



**FACTORS DETERMINING LOW INCOME
HOUSEHOLDS' CONNECTION TO NEW PIPED WATER
SERVICES IN MAILI SABA, NAIROBI, KENYA.**

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DECLARATION

This research project is my own original work and has not been presented for award of any degree or any other examination body in any other University.

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This research project has been submitted for examination with my approval as the University supervisor.

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ABSTRACT

Traditionally, most poor urban households have relied on highly priced water provided by vendors and on scanty public taps/kiosks connected to utility network. In recent times, water utilities have come to the realization that poor people can be connected to networked services and become valuable customers. However, the challenge remains that low income consumers do not respond to traditional utility customer acquisition models premised on intrinsic demand in areas with new networked water supply.

This study based on hypothetical factors and reliant on proof of cross-sectional survey and detailed qualitative analysis, generates understanding on how individual, household, community and policy characteristics determine whether or not, a poor household connects to new or intensified utility water network.

It identifies the criticality of factors, both inhibiting and influencing the decision and the ability of a household to connect. Gender, education and marital status are of no significant influence, while household income, rent paid, housing type and home ownership status are an indicator whether there is likely to be a connection or not. It further confirms that perceptions of connection cost, inability to save for and pay upfront deposits, and lack of awareness on connection process are key target community aspects for influencing demand for water connections. Additionally, reliability of service, consistent meter reading and billing, and response to customer complaints are critical to low income consumers, as much as it is to those who can easily afford.

Overall, the findings unearth key learnings for the sector that poor households can connect to a networked water service within a reasonable level of effort, and provide the confidence required for investment planning for water and sewerage infrastructure network in low income urban neighbourhoods.

LIST OF ABBREVIATIONS AND ACRONYMS

AFD	Agence Française de Développement (French Development Agency)
AFDB	African Development Bank
KEWASNET	Kenya Water and Sanitation Network
LIAs	Low Income Areas
LIC	Low Income Consumer
LISs	Low Income Settlements
MDG	Millennium Development Goals
NCC	Nairobi City Council
NCWSC	Nairobi City Water and Sewerage Company
NGO	Non-Governmental Organization
NRW	Non-Revenue Water
NWSC	National Water and Sewerage Corporation (Uganda)
UN	United Nations
UNDP	United Nations Development Programme
WSTF	Water Services Trust Fund
WSUP	Water and Sanitation for the Urban Poor

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Most developing countries have high population growths and high rates of urbanization, highly characterized by rural-urban migration. UNICEF asserts that as at the year 2012, 24.4% of the Kenyan population was urbanized. Further, it predicts that these urban populations will grow at a rate of over 4% between the years 2012-2030 (UNICEF, 2014) leading to pressures on many limited services such as water supply, transport systems, health needs, sanitation, and the housing sector (The World Bank, 2014). One area that is highly affected by these population demographics is access to social amenities such as piped water. Water supply infrastructure in Kenya, like in most developing countries especially in urban areas, has been stretched beyond the limit. Subsequently, this has led to negative outcomes and economic outflows that are characterized by decreased health care, congestion, ill health, negative social and economic progress amongst other vulnerabilities (UNICEF, 2014).

According to UN-Habitat (2011), among the key challenges resulting from rapid urbanization in developing countries is how to provide adequate level of public infrastructure and services for the increasing urban population. This challenge is compounded by the fact that most of this rapid urbanization is taking place informally (UN-Habitat, 2011). Many problems in informal settlements are due to poor access to public amenities and basic utilities (UN-Habitat, 2011). Problems of inadequate water supply, poor sewerage disposal, uncollected solid waste, poor drainage system, illegal development of land, proliferation of informal housing without adequate provision of basic infrastructure facilities and services (Abbott, 2012; Akatch & Kasuku, 2012; World Bank, 2010) are some of the many informal settlement dwellers face.

Spiraling low income urban/peri-urban settlements (LISs) are also a big challenge to urban water utilities in developing countries (Corey-Boulet, 2009). To extend and maintain water services to these human settlements, urban water utilities need to develop innovative solutions for overcoming various physio-technical, institutional, structural/legal and financial/economic constraints associated with them. The utilities in developing countries face various challenges in the external environment within which they operate (Smith, 2007). A major one is the rate at which low-income settlements are expanding in the cities they serve as a result of ballooning urban population (UN- Water, 2007).

1.1.1 Urbanization and Access to Water Infrastructure

Urbanization is the physical growth of urban areas as a result of rural migration and suburban concentration into cities, particularly the very large ones. Today, approximately 15% of the world population lives in cities. According to UN estimates, by 2015 about 20% of the population will live in cities with more than 5 million populations, (UN-HABITAT, 2004). There are many gaps or challenges that have been identified in providing improved water and sanitation. One of the challenges has been urbanization and water scarcity, which mostly takes place in developing countries (Montgomery, 2007). Rapid urban growth in developing countries is seriously outstripping the capacity of most cities to provide adequate water and sanitation services to their citizens (Cohen, 2006). Water use has risen dramatically in the past 50 years due to population growth, urbanization and demands of irrigation for agriculture purpose (Moe & Rheingans, 2006). Another gap that has been identified is the impact of sustainability of community water supply and sanitation programs, which most of the time is threatened by numerous attitudinal, institutional, infrastructure and economic factors (Pruss-Ustun et al., 2008). Many water and sanitation programs in developing countries have not been sustainable due to such factors as financial cost, no ownership feeling from the communities on the water and sanitation infrastructures, lack of community attitudinal and behavior towards hygiene education and lack of community participation (Cohen, 2006).

As a result of rapid urbanization, the majority of urban residents in sub-Saharan Africa live in informal settlements often characterized by a lack of basic services such as water and sewerage. Consequently, the urban poor often use inexpensive pit latrines and at the same time may draw domestic water from nearby wells. Overcrowding in slums limits the adequate distance between wells and pit latrines so that micro-organisms migrate from latrines to water sources. Sanitary practices in these overcrowded slums are also poor, leading to contamination of these wells (UNHABITAT, 2014).

1.1.2 Poor Planning and Access to Piped Water

Most informal settlements are faced with a myriad of problems ranging from inadequate infrastructure, poor sanitation, noise pollution, water pollution and poor water disposal system (GoK, 2011). Since construction is informal and unguided by urban planning, there is a near total absence of formal street grids, numbered streets, sewage network, electricity, or telephones. Even if these resources are present, they are likely to be disorganized, old or inferior. Informal settlements also tend to lack basic services present in more formally organized settlements, including policing, medical services and fire-fighting (GoK, 2009). In most studies, informal settlements and slums take different meanings; however, for purposes of this study, the two mean the same thing. Urban expansion and the growth of informal settlements (or slums) therefore, places great pressure on already struggling social services such as education, water and sanitation. Slums exert considerable stress on the environment, and are often highly polluted. They also pose challenges to security and social cohesion.

1.1.3 Poverty And Access To Piped Water

Only about one-quarter of the households in Kenya's informal settlements have access to water and a private toilet facility. Thus the majority of slum dwellers rely on shared toilet facilities. An additional 6 percent are even worse off; as they have no access to toilets and have to use open defecation and/or "flying toilets" (i.e. plastic bags that are tied up and then flung away). Water service providers perceive service provision to the poor as commercially unattractive leading to informal providers who are organized in cartels,

profiting from their monopolistic control by distorting competition and creating artificial shortages. The rapid urbanization with its densification of population in the settlements has a particularly huge and negative impact on the living conditions of the population. Therefore, although access in rural areas is lower and the proportion of the poor is higher than in the urban areas, a particular focus on the settlements of the urban poor is important and justified particularly when it comes to basic services like access to water. This study therefore, intends to assess the factors that determine connection to piped water services for poor households in informal settlements focusing on Maili Saba as a case study.

1.1.4 Connection to Piped Water Services in Informal Settlements

In Low Income Areas (LIAs) like Maili Saba in Nairobi, residents continue to be confronted by challenges of water service inefficiencies as a result of old and dilapidated distribution network, unplanned expansion, and frequent breakdown of old operating equipment and machinery (KEWASNET, 2013). Connected low income consumers owe NCWSC some substantial and long debt, but on the other hand, unreliable billing and unresponsive customer care management systems hamper cordial consumer-utility relationships. Illegal land allocation in most LIAs has resulted to water and sewer way leaves obstructions and encroachments, resulting to residential and business premises being built on existing water and sewer lines, rendering NCWSC routine maintenance and periodic repairs impossible. Unlawful water and sewerage connections are also a common feature in LIAs, often perpetuated by vending cartels (business interest) and political gangs (illegal tax collection), making utility operations a nightmare. Sewer system faces serious abuse from illicit dumping of septic and solid waste, as well as deliberate blockage for the purposes of irrigation, construction and even 'cleaning' with waste water.

