water Access

Improved access to water for household use can be taken as an increase in the productivity of domestic labor time.

Table 1.1: Summary of requirement for water accessibility level to ensure good health

Water accessibility level	Distance/Time	Needs met	Level of health anticipated
No access (quantity collected often below 5 l/c/d)	More than 1000m or 30 minutes total collection time	Consumption – cannot be assured Hygiene – not possible (unless carried out at source)	**Very high**
Basic access (average quantity unlikely to surpass 20 l/c/d)	Between 100 and 1000m or 5 to 30 minutes total collection time	Consumption – should be guaranteed Hygiene – washing of hands and basic food hygiene possible; laundry/ bathing hard to assure unless carried out at source	**High**
Medium access (average quantity about 50 l/c/d)	Water delivered through one tap on plot (or within 100m or 5 minutes total collection time	Consumption – assured Hygiene – all basic personal and food hygiene assured; washing and bathing can also be ascertain	**Low**
Optimum access (average quantity 100 l/c/d and above)	Water provided through various taps endlessly	Consumption – all needs met Hygiene – all needs can be met	**Very low**

Source: Howard *et al* 2003

CHAPTER TWO: LITERATURE REVIEW

The chapter gives literature review that is relevant to the problem under study. The chapter is categorized into two main divisions that discuss the theoretical and empirical basis of the literature review. The empirical perspectives of the literature review include studies on access to safe water, challenges to the provision of water supply and coping with water scarcity and potions to improve water supply– as guided by the study objectives. The literature review concludes with summing up of the gaps of knowledge that this study intends to fill. Finally, a conceptual framework for the study is presented.

2.1 Theoretical Perspectives

Water is a significant resource for existence and for good health. However, many people and households around the globe face a problem of water availability. It was based on estimation that 700 million residents in 43 countries inhabit within water scarcity areas with a huge percentage of them living in sub-Saharan Africa (UNDP, 2006; WHO/UNICEF/JMP, 2014). The water scarcity forces many people, households and institutions to use non portable water for drinking and other domestic purposes (WHO, 2009). As such, many deaths occur daily because of waterborne and water associated diseases. Thus, it is not only the availability of water that assures wellbeing but it is also its quality. Africa has the lowest coverage of water and sanitation network and that one in three Africans who reside in urban areas has unreliable access to inadequate public services and facilities (WUP, 2003).

This study is based on resilience theory by Crawford Stanley Holing (1996). The resilience thinking was centered on the magnitude of change that the system can withstand while still being able to perform and to the procedures in which social systems are effective in adapting to these changes. It stresses the dynamic interconnections between the ecological and social systems, which makes it helpful for assessing environmental impacts on livelihoods. Access to safe water in Mbarara Municipality faces these dynamics in ecological and social system, including the effects of climate variability. Climate variability and its impacts like prolonged drought and a combination of human activities has led to reduced river flows which has in turn resulted into low raw

water abstraction rates for the water utility supplier in this case NWSC which makes it unable to satisfy the water demands for Mbarara municipality residents. This implies that water un- reliability which has affected water accessibility with emerging issues like water rationing, low quantities of water available for human use which in most cases are faced by slum residents who are not always integrated in development plans. As a known fact that safe water is life more often than not slum dwellers have to come up with coping mechanisms to overcome such challenges for example purchasing water from vendors and in many times the quality of that water cannot be trusted. Thus this theory becomes suitable for this study.

Access to portable water and sanitation is crucial in breaking down the barriers and contributing to moving people out of poverty (Stern, 2002; Morality *et al*, 2004; Owuor and Foeken, 2012). In other words, access to safe water and sanitation can not only reduce disease burden, but also increases the productivity levels of individuals which consequently reduces poverty through increased incomes and improved health status. As such, the two greatest key relationships between environment, development and human health is access to safe drinking water and the capacity of communities to properly handle wastes through improved sanitation. In their studies in India and Uganda, respectively, Datt and Ravillion (1998), Deninger and Okidi (2003) as cited in Briceño-Garmendia and Estache (2004) conclude that improvements in infrastructure such as water and sanitation, transportation and telecommunication have great impacts on poverty reduction.

According to UNDP (2006), physical accessibility indicates that portable, suitable and water of adequate quantities should be attainable within or in the adjacent of each dwelling, educational institution and work location. Furthermore, the water fetching time must not be more than 30 minutes and the interval to water source should be within 1,000 meters of residence (Howard and WHO, 2003). This should comprise of all populace including the most endangered or less privileged groups.

However, water accessibility can also be looked at in terms of economic accessibility as argued by Frone and Frone (2013). Economic accessibility to water infrastructure

correlates to the simplicity at which water facilities are manageable by all persons including the low income earners in a manner which does not restrict their capability to afford other essential fundamental services such as food, housing and health care. According to Water Aid (2011), when the fees levied on water is so outrageous that the household must forego other essential human needs such as education, housing, health care, food, clothing, among others, then it is said to be economic inaccessibility to water infrastructure. In the light of this, water is considered to be economically attainable if a family's or a household can only spend 5% and less of its monthly income.

In low developed countries, women and children take on average one hour per journey acquiring water which lessens school attendance and performance in children (Kayser*et al*, 2013 UNICEF, 2006; UNICEF, 2014) and also causes to injury through musculoskeletal disorders and related inabilities due to lifting and carrying water. According to UNDP (2006), in Africa and Asia women trek averagely 6 kilometers distance on a daily basis to fetch water. The end result is the consumption less amount of water as water is having great weight and people have to obtain or carry it for long distances.

The Government of Uganda had projected to achieve a comprehensive water supply and sanitation coverage in all urban centers by 2015. At the time of setting these goals, the government stated access to upgraded water supply as having a revamped water source within a walking distance of one kilometer in rural areas and 200 meters in urban areas (Kayaga*et al*, 2009; MWE, 2014). Efforts to improve access to safe water in Uganda have occurred in the context of wide range institutional and economic reforms, including an adjustment from projects to Sector-Wide Approach, encompassing of the private partners, decentralization of service delivery and shifting the government's role from a service provider to policy maker. All these were done within Uganda's Poverty Eradication Action Plan (PEAP) of 1997 – later streamlined in 2000 and 2004 (GoU 2004; Kiggundu, 2017).

Urbanization, industrialization, agricultural practices and population explosion have caused an increase in demand for water as well as extended flow of contaminants into water sources (Holt, 2000; Seyedeh*et al*, 2013; González *et al*, 2014). Urban activities have a direct effect on water quality within river watersheds because effluents stream into waterways in many occasions without passing through any process of treatment. The major notable contamination sources are those associated to direct and indirect emissions of treated and untreated sewage, runoff, atmospheric deposition and pollution (Pesce and Wunderlin, 2000). Furthermore, improper solid waste disposal leads to contamination of surface and underground water resources that places human health at risk (Kjeldsen*et al*, 2002; Misra*et al*, 2005; Flohr*et al*, 2012; Khan *et al*, 2013; He *et al*, 2016).

The extensively used measure of accessibility of water is the overall quantity of blue water movement in the hydrological cycle (Falkenmark and Rockström, 2004) which is also demonstrated in cubic meters of blue water obtainable for each person. Even though water appears to be abundant on the planet earth, sea water is composed of 97% that makes it to be dangerous for human consumption. Of the remaining 3%, 87% is un-accessible because it is either located far down underground aquifers or is restricted in polar icecaps (Xie, 2006). In accordance with (Cap-Net, 2003), it's only 0.4% of the total amount of water which is in the form that can be accessed and available for human use.

While the water resources are becoming increasingly insufficient, it is significant that water demand and usage is governed effectively before exploring new water sources (Dube*et al*, 2003). According to Hut and Others (2008), water storage is given a high consideration in the arid or semi-arid areas of sub-Saharan Africa. Storage of water from the rainy season to the dry season, or even from wet years to dry years is equally significant. However, water storage is still lacking due to insufficient storage facilities. Most households have medium water storage facilities hence cannot cope with the demand, especially in dry seasons. As such, there is still a considerable amount of untapped rainwater potential in Africa that can be used to supply adequate water to an immense portion of the population (Kinkade-Levario, 2007; UNEP, 2008; Ferguson, 2012).

2.2 Empirical Perspectives

2.2.1 Access to safe Water

A study by Mat (2011) in Kosovo-Mathare slum of Nairobi revealed that a reduction in reliance on informal water vendors and providing public access to water reduced the households' cost of water by 50%, reduced the irregularity of daily water supply by 51%, and also reduced the distance to and from water source and time spent to fetch water by 50%. Provision of water projects to the public and empowering the communities to operate such water projects can indeed improve their access to safe water.