To improve services in entire Nairobi County, NCWSC has over the last decade been intensifying leak repairs, updating base maps, distribution network modelling/extension, investing in technological advancement, and development and adoption of a new Customer Service Charter and complaint management system. The utility has also been

interlinking billing process in the regions to enhance service delivery, conducting implementation of a state of the art billing and financial management system, aggressive metering of all un-metered customers, and continuing implementation of various change management programmes. Closely working with the national and County Government of Nairobi, the utility has invested recognizable effort to minimize illegal connections and build more partnerships with donor and the civil society in providing water to the LIAs in the city through its dedicated Informal Settlements Region (ISR) (KEWASNET, 2013).

The ISR has initiated several projects in partnership with various NGOs and other development partners to enable the vulnerable dwellers in LIAs to access clean water and sanitation. In pursuit of contributing to achieving the MDGs (and subsequently SDGs) for access to clean water and sanitation and in ensuring the realization of the constitutional requirement to ‘the right to water’, the utility constructed 24 water kiosks and extended 18km water pipeline in Mathare valley in partnership with WSTF and Pamoja Trust to serve a population of 200,000 people (Republic of Kenya, 2010).

There are similar interventions in other LIAs like Kambi Muru and Gatwekera villages in Kibera whereby, in partnership with Water and Sanitation for the Urban Poor (WSUP), ISD constructed 6 sanitation blocks and 6.5km sewer line and a number of on-plot toilets. Through the Social Connection Policy (SCP), NCWSC has been implementing the Kayole Soweto Water Project with Global Partnership on Output Based Aid (GPOBA) funds channeled through K-Rep bank to cater for the connections fee deposits. The World Bank has given a grant of US\$3,000,000 under the Water, Sewerage and Sanitation Improvement Programme (WaSSIP) to improve water and sewerage services in the area. This involves construction of 18.5 km of water pipeline and an additional extension for sewerline to serve the residents of this LIS. After completion, 2,200 plots with over ten households each and a combined population of 85,000 people will be connected with clean water and sewerage (KEWASNET, 2013).

1.2 Statement of the Problem

Informal settlements are a result of rapid and unplanned urbanization, and are considered a challenge in expansion of basic services. The Nairobi City County has witnessed increased rural–urban migration as a result of its industries and huge concentration of other service driven businesses and general lack of employment in the rural areas. The rapid expansion of industrial and commercial activities has directly contributed to the acute shortage of housing for migrant workers and the subsequent development of sub-standard housing which has led to proliferation of informal settlements.. Based on the above situation, the Nairobi City County is faced with the challenging task of providing vital services such as water to all. With the limited resources (financial and technical) at its disposal, it has become difficult for the County to provide services to whole population. Lack of accurate statistics on the rate of rural-urban migration and resulting informal settlements proliferation within the city coupled with lack of accurate information on existing capacity of the water service providers to meet the rising demand for water and sanitation services creates a challenge in planning for the provision of services such as water especially in the informal settlements. This study generally seeks to understand the underlying causes of low demand and high rate of unsuccessful applications for connection in the areas newly extended with water and sewerage networks in spiraling LIAs in Nairobi (and in extension, similar cities across the world).

1.3 Purpose of the Study

The purpose of this study was to determine the factors that influence the connection or non-connection of piped water to poor households in informal settlements in Kenya, focusing on water services network in Maili Saba, a low income settlement of Nairobi, Kenya.

1.4 Objectives of the Study

The study is aimed at achieving the following objectives:-

- i. To investigate the effect of individual characteristics that determine low income household connection to piped water;

- ii. To investigate the effect of household characteristics that influence connection to piped water in low income areas;
- iii. To investigate the communal factors that influence connection to piped water by low income households;
- iv. To determine policy and regulatory factors that influence connection to piped water by low income households.

1.5 Research Questions

This study is guided by the following research questions:-

- i. What is the individual characteristics that influence low income households connection to piped water?
- ii. What is the effect of household characteristics that influence household connection to piped water in low income areas?
- iii. Do communal characteristics influence household connection to piped water in low income urban areas?
- iv. What is the role played by utility, county and national government policies and regulations that influence household water connections in low income areas?

1.6 Research Hypothesis

The research seeks to test the following hypothesis

H₁: Individual and household characteristics have a significant effect on whether households connect to piped water for residents in low income urban areas.

H₂: There is a significant influence of community characteristics on household connection to piped water in low income urban households.

H₃: Utility, county and national government policies and regulations have a significant effect on household connection to piped water in low income urban settlements.

1.7 Significance of the Study

Currently, both governmental and development supporting bodies have come to recognize that low income consumers deserve convenience and have the ability to pay for water supply and sanitation services just like other residents in urban areas. This change of mindset has resulted to a shift in programming in the sector, which has seen a departure from small, localized investments mainly targeting public access for water and sanitation services to low income households. A good example is common notion that public ablution blocks and water kiosks are the preferred and only viable mode of investment for improving access to water and sanitation services for low income population.

This change in planning and perception has resulted is creation of new, large scale investment World Bank led programmes such as WaSSIP and Kenya Informal Settlements Improvement Programme (KISIP), that are targeting establishment of trunk networked water and sewerage services for low income residents in several towns and cities across Kenya, notably; Nairobi, Mombasa, Eldoret, Malindi and Nakuru. In the end, all these investments will require beneficiary utilities to connect targeted households. However, experience across the global shows that utilities always face numerous but surmountable challenges of connecting and billing low income households. A solution is only possible through conducting a well-grounded study of prospective customers and developing a responsive social, technical and commercial demand creation process and connection model.

Therefore, the findings of this study, which is likely to be among the first of its kind in Kenya, are crucial in informing new programming by key institutional stakeholders in the sector such as NWSC and Athi Water Services Board (AWSB) and their international financial development partners such as AfDB, AfD, KfW and the World Bank. Prominent utility-supporting, non-governmental organizations such as WSUP are also likely to learn immensely from the findings of the study and will enable realization of the intended benefits that the new investments are meant to offer to the targeted consumers and their service provision utilities.

1.8 Scope of the Study

The study will investigate the various promoters/barriers that are likely to hinder low income consumers from connecting to the new networked water service in Maili Saba, Nairobi Kenya. The study will focus on both micro, meso and macro factors that are likely to limit uptake of new water connections within Maili Saba community and seek social market promotion solutions for turning around that situation.

1.9 Assumptions of the Study

The researcher has made the assumption that the respondents will provide correct, reliable and valid information during the study. The other assumption is that the selected sample will not be biased and is representative of the target population, and generally that of other low income dwellers elsewhere.

1.10 Definition of Key Words

Ability to afford: To be able to do or spare something, especially without incurring financial difficulties or without risk of undesirable consequences.

Affordability: It's measured by its cost relative to the amount that the purchaser is able to pay

Demographic pressure: The impact felt on the available resources for instance water or sanitation facilities as a result of uncontrolled population increase which outweighs the areas carrying capacity.

Household: All persons living under one roof or occupying a separate housing unit, having either direct access to the outside (or to a public area) or a separate cooking facility. Where the members of a household are related by blood or law, they constitute a family.

- Infrastructure:** The basic physical systems of a place and includes transportation, communication, sewage, water and electric systems.
- Networked water supply:** Conventional piped water supply comprising abstraction (from ground or surface water), some form of treatment and distribution to households, commerce and industry. Although described as urban, this conventional water supply approach is also used in secondary towns and in some rural areas where economic wealth or water scarcity begin to justify the investment in networked provision.
- Residential development:** Classification of housing where multiple separate housing units for residential inhabitants are contained within one building or several buildings within one complex.
- Social promotion:** The practice is called “social” promotion because non-academic factors and considerations, including societal pressures and expectations, influence promotion decisions
- Spaghetti network:** A spaghetti network is basically a haphazard array of illegal water connections, usually made of unsuitable water reticulation material such low-grade, plastic cable conduits.
- Water cartel:** An individual or group of people which collectively attempt to affect market prices by controlling production and marketing.
- Water connection:** The point of connection between the customer’s piping or constructed conveyance, and the water system’s meter, service pipe, or constructed conveyance.
- Water consumption:** The total volume of freshwater consumed and polluted for the production of the goods and services. It is calculated by adding the direct water use by people and their indirect water use.

Water scarcity:	Is a relative concept which can be defined as imbalances between availability and demand of water in a particular area.
Water stress:	The disequilibrium which results when the demand for water exceeds the available amount during a certain period or when poor quality restricts its use.
Water supply:	The water available to a community or a region.
Water tariff:	A price assigned to water supplied by a public utility through a piped network to its customers.
Water utility:	Private or public entity which owns or operates equipment or facilities for diverting, developing, pumping, impounding, distributing or furnishing of water.
Water Vendor:	A person who resells water to the public, and usually does not own or control a source.
Willingness to pay:	Is an economic concept which aims to determine the amount of money a consumer will readily pay for the supply of water.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a review of the related literature and is intended to show the contribution of past research work in the area of this study with a view of pointing out the relevance in terms of strengths, weaknesses and gaps in knowledge to the subject of this research. Material was drawn from several sources, which are closely related to the theme and the objectives of the study.

2.2 Effect of Individual Factors on Household Water Supply Sources

2.2.1 Education

Apart from location and distance, educational achievement determines one's access to improved water. Lack of or inadequate level of educational achievement serves as a great barrier to empowerment. The lower the educational achievement of an individual, the more they have limited opportunities to demand better facilities from the authorities as he or she is powerless (Bosch, 2008). Lack of or inadequate water and sanitation facilities also tend to affect the education of children, especially girls, as the burden of water collection is borne by them. More often than not, the number of hours spent in collecting the water interferes with their school attendance. Schools with poor sanitary and toilet facilities further discourage children, especially girls, from going to school regularly, which consequently affects their performance and perpetuates the vicious cycle of illiteracy and poverty (Bartlett 2013).

The importance of education has been preached the world over and its numerous benefits cannot be ignored in all sectors of life. It is no wonder education of households and especially that of household heads is a key determinant in the analysis of a household's water sourcing behaviour. This has been proven by several studies on the determinants of households' choice of water source in Developing Countries,

(Madanat and Humplick, 2013; Engel, 2015; Larson , 2016, Naugesand Van Den Berg, 2009 quoted in Fotue 2013).

Level of education is believed to play an important role in understanding how safe a water source can be and what measure can be taken to have access to water of good quality. Therefore, the households with more educated occupants strive to source for their households water from safer sources, unlike those with primary or no formal education who do not really care about how safe the sources of their water is (Onundi and Ashaolu 2014). What this then means is that a household whose education levels are very low, will have problems accessing water whether from improved or unimproved sources as the members will not take their water sourcing habits seriously. This in turn will lead to other complications especially health ones due to poor quality water consumption and hygiene habits. Problems of water access also contribute to poor education of women and children and especially the girl child.

2.2.2 Gender

Bartlett (2003) attributes gender to the fact that the burden of water collection is borne by them. He further points out that in most times the number of hours spent in collecting the water interferes with their school attendance. UNDP (2006) states that for young girls, the lack of basic water and sanitation services translates into lost opportunities for education and associated opportunities for empowerment. The report further states, that the time burden for collecting and carrying water is one explanation for the very large gender gaps in school attendance in many countries. The report further identifies that Tanzania schools attendance levels are 12% higher in homes 15 minutes or less from a water source than in homes an hour or more away.

Gender according to UNDP (2009) refers to the differences in socially constructed roles and opportunities associated with being a man or a woman and the interactions and social relations between men and women. Crow and Sultana (2012) identified three ways in which gender relations might influence the social relations

of water access: gender-based divisions of work, assets or resource ownership and access, and policy discourse and local norms, which may situate economic uses of water and domestic uses in a specific gender domain. According to DFID (2013) the impact of collecting water from traditional sources (particularly during the dry season) takes its toll on the livelihood opportunities of women and girls in particular whereas investment decisions to improve water sources at the household level usually rest with men in their role as household heads.

According to the African Water Development Report (AWDR 2016), as quoted in Alaci (2013), in Africa, poor access to water and the attendant water scarcity affect women and girls disproportionately with the situation being worse in rural areas due to institutional and cultural barriers, including those of disparities in rights, decision-making power, tasks and responsibilities over water for productive and domestic activities. GOK (2006) report on water development describes the role of women in domestic water use by noting that they are responsible for ensuring that their families have water for daily living and as a result, when the resource is scarce, they suffer because of their role as domestic water providers, caregivers and household managers.

According to Totoum (2013), gender of the head of the household plays a role among the determinants of household choice of water source. Totoum (2012) suggests that female-headed households are more likely to adopt private tap or collective tap as main water source, compared with male-headed households. Whittington and Briscoe (2010) looked at the gender aspect and explained that women, because they are the ones most frequently collecting water, better understand water quality than other household members who are fetching water much less frequently. A survey carried out in Uganda on the socio-economic factors' and water source features' and their effect on household water supply choices in Uganda and the associated environmental impact revealed the same results on the question of who is the main water collector in the household (Prouty 2013).

Oyekale and Ogunsanya (2012) reveal that rural households' access to safe water is negatively affected by the sex of the household head. The implication is that male headed households have significantly lower access to portable water. The argument they advance is that women are domestically more inclined towards water fetching. Abebaw (2010) similarly found that in Ethiopia, female headed households have higher probability of having access to improved water sources and one of the reasons adduced was the fact that women and children are directly responsible for fetching water and as heads and decision makers, they may be more inclined to invest in the effort of fetching clean water.

Onundi and Ashaolu(2014), in a study of household water use behaviour in Irepodun Local Government Area of Kwara State, Nigeria on who sources, allocates and uses most indoor water in the households, and for what purpose found out that the people involved in getting water for the various households are female. The study went on to reveal that fetching water for the household had an effect on their time and productivity in that the more time they spent in getting or making water available in their homes the more time they lost in fulfilling other responsibility. Ifabiyi et al. (2010) asserts that women lost considerable productivity time in their quest to make water available for their households. Women possess the power to allocate and determine how and who uses what water in households. In the Kwara state study, this is because they are the providers in the first place and if the commodity is misused then the burden of providing it lies on them.

2.3 Household Factors

2.3.1 Housing Ownership

In a focus-group discussion study conducted in four informal settlements in Nairobi, Kenya by Amuyunzu and Taffa (2009), it was found that not only did residents have to travel long distances to collect water, some of the landlords in the community contributed to limiting their access to water as these landlords rationed water, such that it was only available on specific days of the week and at specific times. Also, the study found that the

costs of water paid by residents without piped connections were higher than those paid by households with piped water.

Households in urban LISs have limited connectivity to water due to the haphazard nature of their residence arrangements. More often than not, the water and sanitation needs of poor urban communities are hardly incorporated into urban and regional planning (Bosch, 2015). Franceys and Gerlach (2010) indicate that though most of the urban poor are housed in slums, many such areas are often denied access or face cumbersome administrative procedures when it comes to connecting them to official water sources partly because of lack of security guarantees for land and pipelines as well as the problems of affordability. Though utility prices are cheaper for those connected to the water systems, most of the poor are denied access because they lack formal property rights to where they live. Their places of residence serve as a barrier to getting access to these facilities because of undeveloped infrastructure networks. For example, in some places, road accessibility is poor and this implies difficulties in the removal and consequently dumping of waste in open spaces meant for wayleaves. Hence, it becomes very difficult for households in these areas to get connected to piped water (UNDP 2009).

Urban dwellers who live in squatter settlements according to Mbogua (2014), have no access to basic services like sanitation, potable water, waste disposal, health and educational services. The reasons for this he attributes to limited financial resources, poor management at local and central government level, rural –urban migration and high unemployment. This has contributed to inadequate infrastructural provision and environmental degradation. This is evidenced in the deterioration of the housing conditions and lack of water provision in these areas,(Awatona, 2014). According to Kitunka (2013), most urban houses are built in informal or squatter settlements that are rapidly increasing in density. Upgrading programmes have enabled a fortunate minority to benefit from potable water supplies, electricity and communal sanitation, but for the most part, these settlements have very little access to basic services.

Most of the informal settlements are created by illegal encroachment of land by urban slumlords without approved boundaries and standards. Although these areas are deemed illegal, they are actually places accommodating large populations and need to be upgraded and legalized for the provision of piped water supply, drainage systems, access to roads, sewerage and refuse disposal services. The fact is, non-conventional housing units are built in these settlements in a response to address the lack and shortage of houses.

2.3.2 Distance and Time Covered To Access Water

A study conducted by Ako (2011) shows that the further away a water source is from a household, the more unaffordable and difficulty for poor household to access water. They are forced to walk for about 3–30 min to get drinking water in order to be able to meet their daily requirements of about 15–25 litres per person per day. However, they tend to compromise on drinking water if they have to spend beyond 30 min to get access to the water. In Lesotho, it was revealed that about 25% of households (lowest income quintile) spend about 2.5 hours in collecting water while the majority of households in East Africa and North Cameroon spend close to 5 hours and 6 hours, respectively, per day collecting water for household needs.