In his study of water supply interventions in slum areas of Nairobi, Nakuru and Kisumu in Kenya, Chakava (2013) found out that making water further affordable by utilizing pre-paid technology lowered the effective cost by 75% and widened consumption per household by 20 liters per day, ensuring the highest service advancement. The study recommended that reviews of the tariff structure for the low income urban earners versus higher income consumers is urgently required, for equitable distribution of this valuable resource and to control exploration of surface and groundwater resources carried out by higher-income consumers.

However, Nganyanyuka*et al* (2014) questioned the extent to which some of these strategies improve challenges of access to water such as quantity, quality, affordability and reliability. Usuk (2015) agreed that access to water interventions in Mukuru and Mathare informal settlements of Nairobi, Kenya, did not meet the national policies or international guidelines. The study recommended that slum upgrading projects should be actualized gradually not only in terms of water supply systems but also other basic services like electricity, housing and roads. In other words, without improving housing and electricity, providing indoor water access remains a huddle and will never improve the slum dwellers' quality of life.

Berg and Mugisha (2010) analyzed pro-poor water utility strategies in Uganda. Specifically, the research examined the way in which public stand pipes and a mixture of other choices can meet both financial restrictions and societal objectives. They identified

technology combinations of yard taps and public water points having or having no prepaid meters for meeting substitute constraints, considering on population supplied and investment demands. These three layouts were found to have unrelated impacts for revamping water accessibility to the large populations in Kampala. Prepaid meters was found only to raise social equity and institutional sustainability, as well as serving as ultimate cost recovery tool in investment plan and also helping to achieve distributive justice for pro poor programs.

Lukubye and Andama (2017) conducted a bacterial analysis of designated drinking water sites in Mbarara Municipality in Uganda. The study found out that all the sampled ground water sources faced contamination of bacterial faecal organisms. Furthermore, sanitary danger assessment of the consumable water sources revealed that a shallow well at Nyamitanga and a shallow well in Kisenyi had high degree of bacterial contamination risk while springs at Kiswahili and Kisenyi had medium contamination chance. The common risks recognized were access by animals within a radius 10 meters of water source; availability of pit latrines within a radius of 30 meters of water source; eroded backfill area; presence of pollution sources (e.g. solid wastes); absence of protective measures a case in point fencing of the water source; and having diversion channels. As such, high level manmade activities (croplands, animal farms, latrines, settlements, landfills, bricklaying, washing sites, and municipal wastes) within the proximity of water sources can compromise the quality of water sources.

Mwirigi (2017) sought to find out the factors that determine customer access to piped water and sanitation services in low income area of Meru town in Kenya. The study revealed that physical parameters and influence of cost to water positively and significantly influence access to piped water and sanitation services. On the other hand, institutional and structural constraints moderately influence positively and significantly to customer access to piped water and sanitation services. His research recommended that water service providers should focus on capacity building for the community for the maintenance of existing water sources and sensitization of the community to participate in water supply needs to be fostered through expression of demand and selection of its

siting, cash contributions and provision of labor and local materials towards project costs and selection of management type.

In a nutshell, Mat (2011) in Kasovo-Mathare slum of Nairobi looked at influence of water supply on the quality of Life of urban informal settlement dwellers, Chakava (2013) researchedon "Transition Stage": water supply intercessions in informal settlements: Kenya while Nganyanyuka and others (2014) studied on accessing water services in Dar es Salaam: Are we counting what counts? and concurred with (Usuk 2015) who investigated on households water accessibility and its effect on quality of life: a case of Mathare and Mukuruslums in Nairobi County, Kenya; Berg and Mugisha (2010) analyzed pro-poor water service strategies in low income countries: promoting justice in Kampala's urban project, Uganda, Lukubyeand Andama (2017) interrogated bacterial analysis of designated drinking water sources in Mbarara Municipality, Uganda and Mwirigi (2017)probed to find out factors that determine customer access to piped water and sanitation services in informal settlements: A case study of Meru town, Kenya.

2.2.2 Challenges to the Provision of Water Supply

According to Brown *et al* (2012) climate change has come up with negative impacts among which prolonged drought have resulted to water shortages in urban settlements. These circumstances have also forced people living in the rural areas to migrate into cities thus putting pressure on infrastructures and services (Locke, 2009). Furthermore, cities have suffered from inadequate water supply from their natural sources and Mbarara municipality is not an exception of such scenarios (Fung *et al*, 2007). A combination of climatic factors for example drought and low levels rainfall, abstraction forces, inadequate infrastructure, infrastructure failures and poor management of catchment has reduced the amount of raw water available for abstraction from river Rwizi which is the only main source of water for National Water and Sewerage Corporation to Mbarara municipality and her neighbourhoods (Songa*et al*, 2015).

Ageing, stressed or poorly sustained distribution system can compromise the quality of drinking water to decline below the accepted level and cause a threat to the health (Lee *et*

al, 2005). Indeed, lack of adequate investments in water infrastructure especially by the governments has registered decline in access to portable water by the urban dwellers (Dagdeviren, 2008). This has been worsen by the many water suppliers having low tariffs collections, insufficient billing, low revenue collection and soaring demand for water (Shirley *et al*, 2002). Moreover, creation of more administrative units and failure of urban planning policies in Uganda has increased the marginalization of slum dwellers as far as service delivery is concerned (Mukwaya*et al*, 2010).

In urban centers, lack of waste water treatment and inadequate control over the waste disposals put water supply systems at the high chances of microbiological and chemical contamination (Haruna*et al*, 2005). Much water is not used because of pollution due to pathogens, nutrients, heavy metals and poor drainage (Matagi, 2001; Janet, 2010). A study by Egor*et al* (2014) on River Rwizi revealed high concentrations of lead and calcium in great amounts than that the WHO guidelines values in drinking. This calls for quick pollution control measures by the concerned stakeholders.

Even though a large number of urban dwellers remain unconnected to the main water supply (Truelove, 2011), it is believed that a lot of water is wasted through leaking taps and pipes, as well as illegal connections (Bapat and Agarwal, 2003; Trow and Farley, 2006). Kleppen (2011) notes that water loss occur in different degrees in all water supply systems and that a half of the water intended for production and distribution remain unaccounted for through distinct ways of wastage.

According to Leak Management Manual (2012) the major causes of water leakages in Uganda are corrosion of internal and external surface of pipe network, excessive load/stress from road traffic, excessive water pressure and water hammer, faulty workmanship , construction and poor design in form of material selection, sizing and lay out. In addition the Office of Auditor General (2009) indicated that non-revenue water in the largest towns of Uganda was at 32.5% by June 2007 against 28.7 % set target by the National Water and Sewerage Corporation best practice of 20%. Additionally, the Asian

Development Bank Report (2007) indicated that water supply interruptions among poor households take longer time than in their richer counterparts.

2.2.3 Coping with Water Scarcity

Ahile*et al* (2015) study on citizens' coping mechanisms with water scarcity in Mkurudi town of Nigeria recommended that the government should increase the budget for water supply projects, for example, by positioning water storage tanks in strategic positions to enable people have unrestricted access to safe water. Mkurudi town residents were also advised to pool resources together for setting up self-help water projects as well as community involvement in water management to curb the vice of water equipment vandalism. Some of the coping strategies with water shortages were rain water reaping; trekking long distances to look for water; digging dry hand dug wells to get water; minimizing water utilization; and storing water in huge containers.

Likewise, Chaminuka and Taurai (2013) conducted an evaluation of water shortage and coping strategies in Harare in Zimbabwe. The coping mechanisms with water shortages were the same as those used by Mkurudi town residents: rain water harvesting, use of trenches and burst water pipes to collect water, use of unprotected shallow wells and use of buckets to store water. The study recommended that municipal authorities should strengthen their ties with Non-Governmental Organizations to source large containers to enable residents store enough water during rainy season for domestic use. Furthermore, municipal authorities should regularize digging of wells and boreholes on residential properties, as well coming up with a sustainable water rationing schedule.

2.3 Summary of Gaps from Literature Review

First, it's believed that urbanization process will proceed in sub-Saharan Africa, Uganda included. The aim is not to stop this process, but rather to maximize on its positive aspects while at the same time minimizing the challenges that comes with it. Extension of water and sanitation, especially in low income areas or slums, is indeed a major challenge that needs constant research, monitoring and evaluation. Sustainable Development Goal 6

emphasizes the need for the provision of safe water to the population as well as sustainability of water resources worldwide.

Secondly, most of the urban growth in sub-Saharan Africa will happen in small and medium size urban centers – which are more-often-than-not given less attention in research and policy documents. Much of the research in urban Africa has often disproportionately concentrated on the major urban centers and cities. Mbarara in Uganda is a medium urban center that is growing very fast and therefore needs to be guided in terms of its growth.