In a review conducted by Howard and Bartram (2013), it was revealed that distance is a crucial factor in determining access to water and sanitation facilities. The further away the source of water is to a household, the more the less income households are disadvantaged. In areas where people walk for more than 1 kilometer or spend more than 30 minutes for collection of water, the per capita water use drops to about 5 to 10 litres per day. At that level of service, it becomes very difficult to meet adequate hygienic standards especially for households with low income. This notwithstanding, in the urban areas, a major deterrent factor may be time taken to get water and not the distance, as more people are most likely to reduce consumption of water if they have to walk shorter distances but have to queue for longer hours to draw the water (Bosch,2015). Cairncross and Cuff (2011), as cited by Osman and Khan (2011), also suggest that the amount of time involved in getting water is probably more important than the distance covered to

the water source as a determinant of access to water. This is because there are some areas where scarcity of water is so severe that it takes longer to obtain water than to reach the water source. For example, in a study conducted in Mueda in Mozambique, women spend about 2 hours getting to a water source and about 3 hours queuing for the water due to the relative scarcity of available water (Cairncross and Cuff 2011).

2.4 Community Factors

2.4.1 Social Perceptions

Perceptions of consumers on service providers can influence access to basic services. Cronin and Taylor (1992) argue that performance perceptions are proxy variables for the evaluation of service quality. Perceptions on performance (or service quality) could influence access to the service. Such perceptions of service quality have been described as attitude that results from the comparison of expectations with actual performance (Bolton & Drew, 2011; Parasuraman, Zeithaml, & Berry, 2008 in Cronin & Taylor, 2012). We thus expect attitudes of households to NGO/CBO services to be correlated to the perceptions of the quality of their services, and in that way influential in actual access of households to water, sanitation and solid waste services. Perceptions of competence of a service provider is another important factor that may determine access, as suggested by Price, Arnould, and Deibler (2011); and Spreitzer (2011). Perceptions of incompetent service providers contribute to negative feelings about the service and service quality, inhibiting access.

2.4.2 Social Proximity

Social proximity refers to the dense interactions and 'bonding' of social relations in social networks. Social relations are fundamental elements for our every day existence and often studied through social networks which in general terms are composed of a set of nodes or actors (individuals or organizations) mutually connected by a set of social relationships with specific kinds of interdependencies such as shared values, cultures, visions, or ideas (Barnes, 1954 and Brass, 1992). The social network perspective enables researchers to study the social actors (Galaskiewicz & Wasserman, 1994), and their

beneficiaries as well as the social relations between them and the implications of these relationships on, for instance, the provision of and access to services.

(Bendapudi & Berry, 1997); and (Lovelock, 1983) have indicated that many services by their very nature require ongoing membership, and that even when membership is not required, customers may seek on-going relationships with service providers to reduce the perceived risk in assessing service credibility properties. Bendapudi and Berry (1997) further suggest that, interaction between the customer and the service provider has the potential to strengthen, weaken or even destroy the relationship between them.

They explored the frequency of interaction between the customer and the service provider and proposed that the more the customer interacts with the service provider the more opportunities the customer has to evaluate the service. And when interactions are satisfactory, frequency would lead to greater trust (Bendapudi & Berry, 1997). Krishna, 2004; Bowles & Gintis, 2002; and Nyangena, 2008 argue that social networks can foster cooperative behavior and ease coordination problems which in our case could ease access to NGO/CBO services. Morgan & Hunt 1994 as cited by Berry, 1997 also point out that cooperation requires an active participation in the relation to achieve mutual benefits and others define it as working together to achieve mutual goals (Anderson & Narus, 1990 in Bendapudi & Berry, 1997). To this effect (Rahman, 2004), found cooperation was essential in resolving conflicts, sensible issues and crises in NGO water and sanitation projects in third world poor urban areas.

Access of the urban poor to water services is complex and demanding because of the nature and vulnerability of this group of people. While this group of people is economically poorly enabled to deal with their issues of water management, they have strong social bonds that could help them deal with such issues. As Pargal, Huq, & Gilligan, 1999 put it, water servicing is an activity where individual action does not have much impact and therefore collective action, which is a function of social proximity, is necessary.

2.5 Sector Factors

2.5.1 The Role Played By Government Institutions in Enhancing Access to Piped Water

The water sector has several institutions charged with the responsibility of ensuring adequate water and sanitation services to the entire citizens of the country. The government has put down many measures and various institutions in the past decade to ensure that the community members and the entire citizenry receive adequate water and sanitation supply in the country (GOK, 2012). There was the establishment of the Water Sector Reform Secretariat (WSRS) whose responsibility was to cover the transitional gap during the period which the water reforms institutions were being established. Water Services Trust Fund (WSTF) was established in 2004, to provide financial assistance towards capital investment costs in areas lacking adequate facilities which are often inhabited by the poor. The transfer of the central government staff and the assets were realized through the development of the transfer plan of 2005 in which the services were delegated to the Water Services Boards (WSBs), and Water Services Providers (WSPs). The draft National Water Services Strategy (NWSS) for the period 2007/2015 was formulated in June 2007(GOK 2007).

According to Guerquin (2013), the Kenyan government has been putting in place a comprehensive water policy framework since 2004, defining priorities for water management and developing local and national financing solution. National government was committed to eliminating the backlog in basic water service; the first step up the water ladder was the provision of at least basic water and sanitation service to all people living Kenya. According to Kahinda (2007), providing water and sanitation to people without access by Kenya government was one of MDGs target obligation. In order to achieve the MDGs, the Kenya Government committed itself to provide financial assistant to poor household and also wanted to implement Domestic Rainwater Harvesting (DRWH), which has an advantage of proving water directly to

household. Although the government made some progress in providing water and sanitation, there are still some obstacles hindering services (Arenas, 2013).

The Constitution under the Bill of Rights, Article 43 (1) (d) confers on every person the right to clean and safe water in adequate quantities. This right is in line with the International Covenant on Economic, Social and Cultural Rights (ICESCR). To state parties, it implies a considerable state responsibility and action beyond the provision of water for drinking purposes, and extends to water for environmental hygiene and health, as well as for growing food. It also involves accessibility, affordability and non-discriminatory access to water; protection against contamination by harmful substances and pathogenic microbes; and monitoring and combating aquatic ecosystems that serve as a habitat for disease (World Bank, 2004).

According to WHO (2011), the minimum amount of water required for survival is 20 litres per person per day. Based on his analysis, Gleick (2016) recommends to service providers to adopt a basic water requirement standard for human needs of 50 litres per person per day. Therefore, about 50 to 100 litres of water per person per day are needed to ensure that the most basic needs are met and few health concerns arise (WHO, 2013). Borrowing from the human rights and the Constitution, every Kenyan is therefore entitled to about 50 litres of water per day. CESCR acknowledges that due to the limits of available resources, immediate realization of this right to water may be a constraint. Therefore, the right to water requires government activities to progressively increase the number of people with safe, affordable and convenient access to drinking water (WWC, 2011).

2.5.2. Policy and Legislative Framework

This part of the study analyses the existing policy and legal framework and their relationship with the study.

2.5.2.1 The Constitution of Kenya, 2010

The Constitution of Kenya, 2010 in chapter one, article one recognizes the sovereignty of the people. Subsection one states that “All sovereign power belongs to the people of Kenya and shall be exercised in accordance with this Constitution”.

Chapter four of the Constitution of Kenya 2010 covers the bill of rights. Article 19 section two states that “The purpose of recognizing and protecting human rights and fundamental freedoms is to preserve the dignity of individuals and communities and to promote social justice and the realization of the potential of all human beings”

Chapter 5, section 43 on economic and social rights, subsection (b) states that “Every person has the right to accessible and adequate housing, and to a reasonable standard of sanitation”. Therefore, it is clear that access to adequate housing and to a reasonable standard of sanitation is a right enshrined in the constitution which is the supreme law of the land.

Provision of decent and quality housing with accompanying services such as water and sanitation is therefore an obligation of the state through its agencies. Thus there is sufficient justification for provision of quality and adequate water and sanitation services that complete the definition of adequate housing.

2.5.2.2 The National Housing Policy in Kenya

Currently, the housing sector is guided by Sessional Paper No.3 on National Housing Policy for Kenya of 2004. The policy highlights problems in the housing sector which are manifested in overcrowding, slums and proliferation of informal settlements especially in peri-urban areas. These problems are manifested in itself in poor quality of housing and lack of basic services such as drinking water. The policy recognizes that the essence of ‘informal’ or ‘spontaneous’ or ‘squatter’ settlements is that it is without secure tenure and/or is unplanned. The problems of ‘squatters’ and informal’ settlements continue to present a challenge for development in Kenya. A large proportion of Kenya’s population

has no decent homes, and lives as ‘squatters’ or in slums and other squalid places (RoK, 2014).