Thirdly, although urban water service providers have taken positive steps in service enhancement, the informal settlements are still doing relatively poorly in terms of reliable water supplies, affordability and safe water. Furthermore, variability of water provision is factor that is usually not taken care of in water studies. Several parts of the world experiences high degrees of seasonal variation in rainfall and river flows, which frequently lead to insufficient water supplies in the dry spells. Inter-annual alterations resulting prolonged droughts bring another amount of stress. Variability may also come from water supply systems which are unreliable.

2.4 The Conceptual Framework

The conceptual framework (Figure 2.1) illustrates that water in urban areas can be provided by both state and non-state performers. The state actor, for example in Uganda, is the National Water and Sewerage Company (NWSC) – which is the government utility responsible to make sure that the urban households are provided with safe and reliable water supply.

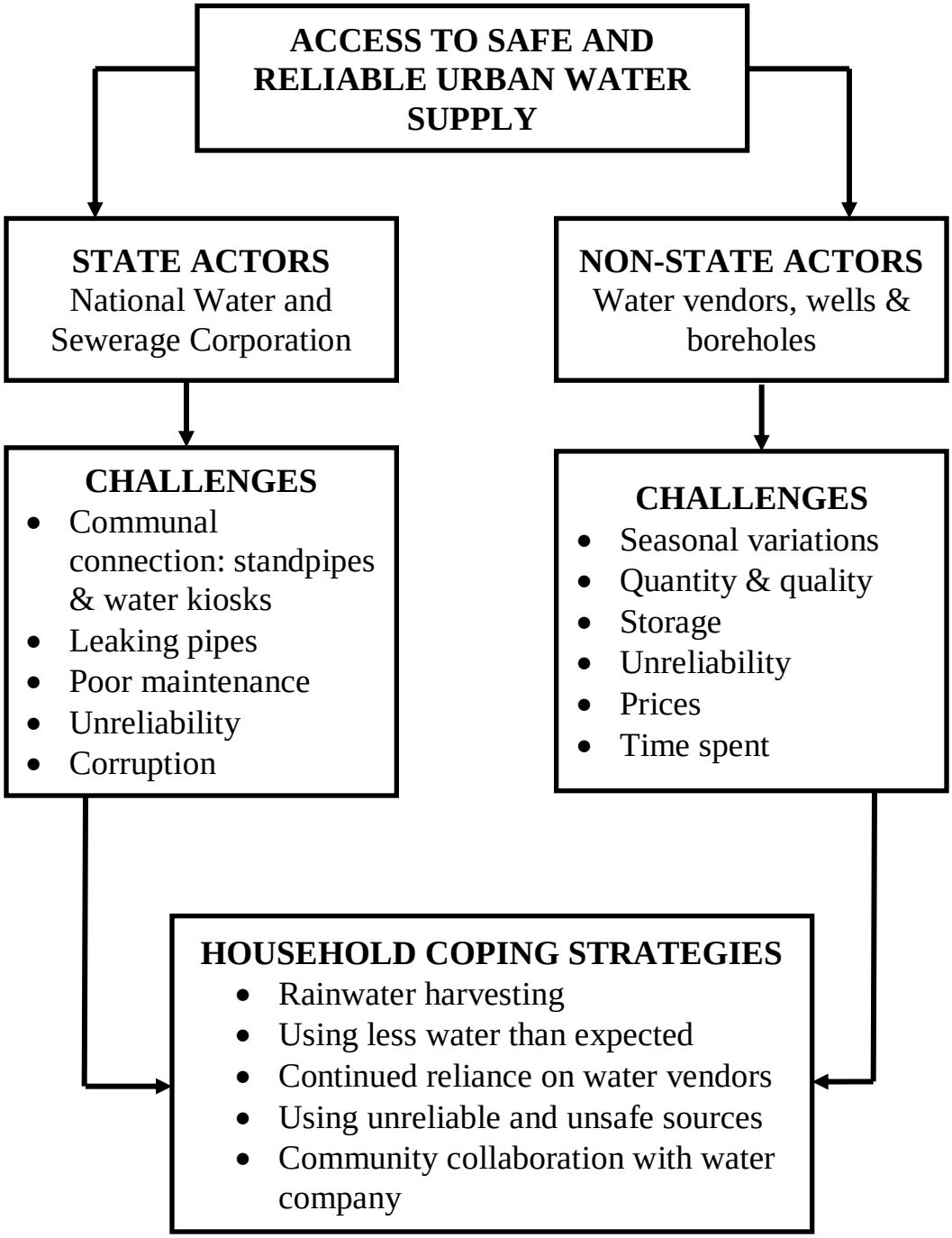
However, the state actors experience a number of challenges that make them unable to achieve their intended mandate. The challenges range from structural inefficiencies, management issues to corruption, which leads to poor service provision. Furthermore, the informal settlements are rarely served in terms of service network coverage and individual connections.

Poor service provision by state has forced citizens and institutions to resort to privatizing the same services through non-state actors. In case of water supply, there is increased reliance on water vendors in many urban centers. The state is mandated to extend water to its residents but in most cases unplanned settlements have not been fully catered for which has attracted private service providers or non-state actors to provide water to such areas.

The provision of water by non-state actors has opened up scholarly debates on issues of water prices, affordability and questions concerning the quality of water that is provided to the residents. Accessibility to sources of water in informal settlements depends on actors involved in water provision; the available water facilities; cost of water; household's preferred option; time taken and distance to water source; family income; and water reliability by the utility.

By the virtue of the unpredictable and undependable supply of water by formal and informal actors, households have adopted a number of coping mechanisms to get or use the only available water. These include: - rain water harvesting, using less water than expected, continued reliance on water vendors, using unreliable and unsafe sources, as well as looking for ways to partner with the water company for better service provision.

Figure 2.1: The Conceptual Framework



Source: Researcher (2017)

The surrounding environments or neighborhoods may determine the quality and quantity of water accessed so that such circumstances can bring satisfaction or stress depending on the individual or household's capacity in terms affordability and desired qualities and quantities. Therefore, modes of water provision for household consumption depend on different functionality of water facilities for accessibility and for their needs. For example, if water is within the dwelling unit, the household is likely to consume more water. However, slightly shifting of water points and yard pipes reduces the amount of water a household consumes and the increases the distance to water source.

CHAPTER THREE: METHODOLOGY

This chapter begins by giving the study area and the methodology used by the study. It outlines the population targeted, sampling techniques, sources and data collection methods, as well as data analysis methods.

3.1 The Study Area

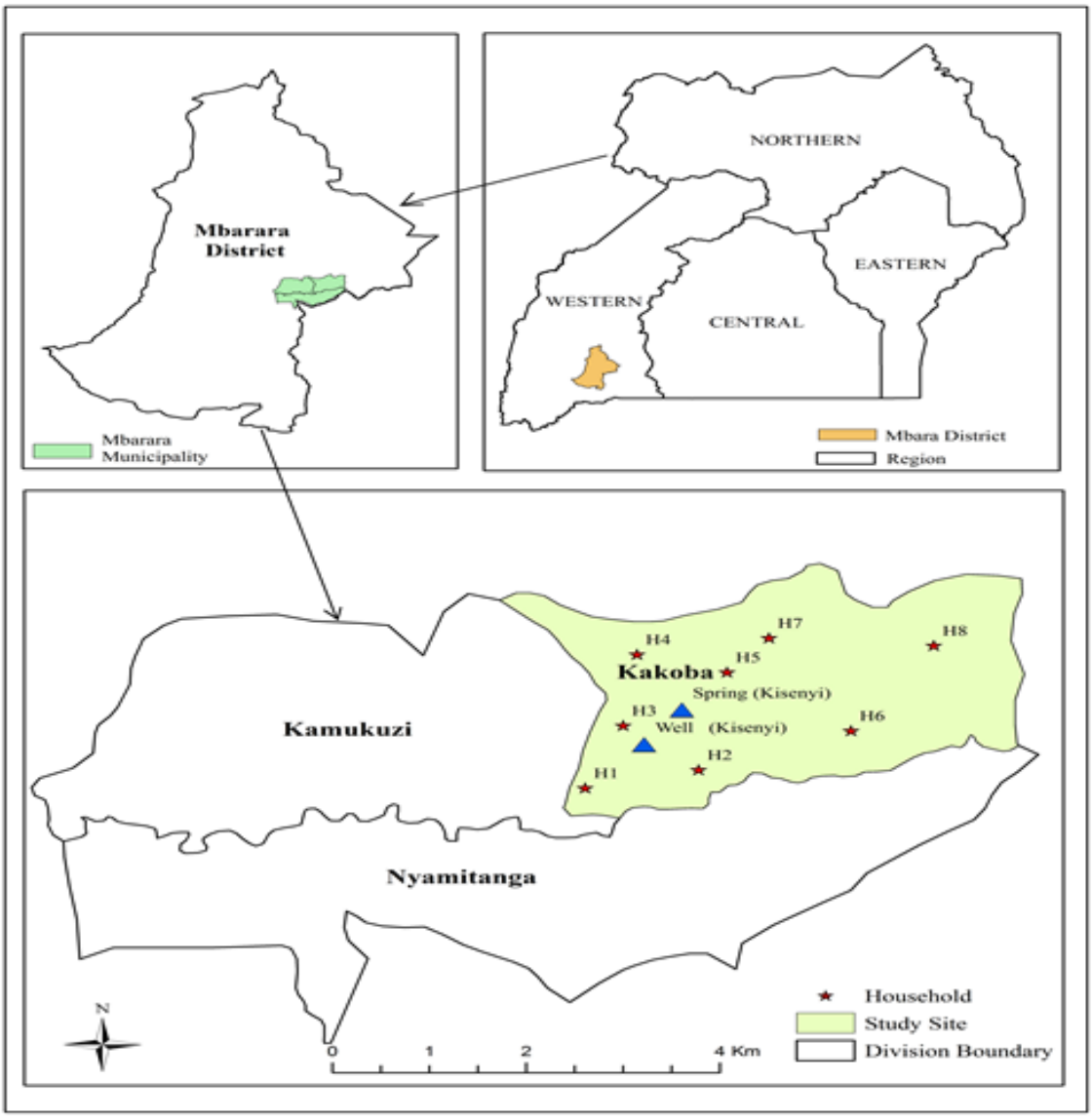
3.1.1 Geographical and Physical Characteristics

Mbarara municipality covers an area of approximately 51.47 square kilometers, shelters the political and administrative head offices of Mbarara District. The municipality has experienced a steady growth due to its location on the Kampala-Kabale-Fort Portal cross roads – the nerve center of many feeder roads connecting all parts of Ankole's vast territory.The municipality has three administrative divisions which are Nyamitanga, Kamukuzi and Kakoba which has many informal settlements including Kisenyi.

The municipality has two rainy seasons, separated by two dry seasons. It has an average annual temperature of 25^{o}C and an average annual rainfall of 1,125 millimetres per year. The topography of Mbarara is characterized by a combination of moderately rolling and sharp hills, fairly deep and shallow valleys and flat land. The soils are loamy fertile literate soils, favorable for agriculture. The vegetation generally comprise of grasslands and woodland savannah with patches of forest covers and some mineral resources. The municipality rests at an average altitude of 1,432 meters above the sea level.

The area of study is Kisenyi informal settlement situated in Kakoba Division in Mbarara Municipality (Figure 3.1). It is one of the informal settlements in Mbarara Municipality, approximately 266 kilometres from the capital city Kampala, on Kampala-Kabale Road, in south-western part of Uganda. Kisenyi settlement covers an area of 366.8 acres of land, has an estimated 4,000 people living in 500 households. Businessmen from Kampala named the area Kisenyi after the Kisenyi slums in Kampala, which is also known as a place of robbers.

Figure 3.1: Mbarara Municipality



Source: Lukubye and Adama (2017)

3.1.2 Human Characteristics

Population

Kakoba Division has a total population of 55,540 people: 27,578 males and 27,962 females (Table 3.1). It has 16,732 households with an average household size of 3.1 (UBOS, 2017). Kakoba has the highest population compared to other divisions in Mbarara municipality. The municipality is densely populated and is experiencing rapid rise of unplanned settlements.

Economic activities

Majority of the residents in Kisenyi informal settlement are business people and traders who operate small retail shops, food groceries, salons, food kiosks and stalls, charcoal selling businesses, largely as a source livelihood. Notably, operating motorcycles (commonly known as *bodaboda*) is also a common, mainly by the youth. According to Act Together (2010) the majority of these motorcycle operators earn an average income of UGSH 3000 shillings per day. Generally, the Kisenyi's economy is established on businesses, public service sectors, informal sector activities, trade and industries ranging from medium to small manufacturers.

Table 3.1: Population of Mbarara Municipality

Divisions	Male	Female	Total
Biharwe	10,809	11,098	21,907
Kakiika	10,385	11,292	21,677
Kakoba	27,578	27,962	55,540
Kamukuzi	16,974	17,914	34,888
Nyakayojo	18,852	19,333	38,185
Nyamitanga	11,081	12,044	23,125
Total	95,679	99,643	195322

Source: Mbarara District Statistical Abstract 2016/2017

Service Provision

The National Water and Sewerage Corporation (NWSC) serve over 47.5% of the residents of Mbarara Municipality. The remaining part of the inhabitants, and especially those in the informal settlements (including Kisenyi), survive on unprotected water sources such as Rwizi River, Lake Kiyanja, protected springs, boreholes, wells and rainwater.In the municipality water vending of water by private individuals is also a common practice. Due to rapid urbanization, Mbarara municipality is faced with various service provision challenges such as poor management of waste, provision of enough and affordable housing, provision of clean and safe water and extension of proper health care services.

Being an informal settlement, Kisenyi is characterized by lack of planning, poor housing conditions, tenement (locally known as mizigo), overcrowding, high housing density, mixed land uses, vulnerability to disasters and health hazards, as well as lack of public services and infrastructure (see Photo 3.1). Whereas land tenure in the informal settlements of Uganda is obtained through procuring of occupancy licenses, which permit rights of occupancy for a specified period time and are renewable, most people settle in these settlements illegally.

Plate 3.1: Kisenyi Informal Settlement in Kampala

Source: http://actogether.blogspot.co.ke/2011/07/

3.2 Research Methodology

3.2.1 Target Population and Sample Size

The selected population comprised of 500 households, 72 water vendors and 5 officials from the National Water and Sewerage Corporation (NWSC). Out of these, 200 households, 15 water vendors and 2 officials from the National Water and Sewerage Corporation were sampled for the study (see Table 3.2). The sample size of 200 households was determined using the equation advanced by Krejcie and Morgan (1970) when they calculated the size of the sample for known population applying the formula as follows:

$$s = X^2NP(1-P) \div d^2(N-1) + X^2P(1-P)$$

Where:

s = needed sample size

X^2 = table value of chi-square for 1 degree of freedom at the desired confidence level (3.841)

N = population size (500)

P = population proportion (assumed to be .50 since this would provide the maximum sample size)

d = degree of accuracy expressed as a proportion (.05)

As such:

3.841 x 500 x 0.5(0.5) ÷ 0.05 x 0.05(499) + 3.841 x 0.5(0.5)

= 480.125 ÷ 1.2475 + 0.96025

= 480.125 ÷ 2.20775

= 217.47

Table 3.2: Target Population and Sample Size

Category	**Target Population**	**Sample size**
Households	500	200
Water vendors	72	15
Officials from NWSC	5	02

3.2.2 Sampling Procedure

The study used both probability and non-probability sampling methods in order to obtain detailed data from the targeted population sample that is probability sampling was used to determine household sample size as follows:-

The population of Kisenyi was estimated to be 4000 people who were believed to be residing in about 500 households which were selected as the target population for this study (Act Together, 2010).

The selection of the 200 sampled households was done using simple random sampling procedure where every household had a chance of being selected. Numbers were drawn out of a box to choose household to participate in the study, while taking into account the researcher's accessibility to some parts of the settlement. Furthermore, care was taken to spread the sample in lower, central and upper Kisenyi areas with the guide of Kisenyi local council one chairperson who knew the boundaries of the area.

Non-probability sampling was used to determine the sample size of water vendors who were selected using snow-ball sampling procedure, while the two National Water and Sewerage Corporation officials were selected using purposive sampling since they had technical knowledge, proficiency and experience regarding safe water access as they were responsible for water supply in Kisenyi informal settlement and Mbarara municipality at large.

3.2.3 Sources and Methods of Data Collection

The study utilized both primary and secondary data. Primary data was gathered through pre-coded questionnaires which focused on getting information geared to achieving the study objectives. These are:- sources of water; time and distance to water source; price of water; perception on water quality; reliability of water supply; options to improve water supply; preferred option to water supply; investments to water supply; management to water supply; and household conservation and coping mechanisms. On the other hand, secondary data was sourced through use of existing literature from textbooks, articles and journals, newspapers, government of publications, internet sources, research theses and projects relevant to the objectives of the study. These secondary sources of data comprised of both published and unpublished materials from different institutions in water and sanitation sectors ranging from local to international sources.

Before the data collection exercise, the household questionnaire was discussed with colleagues, pre-tested in Kisenyi informal settlement and thereafter revised to accommodate the emerging changes. During data collection, ethical issues were

considered such as proper introduction, having a research permit, explaining the research instrument and stressing about confidentiality of the respondents and responses.