One key objective of this policy is to promote the development and ownership of housing that is functional, healthy, aesthetically pleasant and environmentally friendly. Provision of adequate water services is one of the ways and means of achieving this objective.

The policy also aims at enabling the poor to access housing and basic services and infrastructure necessary for a healthy living environment especially in urban areas. One of the most important basic services is water and therefore the National housing policy is crucial for planning for water services especially in informal residential settlements.

The main goal of the policy is to facilitate the provision of adequate shelter and a healthy living environment at an affordable cost to all socio economic groups in Kenya in order to foster sustainable human settlements and taking into account key upgrading components that cover among others provision of basic infrastructural facilities and services of the target community.

2.6 Theoretical Framework

This section deals with the theoretical framework applied to this research. The theoretical framework provided here considers other scholars’ perceptions on the issues being addressed by the study. These are institutional, governance, elite, decision-making and political power theories that reflects the perception of public policy formulation and implementation processes. These selected theories provide tools for scrutinizing the bureaucracies and decision-making processes, structures and functions of organizations, all which are relevant when examining barriers to water connectivity informal settlements. The theory on the impact of political influence on policy is also examined. Using a combination of these theories is useful in analysis of the proposition that household characteristics and weak institutions, poor policy guidance and political interference have a bearing on the situation of water accessibility in informal settlements in Maili Saba slums in Nairobi. The theoretical framework to this research considers the

policy phases approach in conceptualizing the policy on piped water connection in informal settlements.

2.6.1 Social Development Theory

This theory explains qualitative changes in the structure and framework of society that enable the human civilization to better realize its aims and objectives. Development is governed by many factors that influence the results of developmental elements. A motive must exist, that drives the social change and essential preconditions for that change to occur. The object must be dominant enough to overcome impediments that obstruct that particular change from occurring. Development also requires resources such as capital, technology, and supporting infrastructure in order to flourish.

Further, human development theorists believe that development must start with and come from the individual. Unless motivation comes from within, efforts to promote change will not be sustained by that individual. Human development also called personal development, seeks to develop in the individual self respect, self reliance, and active participation in community's development. This approach empowers the poor to come up with their own solutions and development plans and be the ones to implement them (Burkey, 1993).

There are many reasons why the poor should be involved in their own development. Firstly, the poor are the most knowledgeable about their condition and their needs because they are the ones experiencing them. Secondly, the poor need to feel empowered to change things themselves. Doing everything for the poor ignores their value and undermines their dignity as human beings and treats them as if they have no understanding of their own condition and no idea on how to change it (Chambers 1983). Development projects, therefore, should stop simply giving things to the poor, but instead, focus on empowerment of the poor to do things for themselves (Eade 1997). This type of development is the only type that will last if/when outside aid ends.

2.6.2 Institutional Theory

The institutional theory underscores the relevance of institutions in managing policy, which is recognized in this study as one of the barriers to access water services and sanitation in Nairobi's low income settlements. According to Gormley (1987), institutional policy analysis focuses on the procedural choices, their definition of relationships within government or decisions that affect the influence of outsiders on government itself. The institutional theory stems from this conceptualization provided by Gormley. The theory emphasizes the formal and legal aspects of government structure; their legal powers and their rules and procedures (Kraft and Furlong, 2004). Of relevance to this study is the process by which power is shared between national government agencies and provincial government (local authorities in this instance). Kumsa and Mbeche (2004) are skeptical of institutions in developing countries, which in their view are weak as a consequence of ineffective enforcement of the rule of law, corruption as well as the absence of strong civil society organizations. Williams (2006) argues that institutions may limit as well as enable effective action and responsibility in the policy sphere. However, the networking and institutional theories give a basis for the methodology to be applied in the research as well as insights and a more comprehensive understanding of institutions and their role or lack of it in water and sanitation provision in the area of study. This theory provides a reference point when examining institutions and their relationships during the different phases of water and sanitation policy-making and implementation in low income settlements in Kenya.

2.7 Conceptual Framework

The conceptual framework outlined below shows the possible factors influencing low income households to connect to networked water services in Maili Saba settlement in Dandora area of Nairobi, Kenya. A general conceptualization diagram as shown below illustrates that connecting to networked water services is a dependent variable and barriers to low income households as independent variables.

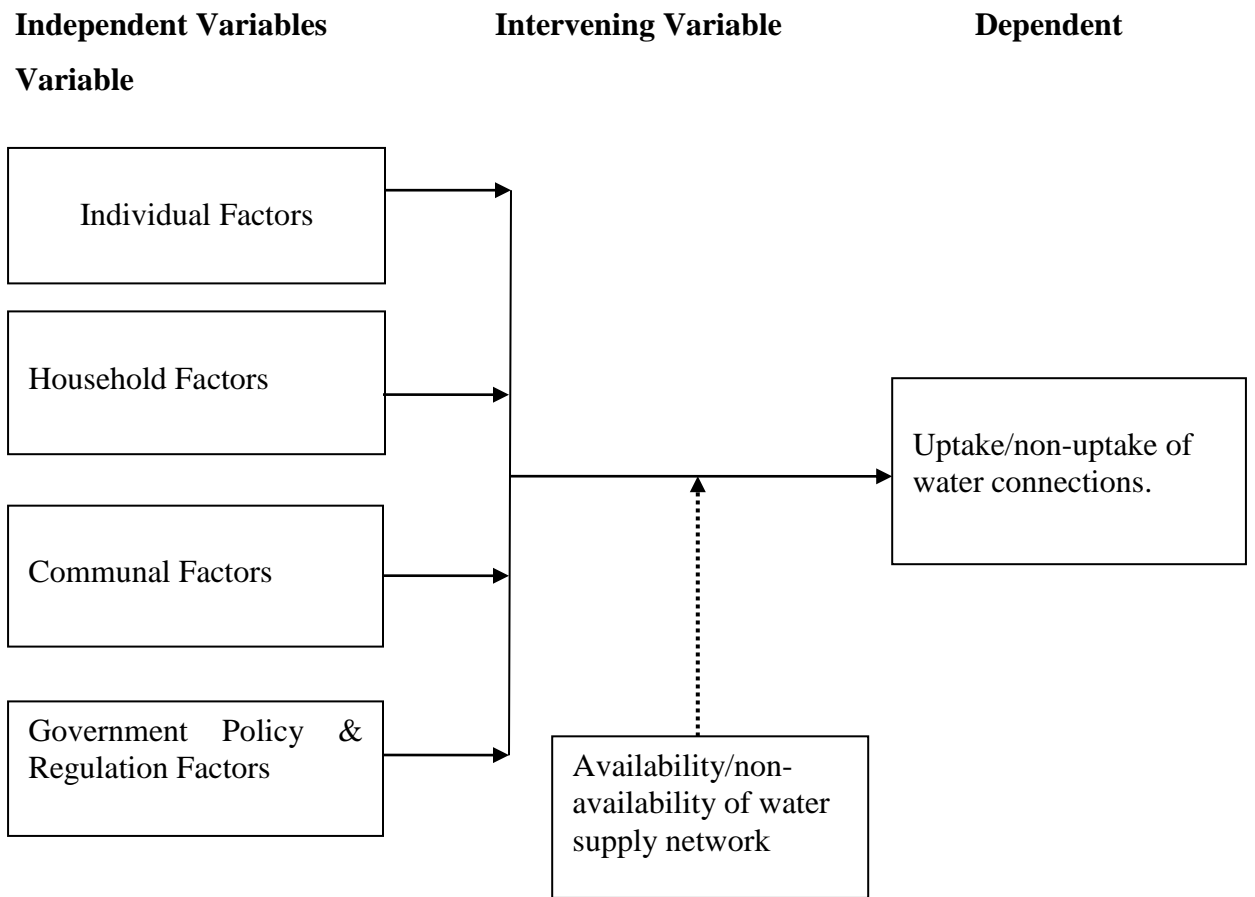


Figure 2.1: Conceptual framework

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the type of research methodology that was applied in this study. It covers the type of research design, sample and sampling procedure method, target population, accessible population and sample size. Further account is made on the study's adopted data collection procedure, study research instruments and analysis. It also focuses on validity and reliability of applied instruments and ethical issues.