3.2.4 Methods of Data Analysis

Data from the completed questionnaires was first cleaned for errors and inconsistencies and then coded before being entered into the Statistical Package for the Social Sciences software platform. This was then used to produce frequency distributions (tables, pie-charts and graphs) and cross-tabulations that were used to describe the sample data.

Qualitative data gathered from water vendors and National Water and Sewerage Corporation officials was then subjected to content analysis for better interpretation in relation to the study objectives which were being investigated.

CHAPTER FOUR: RESULTS AND DISCUSSION

The overall objective of this research was an assessment of access to household water supply in Kisenyi informal settlement, Mbarara municipality, Uganda. This chapter gives the results of the research and discussion based on the three objectives: 1) to assess the access-to-safe water in Kisenyi informal settlement; 2) to determine the challenges to provision of water in Kisenyi informal settlement; and 3) to establish households coping strategies to water scarcity and options to improve water supply in Kisenyi informal settlement. However, the chapter starts by giving an overview of the characteristics of the sampled households.

4.1 Characteristics of the sampled Households

Unlike what is found in many informal settlements, households in Kisenyi had relatively fewer household members (Table 4.1). About one-third of the households had one or two household members. Another 40% of the households had three or four household members, while 25% had more than four household members.

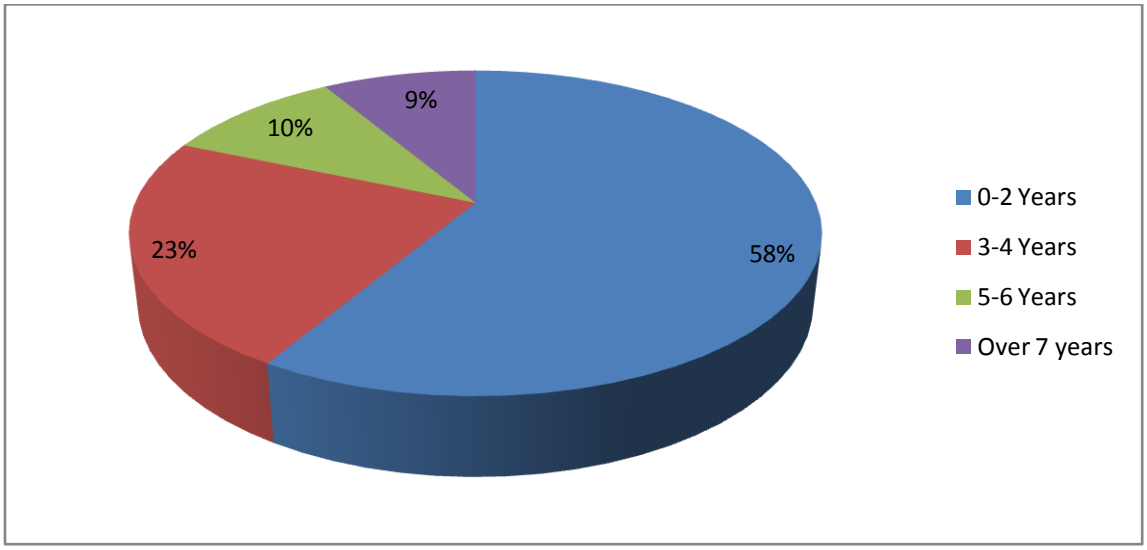
Table 4.1: Number of Household Members

	Frequency	Percent
1-2	69	34.5
3-4	81	40.5
5-6	37	18.5
7+	13	6.5
Total	200	100.0

Source: Fieldwork (2017)

More than half of the households (59%) had not lived in Kisenyi for a long period (Figure 4.1). They had stayed in the settlement for up to a maximum of two years. About one-quarter (23%) had stayed between 3-4 years, while the rest had lived in the informal settlement for 5 years and more.

Figure 4.1: Number of Years Stayed in Kisenyi

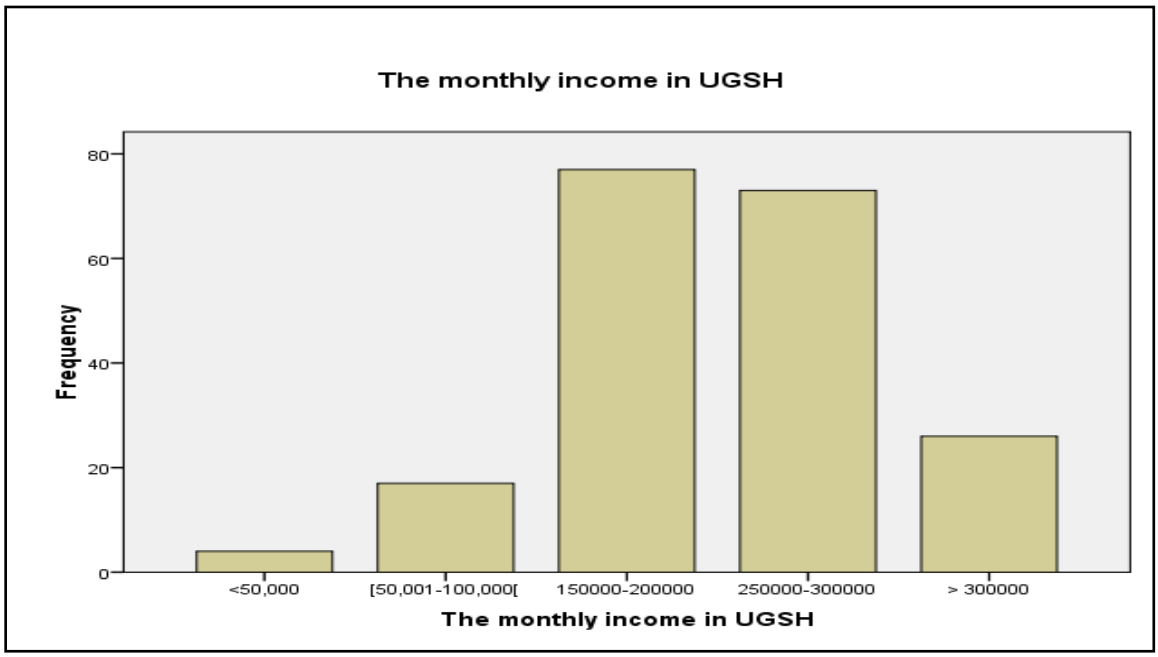


Source: Fieldwork (2017)

In terms of monthly income, three quarters of the households either earned between UGSH 150,000-200,000 (39.1%) or UGSH 200,000-300,000 (37.1%). Fewer households had a monthly income of UGSH 300,000 and above (13.2%) as well as UGSH 100,000 and below (10.6%) (Figure4.2). Even then, the majority of the informal settlement residents were engaged in the informal sector. From the other point of view, monthly expenditure varied on most items.

Generally most expense is experienced on rent and food. More than 70% of the households spend above UGSH 30,000 on rent and food, respectively. Notably, charcoal seemed to more be expensive than water, paraffin and fuel wood (Table 4.2). Reliance on charcoal and wood fuel has resulted to the destruction of water catchment areas of River Rwizi as well as causing indoor air pollution especially for women and children who are in charge of food preparation within the overcrowded dwellings. Furthermore, cutting of trees for charcoal has also accelerated pollution of both soil and water which has increased the cost of water treatment by the National Water and Sewerage Corporation.

Figure 4.2: Household's Monthly Income



Source: Fieldwork (2017)

Table 4.2: Household's Monthly Expenditure

	Rent	**Water**	**Char-Coal**	**Para-ffin**	**Wood Fuel**	**Food**	**Clothes**
	N=197	N=198	N=183	N=99	N=23	N=194	N=188
≤10,000	1.0	71.7	22.4	84.8	56.5	3.6	22.3
10,001-30,000	25.4	27.3	70.5	9.1	30.4	19.6	52.7
30,001-60,000	40.1	.5	6.0	4.0	8.7	40.7	19.1
60,001-90,000	23.9	.5	1.1	2.0	4.3	19.1	3.7
≥90,001	9.6	0	0	0	0	17.0	2.1

Source: Fieldwork (2017)

4.2 Access to Safe Water

4.2.1 Sources of Water

The main source of water in Kisenyi is water supplied by the National Water and Sewerage Corporation (NWSC), accessible to three quarters of the households (Table 4.3). However, this is more often than not in the form of shared stand-pipes connected to the main NWSC network rather than in-house individual connections. Another 18% of the households relied on public taps see **Plate 4.3** which charged water at a relatively higher price. Other sources of water – shallow wells, water kiosks, handcarts and tankers were not commonly used by the Kisenyi residents.

Provision of water by the NWSC has therefore improved access to safe water in the settlement. In other words, reliance on unprotected water sources has greatly reduced. The water vendors also sourced their water from the National Water and Sewerage Corporation. Five vendors relied on bulk water provided by the Corporation, two vendors relied on a water kiosks and one vendor relied on a borehole. The rest of the vendors sourced their water from wells, springs, rivers and ponds. This is mostly common throughout the dry spell when they undergo acute water shortage due to water rationing.

Table 4.3: Main Sources of Water for Households in Kisenyi

	Frequency	**Percentage**
NWSC	151	75.5
Public taps	36	18.0
Shallow well	2	1.0
Water kiosk	6	3.0
Handcart	4	2.0
Tanker	1	0.5
Total	200	100

Source: Fieldwork (2017)

Plate 4.1: Public Tap in Kisenyi slum

Source: Fieldwork (2017)

4.2.2 Time and Distance to Water Source

The landlords in Kisenyi have provided stand-pipes in most of the rental structures. As such, about half (53%) of the households had on-plot source of water (Table 4.4). One-

third (32.5%) of the households spend less than 10 minutes to their water source. The rest of the households, fewer in number, took between 10 to 20 minutes (11.5%), between 21 to 30 minutes (2%) or took more than 30 minutes (1%).

Table 4.4: Time and Distance to Water Source

	Frequency	Percentage
On Plot	106	53.0
Less than 10 Minutes walking	65	32.5
10-20 Minutes walking	23	11.5
21-30 Minutes walking	4	2.0
More than 30 Minutes walking	2	1.0
Total	200	100.0

Source: Fieldwork (2017)

The increased number of stand pipes or yard taps has reduced the distance and time spent by Kisenyi residents to fetch or collect water from their water sources. However, the flow of water from the stand-pipes is never reliable from the service provider (NWSC) or collection times may be controlled or restricted by the landlords. Furthermore, the nearer the household to a water source the more the water consumed and vice versa.

The time taken to fetch water may be influenced by several factors such as reliability of the flow of water, stand-pipes or yard taps operation hours and the season. For example, the situation becomes worse during the dry season when the residents have to endure relatively longer times of looking or queuing for water.

4.2.3 Cost of Water

The price of water was determined in terms of the price of water per 20 liter jerry-can. Majority of the households purchased water at a cost of between UGSH 100 and 200 per jerry-can, while another 22.7% paid between UGSH 300 and 500 per jerry-can (Table 4.5).

Table 4.5: Cost of Water

(Cost in UGSH)	Frequency	Percentage
Less than 100	18	9.1
100-200	131	66.2
300-500	45	22.7
More than 500	4	2.0
Total	198	100

Source: Fieldwork (2017)

The cost per jerry-can is relatively higher than the price of water in middle and high income neighborhoods (UGSH 20 for 20 liters). Water vendors who buy bulk water from NWSC resell the same water at a relatively higher price. As such, the price of water increases as per the amount of water consumed reduces in a household. Subsequently, lack adequate money to purchase water means insufficient water supplies to the dwellings. The daily amount of water consumed by dwellings varied as shown in Table 4.6.

Table 4.6: Daily Household Water Use

	Frequency	Percentage
1 Jerry-can	78	39.0
2-3 Jerry-cans	95	47.5
4-6 Jerry-cans	23	11.5
More than 6 Jerry-cans	4	2.0
Total	200	100

Source: Fieldwork (2017)

It is evident that the majority of the households use between 1 and 3 jerry-cans of water in a day. According to NWSC parameter for defining poverty in Uganda, 39% of Kisenyi households were below the poverty line since they had a lower water usage of 0-20 Liters per Capita per Day (LCPD) which is equivalent to 3.6 m^3 per month for a dwelling of six members, as they used this water purposely for drinking and food preparation.

4.2.4 Perception on Water Quality

There was mixed reactions about the quality of water, especially for drinking. Slightly more than half (55.5%) of the respondents indicated that they used water which is "not safe" for drinking, while 45.5% indicated that the water is "safe" but still took precautions to treat it for drinking purposes. The common mode of treating water for drinking was boiling, followed by use of chemicals and filtering (Table 4.7). It is important to note that households used multiple methods of treating water for drinking.

Table 4.7: Mode of Treatment of Water for Drinking

	Frequency	**Percentage**
Boiling	164	82.4
Use of chemicals	21	10.6
Filtering	10	5.0
Others	4	2.0
Total	199	100

Source: Fieldwork (2017)

4.2.5 Reliability of Water Supply

Almost three quarters (71.9%) of the households indicated that they experience interruptions in water supply from the main source (NWSC network). The interruptions to water supply could take a day or several days (Table 4.8). Thirty-nine percent of the households acknowledged that they had experienced water supply interruptions of between 1-3 days. Another 29.5% reported that they experience water supply interruption for less than a day. Another 20.5% experienced water supply interruptions of between 4-6 days, while 11% had experienced the same for more than 6 days.

According to the respondents, water supply interruptions occur during the dry season or because of leaking taps and pipes (Table 4.9). Water rationing occurs during the dry season, as well as low water pressure. Leaking pipes occur during construction works or

because of the ageing water pipes. During the dry season, Kisenyi residents have to wake up early, spend longer hours or cover longer distances to look for water.

Table 4.8: Number of Days of Water Supply Interruptions

	Frequency	Percentage
Less than 1day	43	29.5
1-3 days	57	39.0
4-6 days	30	20.5
More than 6 days	16	11.0
Total	146	100

Source: Fieldwork (2017)

Table 4.9: Causes of Water Supply Interruptions

	Frequency	Percentage
Taps/pipes leak	58	39.7
Dry season	65	44.5
Pollution of Water Source	06	4.1
Lack of Maintenance	12	8.2
Others	05	3.4
Total	146	100

Source: Fieldwork (2017)

4.3 Challenges to Provision of Water

The challenges to provision of water were measured largely in terms of accessibility, cost of water, quantity of water and quality of water (Table 4.10). Leading the hierarchy is the quantity of water. The number of water jerry-cans per households' use on a daily basis is not sufficient for the residents demand. This is related to the cost of water, unreliability of water supply, increased population, water rationing and lack of water during the dry season.

The second challenge was accessibility. Most stand-pipe, yard pipes and water kiosks operate according to pre-determined schedules. Some water kiosks close as early as 6 pm in the evening. Furthermore, there is rampant non-payment of water bills, corruption, illegal connections, and delayed connections, altering of water meter readings, leaking pipes and delayed repairs that may directly or indirectly cause lack of water. Water quality is also compromised because of the same factors, as well as pollution of water sources by human activities. Lastly, some households cannot afford to buy the amount of water they need per day.

Table 4.10: Challenges to Provision of Water

	Frequency	**Percentage**
Access	44	22.1
Price	35	17.6
Quantity	52	26.1
Quality	36	18.1
Others	32	16.1
Total	199	100

Source: Fieldwork (2017)

The water vendors enumerated the following challenges:

1. High prices of water. According to the vendors, the price of 40 jerry-cans of water was increased from UGSHS 1,900 to 2,650 by the water company (NWSC). This is an average of UGSHS 66.25 per jerry-can. This implies that the vendors transfer this cost to the consumers by selling one jerry-can of water at UGSHS 100 and above – making water very expensive to the final consumers. As such, pro-poor policies are yet to be implemented in Kisenyi informal settlement.
2. Water rationing which is still rampant in the informal settlement as most of the water is supplied to high and middle income neighborhoods. Water vendors reveled that water was not available from NWSC public taps ranging from one day to three days but this however worsens during the dry season where it extends even beyond one week and it is always available for two hours during the night from 3am to 5am. This

makes the vendors to resort to unsafe water sources to meet the water demand from their customers.

3. Low water pressure resulting in long hours of queuing to look for water. The vendors stressed that depending on the season of the year for example during the wet season they spent between 5-6 hours and above see **Plate 4.2** below but during the dry season it can even take a day which also results into fights and assaults due to high competition for water.
4. Theft of water meters and taps which forced water vendors and households to resort to plastic taps see Plate 4.3 public tap with a plastic head tap unlike the metallic ones

Lastly, the National Water and Sewerage Corporation outlined the following challenges:

1. Old and dilapidated network which cannot sustain the present demand and increase in population see for example **appendix Plate 4.3.**
2. Illegal water connections, leakages, cutting of water pipes during construction and lack of water stoppers.
3. Low levels of water in river Rwizi which is the NWSC only major source of raw water and it worsens during the dry season.

Plate 4.2 Girls fetching water on long queue of jerry cans in one of the water kiosks in Kisenyi.