3.2 Site Description

The study was carried out in Maili Saba, an informal settlement area of about 3.9 square kilometers in Nairobi city. The settlement is situated about fifteen (15) Kilometres East of the city centre, off Kangundo Road. It is within Komarock sub-location of Embakasi Sub-County and borders Dandora to the East, and Saika Estate to the South. It is subdivided into 8 villages (zones) including Bondeni, K.P.C.U, Shilanga Railway, Bosnia, Silanga Riverside, Maili Saba Central, Biafra and Silanga Central.

Maili Saba (generally including Silanga) has an estimated population of 7,862 and a total of 1,966 households with children making a third of the population¹. In a study conducted by WSUP in 2015, majority of the respondents reported to have received some form of education with 42.17% having some primary education or had completed primary education while 39.64% reported to have a secondary education with only 20.20% of these reporting to have completed secondary education. Most of the people within the settlement were using water kiosks as their main source (49.2%). The other sources of water being used were: Piped water into compound (31.06%), public taps and stands (4.29%), piped water into compound (3.77%), tube well/borehole (4.55%).

¹ Ibid.

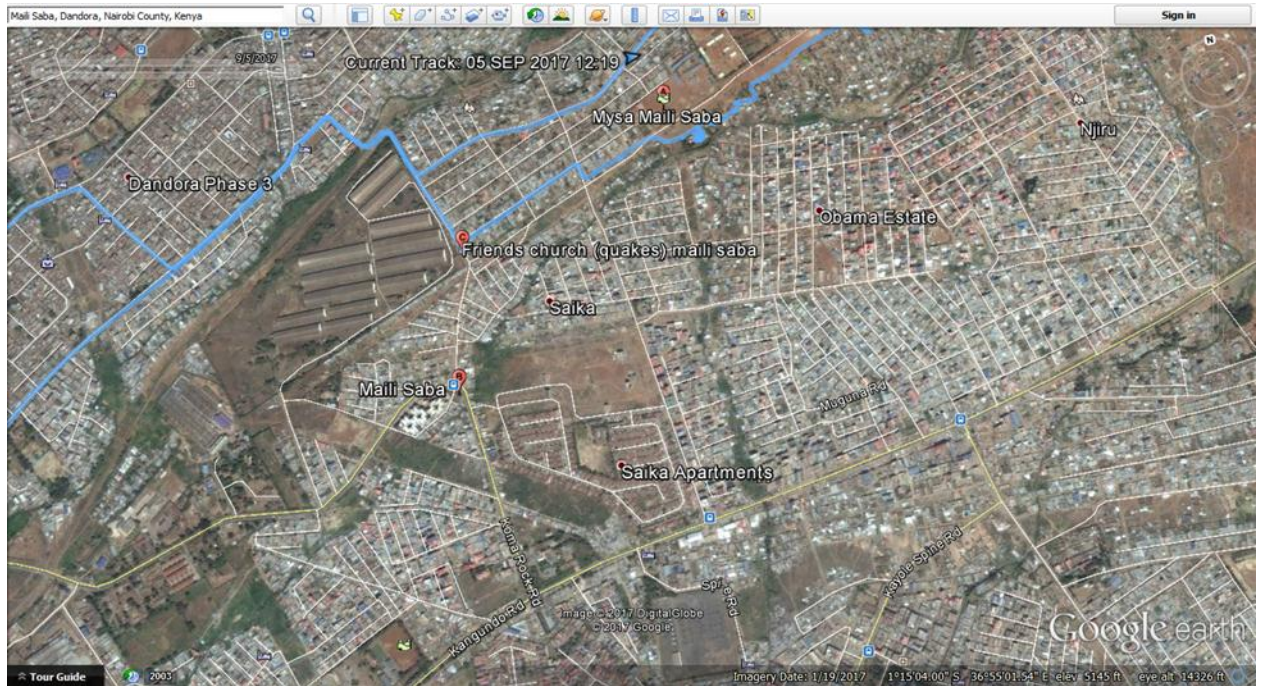


Figure 3.1 General location of Maili Saba in Nairobi

A socio-economic study by the World Bank in 2011 revealed that more than half of the residents (71% to be precise) own occupied and 29% rented their dwellings while employment constitutes 67%, casual labour 20%, permanent employment 10%, while those who are not employed constituted 3%. Analysis of occupation by gender revealed an almost equal proportion of both men and women were in self-employment. The proportion of women in casual employment was slightly more compared to their male counterparts. Further analysis of activities by gender revealed that men dominated the more lucrative activities in the informal sector, such as jua kali, manufacturing, renting out of rooms, and water vending. Women on the other hand engaged in selling foodstuffs, brewing and selling illicit brew, vegetable trading as well as sell of second hand clothes.

The report further revealed that coverage by the NCWSC network was limited to a small section of the settlement meaning only a few individuals had been able to connect to the existing network supply. Across the households, the average distance to the primary water sources was given as 195 meters. However, analysis of the maximum and minimum distance revealed a minimum of 1 meter and a maximum of 1000 meters depending on the source, while the average time taken to draw water including waiting at the source ranged from 11 minutes to 3 hours depending on the source and the people at the time of visit.

3.3 Target Population

In order to get the target population, two primary data sources of sample population were selected. A sample is a representative part of a population, and sampling makes it possible to know the characteristics of a society without having to study the entire population. Peter (1994) defines probability samples as those which are chosen without involving personal judgment, purpose, deliberation or bias of the researcher even in a single instance. According to Dudovskiy (2016), many populations of interest are too large to work with directly, and as a result, techniques of statistical sampling have been devised to obtain samples taken from larger populations.

Mali Saba is subdivided into 8 villages (zones). A map of all the households was obtained and 102 of them were sampled in clusters. In each cluster, 15 household heads were interviewed. Within the household's, further disaggregation based on age and sex of the respondents was put into consideration. The desired sample of 92 was arrived at as shown in the formula below. To establish a proportionate number of units for each cluster/village, the cluster was multiplied by the desired sample and then divided by the total number of households in the locality. This was calculated using the following formula;

$$K=N/n$$

Where k=sampling interval

N=the total number of respondents

n=desired sample size calculated.

However, a sample from each cluster was obtained using systematic random sampling method to pick respondents. Best and Khan (1998) say that the larger the sample, the smaller the magnitude of sampling error and the greater the likelihood that the sample is representative of the population.

3.4 Sample Size and Sampling Techniques

According to Orodho, (2002) sampling means selecting a given number of subjects from a defined population as representative of that population. Any statements made about the sample should also be true of the population.

As mentioned earlier, all the 7 villages in Maili Saba slums were covered. The total households were 1,966 according to data acquired from the local chief. The sample size was determined based on the population size.

Table 3.1 Maili Saba Sampling Frame

Villages	Households	Sample size	Percent
Village 1	300	34	11%
Village 2	290	75	26%
Village 3	280	46	16%
Village 4	280	57	20%
Village 5	280	46	16%
Village 6	270	75	28%
Village 7	270	52	19%
Total	1970	384	19%

The sample size was determined by adopting Cochran's sample size formula for continuous data. The sample size was determined by adopting the standard formula, that is, $N = Z^2 pq D / d^2$ as used by Cochran (Mugenda and Mugenda, 1999).

n = the minimum sample size (if the target population is greater than 10,000)

Z = the standard normal deviate at the required confidence level 1.96 which corresponds to 95

p = Proportion of the target population estimated to have characteristics being measured.

q = 1-p

d = the level of statistical significance or degree of freedom which is 0.05

D = Degree of accuracy =1

$$\text{Thus: } N = \frac{(1.96)^2 \times 0.5 \times 0.5 \times 1}{(0.05)^2}$$

$$N = 384 \text{ Respondents}$$

Therefore, the study targeted a sample size of 384 household heads in Maili Saba LIA survey.

3.5. Method of Data Collection

The study sought to elicit both quantitative and qualitative responses and used two data collection methods in order to enhance the validity and reliability of results. The two methods are:

3.5.1 Survey Method

Survey method included any measurement procedures that involved asking questions to the respondents. It consisted of both closed and open ended questionnaire meant to capture relevant and significant quantitative information for further analysis. Data was collected using the survey questionnaire and interview guide. Respondents were persons

who have resided in Maili Saba area for at least one year preceding the interview. The residents were randomly selected. Those residents within the confines of the study's geographical coverage, age and gender disaggregation and present at the time were eligible for this study because they somehow faced issues related to household connection to piped water. The questionnaire was designed with purely closed questions on a Likert Scale measurement to collect quantitative data from the households. The key informant interview guide was composed of mainly open ended questions which were administered on a face-to-face standardized interview schedules.