Source: Field Work (2017)

4.4 Households Coping Strategies to Water Scarcity and Options to Improve Water Supply

4.4.1 Households Coping Strategies to Water Scarcity

Kisenyi residents have a number of coping strategies to water scarcity and shortages (Table 4.11). These are storage of tap and rain water using buckets, jerry-cans and small tanks (37.8% of the households); resorting to buying water from water vendors and water carriers (20.1%); resorting to fetch water from rivers, ponds and streams (16.8%); buying water from kiosks and stand pipes (9.2%); resorting to collect water from boreholes and springs (5.9%); begging for water from neighbors (5%); and using the available water sparingly (5%).

Table 4.11 Households Coping Strategies

	Frequency	Percentage
Storage of tap and rain water in containers	45	37.8
Purchasing water from vendors/carriers	24	20.1
Fetching water from rivers/ponds/streams	20	16.8
Procuring water from kiosks and stand pipes	11	9.2
Fetching water from boreholes/springs	07	5.9
Begging for water from neighbors	06	5
Using water sparingly	06	5
Total	**119**	**100**

Source: Fieldwork (2017)

4.4.2 Households Preferred Option for Water Supply

Most households in Kisenyi informal settlement suggested that they preferred individual connections as their main source of water (Table 4.12). Over 70% of the households were willing to have water connection in their dwellings from NWSC to ensure equity, accessibility and sustainability for the informal settlement residents. However, this can only be possible through subsidized water connections and pricing, as well as block tariffs. Other fewer households preferred stand pipe connections and/or water kiosks.

Table 4.1.2: Households Preferred Option for Water Supply

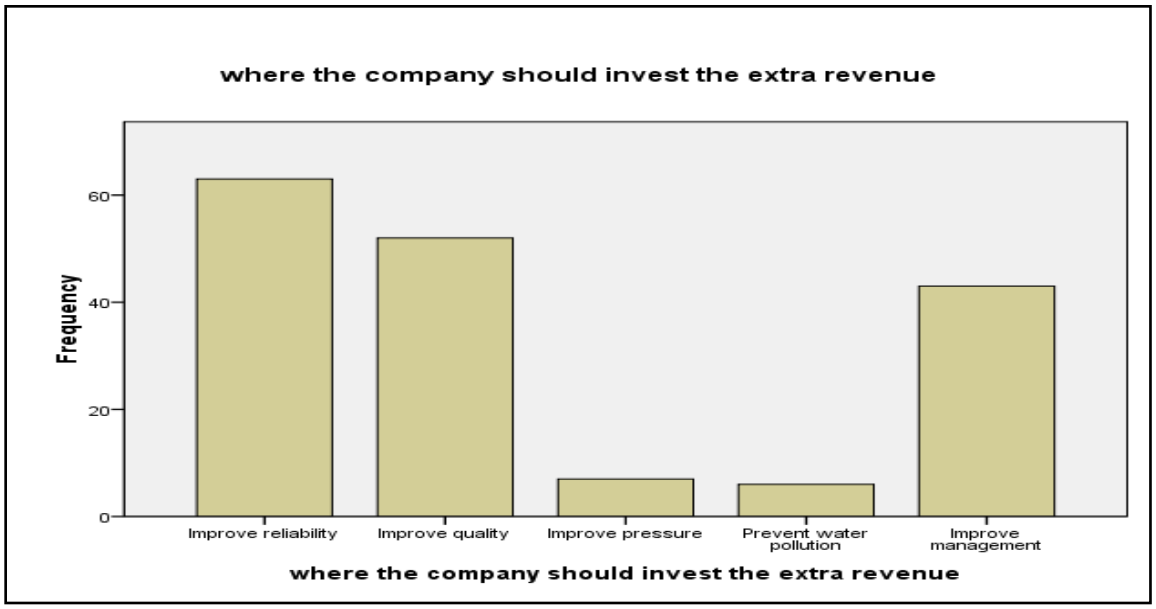
	Frequency	Percentage
Stand pipe	20	12.5
Water kiosk	22	13.8
Individual connection	117	73.1
Others	1	0.6
Total	160	100

Source: Fieldwork (2017)

4.4.3Investment in Water Supply

The respondents suggested some investment in water supply to improve their accessibility to water supply. About one third (35.8%) of the households preferred that NWSC should focus its investment to improve reliability of water supply (Figure 4.4). As much as Kisenyi is connected with stand-pipes and yard taps, water supply is unreliable. The second investment priority was to improve the water quality (30.1% of the respondents). According to the respondents, the existing water supply sometimes has visible impurities and cannot be trusted for drinking. The water quality may also be compromised by improper solid waste management or by storm water. Improvement of management was also highlighted by 21% of the respondents. This is basically managing burst water pipes, repairs, company losses, corruption and good service delivery. Other investment priorities were improving the water pressure and preventing water pollution.

Figure 4.5: Investment in Water Supply



Source: Fieldwork (2017)

Although, the National Water and Sewerage Corporation outlined the following measures in addressing water supply challenges in Kisenyi:-

1. Addition of more slum dwellers willing to be connected to water mains and diverting some water pipes to Kisenyi informal settlement.

2. Constant detection of illegal water connections and water pipe leakages.
3. Ensure reliability in water supply, good water pressure and network coverage in Kisenyi.
4. Quick action to complaints from clients.

4.4.4 Management and Conservation of Water

The respondents believe that it is the duty of the water company (NWSC), together with the private operators to manage and conserve water (Table 4.13). So far, the respondents applaud NWSC for extending water connection to the settlement, timely billing system, improved connection time after application, and reduced connection fees.

Table 4.1.3: Responsibility to Management and Conservation of Water

	Frequency	**Percentage**
NWSC	84	42.2
Local Council leaders	24	12.1
Private operators	80	40.2
Community Based Organizations	8	4.0
Others	3	1.5
Total	199	100

Source: Fieldwork (2017)

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

This chapter presents the summary of results, conclusions and recommendations grounded on the three objectives of the research: 1) to assess the access-to-safe water in Kisenyi informal settlement; 2) to determine the challenges to provision of water in Kisenyi informal settlement; and 3) to establish households coping strategies to water scarcity and options to improve water supply in Kisenyi informal settlement.

5.1 Summary of Findings

5.1.1 Access to Safe Water

National water and sewerage corperation (NWSC) is the main supplier of water which is supplied mostly inform of shared stand pipes or yard taps at 75.5% in Kisenyi informal settlement.This has greatly reduced the reliance on unprotected water sources.

The time and distance to collect water has been greatly reduced since 53% had water taps on plot and it's attributed to landlords complying with the guideline set by the ministry of water and environment which stipulates water points to be located within a radius of 200 meters for urban areas.

The price of water per 20 liter jerry can is relatively high because 66.2% paid 100 and above which implies that the amount of water consumed per household in Kisenyi is still not satisfactory.

The quality of water is not considered to be safe and therefore mixed methods of water treatment are employed while boiling water is still common with 82.4 percent.

In terms of water reliability,at least each household experienced water interruptions ranging from one day to several days and it's believed that the dry spell and taps/pipe leakages were highlighted to be the major cause of water supply interruptions.

5.1.2 Challenges to Provision of Water

Even though NWSC has improved water situation in Kisenyi informal settlement several challenges are still being faced:-

To begin with the quantity of water consumed perday at 26.1percent was not enough for the majority of households daily demand and this was associated to the high price of water, unreliability of water supply, increased population in the area, water rationing and lack of water during the dry season.

Secondly,household water accessibility 22.1percent was found to be the major challenge since water operators of stand pipes/yard taps worked on pre-determined schedules,disconnection due to non- payment of water bills,illegal connections and delayed repairs which all curtailed water access.

Other challenges noted on water provision were; pollution of water sources by human activities, low water pressure resulting in long hours of queuing for water, theft of water meters and metallic taps, old and dilapidated network which cannot sustain the present demand and increased population, leakages, cutting of water pipes during construction and lack of water stoppers for blocking water leakages and low levels of water in river Rwizi which is the NWSC only major source of raw water and it worsens during the dry season.

5.1.3 Households Coping Strategies to Water Scarcity and Options to Improve Water Supply

Water scarcity in Kisenyi informal settlement has compelled residents to come up with coping mechanisms which include: - storage of water and rain water in containers at 37.8 percent,buying from water vendors or carriers with 20.1percent, hauling water from river/ponds/streams with 16.8 percent, fetching water from bore holes or spring wells,begging water from neighbors and using water efficiently.

However, the residents had their options which they thought ware key to improved water supply:-

The slum dwellers preferred individual household or in-house water connection at 73.1 percent and they believed it would ensure that there is equity,accessibility and sustainability by the water utility.

The residents prefered NWSC to improve on water reliability by improving water pressure and also improve water quality.

The residents vested their trust in NWSC 42.2 percent and private partners 40.2 respectively to manage and conserve water so as to improve water supplyin the area.

5.2 Conclusion

The study revealed that NWSC is the major supplier of water to the inhabitants of Kisenyi informal settlement through stand posts or yard taps at 75.5 percent and water kiosks 18 percent.Although NWSC has improved the access to safe water by reducing the large number of residents relying on unprotected water sources, water prices are still considered high and water supply in most cases is un-reliable.

Despite the efforts by the NWSC water utility to supply water in Kisenyi informal settlement a number of challenges are still looming in regard to water supply which include:- low quantity of water consumed per household per day at 26.1percent,low water access at 22.1 percent, high cost of water,unreliability of water,water rationing, illegal connections,failure to clear bills in time,low water pressure and dilapilated old water net work.All these challenges have forced residents to come up with coping mechanisms to water shortage and scarcity which is not limited to storing water in containers at 37.8 percent,buying water from vendors with 20.1 percent,fetching water from ponds/streams/rivers 16.8 percent,begging water from neighbors and using water sparingly both with 5percent respectively.The study recommends that pro-poor strategies which were piloted in Kampalas informal settlements need to be replicated in other informal settlement for medium urban centers like Kisenyi to enhance water accessibility in slums.Improving infrastructure development in informal settlement by extending good

road network,improved housing will enhance access to safe water by promoting household water connections which was the residents preferd option. This will enhance attainment of sustainable development goal number six by ensuring access to safe water and water resource sustainability.

5.3 Recommendations

5.3.1 Policy Makers

The government and NWSC can mobilize funds to construct a reservoir dam to channel raw water from the river Rwizi during rainy seasons which can be treated and supplied most especially during the dry spells so as to ensure continued water supply to the low income areas.

There is a need to conserve existing natural water sources for this case river Rwizi which its water levels are reducing drastically due to degraded riparian and other water source towers so as to ensure reliable water supply to present and future generations.

Public private partnership need to be brought on board so as to tackles issues of water storage facilities to household especially in slums who are victims of price exploitations during the times of water shortages so as to invest in water projects like rain water harvesting storage technologies like roof catchment,borehole drilling among others.

NWSC utility should prioritise in reduction of Non Revenue Water(NRW),replace the old dilaplited water supply system so as to match the current population demands.

5.3.2 Future Researchers

The study recommends for a comprehensive investigation to be undertaken on influence of infrastructure and water governance for effective supply of water in informal settlements.

There is need to examine the sanitation situation by integrating participatory approaches to promote ownership and good governance of such facilities in informal setllements for intermediate urban areas which was not captured in this study.

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APPENDICES

HOUSEHOLD QUESTIONNAIRE

PART ONE: HOUSEHOLD PROFILE DATA

1. Name of respondent (optional)

2. Sex 1) Male 2) Female

3. How long have you been staying here?

   1) 0-2 years 2) 2-4 years 3)4-6 years 4) over 6 years

4. How many people reside in this household?

   1) 1-2 2)3-4 3) 5-6 4)7 and above

PART TWO: HOUSEHOLD SOCIAL-ECONOMIC DATA.

5. What is your monthly income in UgSh?

≤50000	100,000-150,000	150000-200,000	250,000-300,000	≥ 300000

6. How much do you spend on the following?

Item	≤10,000	10,001-30,000	30,001-60,000	60,001-90,000	≥ 90,000
Rent					
Water					
Charcoal					
Fuel-wood					
Paraffin					
Food					
Clothing					
Others					

PART THREE: ACCESS TO WATER

	Source of water	Main source of water	Use of water	Distance to water source	Buy the water	If buy cost per jerry can	Quantity used per day	Clean and safe for drinking	Mode of water treatment
NWSC									
Public taps									
Bore hole									
Shallow well									
Water kiosk									
Carrier/hand carts									
Tankers									
Others									
Uses of water:1) Drinking; 2)Cooking; 3) Washing/cleaning; 4)Other									
Distance to water source: 1) On plot; Off plot; 2) <10 min walking; 3) 10-20 min walking; 4) 21-30 min walking; 5) >30 min walking									
Buywater/Treat water/Clean and safe for drinking: 1) Yes; 2) No									
Cost per jerry can: 1) <100; 2) 100-300; 3) 300-500; 4) >=500									
Quantity used per day (20 litrejerry cans): 1) <1 Jerry can; 2) 1-3 Jerrycans; 3) 4-6 Jerrycans; 4) >=7 Jerry cans									
Mode of treatment: 1) Boiling; 2) Use of chemicals; 3) Filtering; 4) Others									

PART FOUR: CHALLENGES TO WATER PROVISION

6. Does your household experience interruptions/breakdown in the water supply from the main source?1) Yes; 2) No

7. During interruptions/breakdown, how many days is water not available from the main source?

1) <1 day; 2) 1-3 days; 3) 4-6 days; 4) >7 days

8. What are causes of interruptions/breakdown in the water supply from the main source?

1) Taps/pipes leak; 2) Dry season; 3) Pollution of the water source;

4) Lack of maintenance of the water source; 5) Others

9. What do you consider to be the biggest problem with water provision in Mbarara?

1) Access; 2) Price; 3) Quantity; 4) Quality; 5) Others

PART FIVE: COPING STRATEGIES TO WATER SHORTAGES

9. In case of improvement in water supply services are you willing to be connected to water supply?1) Yes; 2) No

10. If yes, what option would you prefer?

1) Stand pipe; 2) Water kiosk; 3) Individual connection; 4) Other

11. If Water Company further improves its water service, for example by providing better quality water that you could drink directly from the faucet, would you be willing to pay more for your water? 1) Yes; 2) No

12. If you are willing to pay more for water, where would the water company invest extra revenue?

1) Improve reliability; 2) Improve quality; 3) Improve pressure;

4) Prevent water pollution; 5) Improve management

13. Have you ever noticed any propaganda on water conservation? 1) Yes; 2) No

14. In your opinion, who can be relied upon for effective water supply and water conservation?

1) NWSC; 2)Local Council Leaders; 3) Private operators;

4) Community Based Organization; 5) Other

15. If the government offers subsides to household to improve the existing water systems would you be willing to participate in the program? 1) Yes; 2) No

16. In your opinion, what are the water storage strategies resulting in water shortages in Mbarara municipality

FOCUS GROUP DISCUSTION WITH COMMUNITY GROUPS

1. Who are the main suppliers of water in Mbarara

2. What is the current water situation in Mbarara municipality in terms of?
   a) Availability; b) Quality; c) Quantity; d) Reliability

3. What are the factors responsible for the current water situation?

4. How can the situation be improved?

5. How would the improvement impact on your daily activities?

6. What do you think should be responsible for improvement and why?

7. Do you think residents would be willing to pay for cost sharing role in the supply improvement during:
   a)Implementation(contributing to investment cost)
   b) Operational maintenance stage (pay for user fee)

8. If there is any improvement to be done on water which agencies would you like to manage resources/process?

QUESTIONAIRE FOR NWSC

1. Under the current water supply, has NWSC covered informal settlements?

2. If yes, how much have you supplied to kisenyi ward?

4. If no, who are the water providers in Kisenyi

4. a) What is the number of licensed water vendors (if any) in Kisenyi
   b) In which section of Kisenyi do these vendors supply water?

5. What are the challenges faced by NWSC to supply water to residents in Kisenyi?

6. How are you currently addressing water problem in Kisenyi?

7. Are there any planned or ongoing water projects in Kisenyi

8. If yes, who are the actors involved and what rolesdo they play?

9. Is there any plan to completely cover the area with piped water?

10. If yes, what is the time scale?

11. What advice would you give to other water operators in order for them to operate efficiently?

12. Given the situation in Kisenyi, what in your view is the best mode of water supply in the area?

QUESTIONAIRE FOR WATER OPERATORS

1. Name of respondent

2. Ageof respondent

3. Sex of respondent1) Male; 2) Female

4. How long have you been supplying water in this area?
   1) 0-1 years; 2) 1-3years; 3) 3-5years; 4) over 4years

5. Where do you obtain the water that you sell?
   1) NWSC; 2) Boreholes; 3) Well/springs; 4) Water kiosks; 5) Others

6. For how much do you buy water and at how much do you sell the water

7. What mode do you use to supply water?
   1) Hand cart; 2) Stand pipe; 3) Water kiosk; 4) Others

8. What problems do you encounter in obtaining water from the source?

9. What problem do you encounter from the source?

10. In your opinion how can water situation be improved?

11. How would the improvement impact on your operation this area?

12. Who do you think should be responsible for improvement and why?

13. Is your business licensed and why 1) Yes; 2) No
If no, why

Plate 4.3: Showing NWSC Old Network Being Repaired at Ruharo Water Treatment Plant in MbararaMunicipality

Source: Field work 2017