3.5.2 Key Informant Interviews

A key informant is someone that can offer specific specialized knowledge in a particular issue like in this study, regarding factors influencing water connection by low income households. They filled the information gaps that the researcher could have had with regards to the process of obtaining water connections and the social, economic and policy environment around it. Informants gave particular perspectives or communicated specific challenges that the households were facing in the process of connecting to the utility water network. The key informants in this study were local leaders, development workers and NWSC staff. Five key informants were selected based on their knowledge and experience with water supply access in low income settlement of Maili Saba and other similar areas in the city of Nairobi. The purpose of seeking key informant responses in this study was to develop a basis for composite analysis to establish if there were any gaps between what was the perception of the local and utility leadership and the reality being faced by the residents.

3.6 Data Collection Procedures

The survey was directed to the residents of Maili Saba settlement, the local leadership, and stakeholders in water supply services and management from selected agencies within the Nairobi region. A total of 102 individual respondents were interviewed as well as 10 key informants from the utility and local leadership.

3.7 Validity of Instruments

Joppe (2009) provides the following explanation of what validity is in quantitative research. *Validity determines whether the research truly measures that which it is intended to measure or how truthful the research results are.* In other words, does the research instrument allow you to reach the core of your research object?

Researchers usually determine validity through serial questioning, and correlate their results with the findings of other researchers.. Wainer and Braun (2008) describe the validity in quantitative research as “construct validity”. The construct is the initial concept, notion, question or hypothesis that determines which data is to be gathered and how it is to be gathered. They also assert that quantitative researchers actively cause or affect the interplay between construct and data in order to validate their investigation, usually by the application of a test or other process.

Data quality was incorporated in the entire study process especially at the data collection point to include completeness of questionnaires, legibility of records and validity of responses. At the data processing point, quality control included; data cleaning, validation and confidentiality. Face validity was improved by pre-testing of survey instruments. The use of expert opinions, literature searches, and pretesting of open-ended questions helped to establish content validity.

3.8 Reliability of Instruments

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials (Mugenda & Mugenda, 2003). According to Kothari (2009), reliability refers to consistency of measurement; the more reliable an instrument is, the more consistent is the measure. Reliability is influenced by random error. As random error increases, reliability decreases. Random error is the deviation from a true measurement due to factors that have not effectively been addressed by the researcher (Mugenda & Mugenda, 2003). The researcher made all possible attempts to minimize

random errors and hence increase the reliability of the data collected by administering the same instrument twice to the same group of subjects.

3.9 Data Processing and Analysis

3.9.1 Quantitative Data

The completed questionnaires were edited for completeness and consistency, checked for errors and omissions and then coded to Statistical Package for Social Sciences (SPSS). They were then analyzed qualitatively and quantitatively. Editing involved checking of questionnaires to verify if respondents responded to questions and took note of blank responses.

3.9.2 Qualitative Data

Qualitative data was sought into themes, categories and patterns. This enabled the researcher to make general statements in terms of the observed attributes hence conceptualization (Saunders, 2007). Tabulation involved counting the number of cases that fell into various categories.

Data from questionnaires was summarized, coded, tabulated and analyzed. Editing was done to improve the quality of data for coding. Coded data was then fed into the SPSS version 21.0.0. This version was selected for analysis since it offered a more user friendly interface and could easily be linked to Microsoft office suite programs.

Descriptive statistics were used as well. Descriptive statistics such as mean, standard deviation were then generated. Standard deviation represented the degree of variability in the responses. Linear Regression Analysis was used to investigate on the barriers to low income household consumers' in connecting to networked water services. The coefficient of determination (R-Square) resulting from the linear regression was used to determine the goodness of fit. From the literature an R-square greater than 0.7 indicates a very good fit (Reference). P-values for the T-test statistics was used to determine the significance of the independent variables in the regression model. Those variables in the equation with a P-value less than 0.05 were considered significant. A simple regression model was used

in determining the level of influence the independent variables had on dependent variable as shown below:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + e$$

Where:

- Y = Connecting to networked water services in Maili Saba (Dependent Variable)
- β_0 = Constant Term
- $\beta_1, \beta_2, \beta_3$ = Beta coefficients
- X_1 = Affordability
- X_2 = Inadequate Water Supply System
- X_3 = Illegal connections
- e = Error Term

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION & INTERPRETATION

4.0 Introduction

This chapter presents the study findings and provides a comparison with the already existing data from documented sources and other reports. The purpose of this study was to determine the factors that influence connection or non-connection of piped water to poor households in low income urban households, focusing on water services network in Maili Saba, settlement of Nairobi, Kenya. The study's specific objectives were: to investigate the effect of individual factors that determine low income urban households' connection to piped water; to investigate the effect of household factors that influence connection to piped water in low income urban areas; to investigate the communal factors that influence connection to piped water by low income urban households; and to determine policy and regulatory factors that influence connection to piped water by low income urban households.

The study targeted to cover a sample of 384 households within the Maili Saba area. However, due to logistical challenges, the study was only able to cover 102 households successfully. This translated to a response rate of 27%. Going by recommendation of Mugenda and Mugenda (1999), a minimum response rate of 25% is acceptable for household surveys. Based on this, the response rate was taken to be statistically representative of the entire population.

4.1 Status of Connection to Piped Water by Households

The main objective of the study was to examine the determinants of connection to piped water by households living in Maili Saba settlement. It was therefore important for the study to first determine the connection status of households in the target area to piped water network. The study established that majority of the households (52%, n= 53) had a connection to the piped water supply. The results are as shown in Table 4.1 below.

Table 4.1: Status of connection to piped water in Maili Saba

Status of Connection	Frequency	Percentage
Not Connected	49	48
Connected	53	52.0
Total	102	100.0

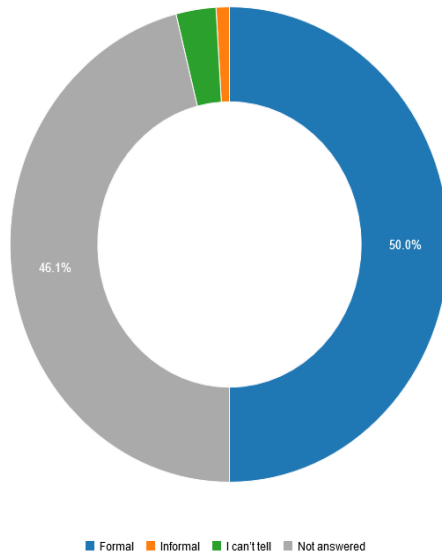


Figure 4.1: Type of piped water connection

Regarding the type of connection (whether formal or informal) the study established that half of the connections (50%, n=51) were formal connections which meant that deposit was paid and receipts received by the utility. However, 3% couldn't determine whether the connection was formal or not, and only 1% of the households admitted being informally connected to the water network (illegal connection not done by the utility).

The rest declined to respond to this question. The results in this regard are as shown in chart 4.1 below.

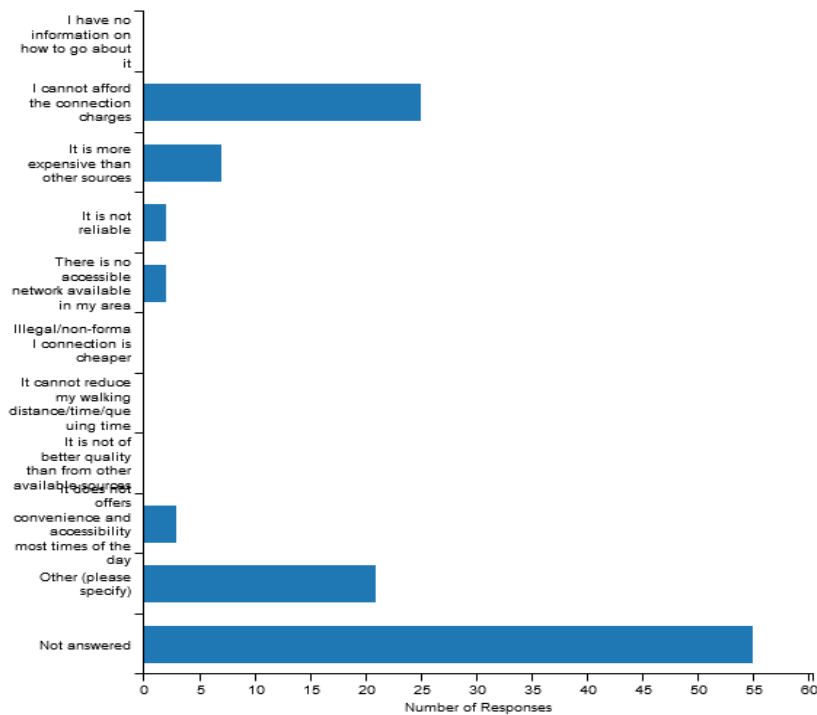
Table 4.2: Reasons for household connection to piped water in Maili Saba

Statement	Frequency	Percentage
N/A (no formal connection)	47	46.1
I could afford the connection charges	1	1.0
It could reduce my walking distance/time	2	2.0
It is cheaper than other sources	7	6.9
It is more reliable than other sources	36	35.3
It is of better quality than from other sources	3	2.9
It offers convenience and accessibility most times of the day	6	5.9
Total	102	100.0

The reasons for the household decision to connect to the piped water system were also examined. From the study findings, majority of the households were motivated by reliability of water sources in their decision to formally connect to the utility system as shown by (35%, n=36) of the respondents. Few (7%) were driven by the fact that piped water was cheaper than other sources while others (6%), sought connection since piped water offered convenience and accessibility most times of the day. Other factors that enabled Maili Saba households to connect to piped water were the fact that they could afford the connection fees (1%) while others (2%) wanted to reduce time and distance to the nearest water source. Table 4.2 above summarizes the basis for households in Maili Saba to apply and pay for piped water connections.

The main reasons given for lack of connectivity to piped water by the households living in Maili Saba LIA were first and foremost - inability to afford connection charges, as reported by 42% of the respondents not connected to piped water source. The second reason given was that piped water connection charges were more expensive than other sources as reported by 8% of those respondents who were not connected to piped water supply. Others (2%) gave both unaffordable connection charges and availability of cheaper sources as reasons why they were not connected to piped water source.

Figure 4.2: Reasons for Lack of Connectivity to Piped Water



The study also found it necessary to assess the levels at which connected households were satisfied with the piped water service by determining the frequency of water availability in their connection/tap. The study findings were that majority, (33% n=34) had their water available on a daily basis while 6% indicated that water was never available on their taps at any one time. Some (7%) could access the water twice a week while 3% accessed it thrice a week. The results in this regard are as shown in Table 4.3 below.

Table 4.3: Availability of water at the taps

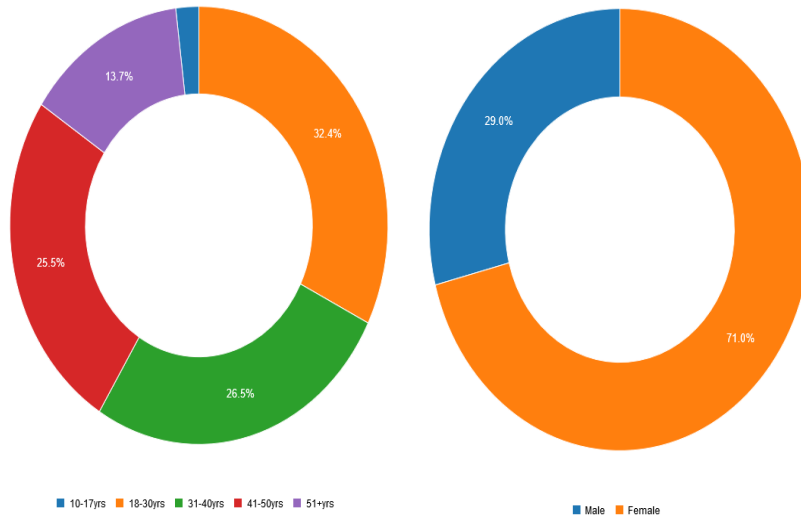
Water Availability	Frequency	Percentage
N/A (not connected)	47	46.1
Daily	34	33.3
I can't tell	2	2.0
Never	6	5.9
Once a week	1	1.0
Other (please specify)	2	2.0
Thrice every week	3	2.9
Twice every week	7	6.9
Total	102	100.0

4.2 Demographic Information on Respondents

4.2.1 Age and Gender of respondents

The total number of respondents interviewed was 102. The demographic information was stratified by age, gender, education and location. The target locations were; Maili Saba (Males 16: Females 35 Respondents); Silanga (Males 12: Females 39 Respondents); The total number by gender was 28 Males and 74 Females. Majority of the respondents (32.4%) were in the age bracket 18 – 30 years, while 26.5% were in the age bracket of 31- 40 years, 25 .5% were in the age bracket 41-50n years and 13.7% were over 51 years. Figure 4.3 below summarizes the demographic characteristics of the respondents by age and gender

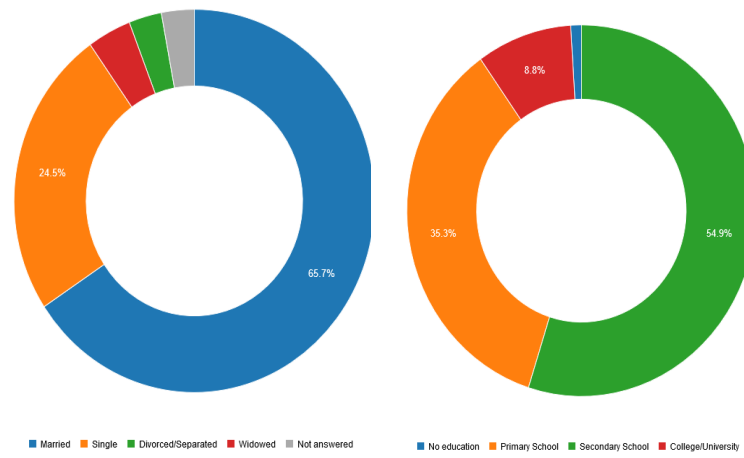
Figure 4.3: Respondents by Age and Gender



4.2.2 Marital Status and Education level of respondents

The education level was tabulated across highest education level attained and age. The highest number of respondents had attained secondary school education (n= 56), followed by those who had attained primary school level (n=36) and lastly college or university graduates and post graduate degree holders, (n=9). Only one of the respondents had not attended any level of formal education. Majority of the respondents (65.7%) reported to be married (66 married respondents of which 43 were women while 23 were male). 24.5% of the respondents reported to be single.

Figure 4.4 Respondents by Marital Status Education level and Age



4.3 Analysis of Results by Objectives

The study sought to present the findings as per objectives. The overall objective was to investigate the effect of various factors that determine low income household connection to piped water network.

4.3.1 Effect of Individual Factors influencing connection to utility piped water supply

The study assessed individual factors of the respondents in regard to how they affected household connection to piped water – mainly gender, education and marital status.

4.3.1.1 Gender

Table 4.4 Gender and connection to piped water

Gender	Connection Status			Total	% of connected HH relative to specific gender
	Don't know	No	Yes		
Female	1	35	38	74	53%
Male	1	12	15	28	51%
Total	2	47	53	102	N/A

According to the empirical study findings, there was a no direct link between gender and household connection to piped water source. This was shown by the insignificant difference of 2% between male population (relative to total males) connected to piped water versus female population (relative to females) that was connected. However, the study further established that there was a significantly higher proportion of male-headed households (54%) connected to water services, as compared to 46% of female-headed households.

4.3.1.2 Education

Table 4.5 Education and household connection to piped water

Education level	Piped water connection		Total	Percentage Connected Per Education Category
	No	Yes		
College/University	5	4	9	44%
Secondary School	27	29	56	52%
Primary School	17	19	36	53%
No education	0	1	1	100%
Total	49	53	102	

Similar to gender, education was also found not to have direct influence on household connection to piped water in Maili Saba slums. From the analysis above, the higher the education level, the lower the percentage of connections/household.

4.3.1.3 Marital Status

Statistical analysis indicated that marital status did not have much influence as majority of the respondents were married and the difference between married and unmarried respondents was very minimal and hence insignificant to draw analytical conclusions. However, qualitative findings from key informant interviews pointed to the fact that even though men head households and control resources, they do not have time to make and follow-up applications for water connections. Discussions in FGDs revealed that it is

their wives who actually led the process from application through to ensuring a connection is in place.

Table 4.6: Pearson Product Moment Correlation Analysis Results for the Relationship Individual factors and connection to piped water

Variables	Pearson correlation coefficient
Relationship between Individual factors and connection to piped water	0.321

P < 0. 01

Pearson’s’ Product moment correlation statistical technique was used to test the strength of the relationship between individual factors and connection to piped water. The Pearson’s Product Moment Correlation co-efficient for individual factors showed a moderate positive relationship with the connection to piped water ($r = 0.321$, $P < 0. 01$).

4.3.2 Influence of Household Factors on Connectivity to Piped Water

The study also sought to determine how household factors influenced the connectivity to piped water for households in Maili Saba slums in Nairobi. The household factors assessed included; house ownership, house type and household income.

4.3.2.1 House Ownership

The study revealed that households whose house ownership status was ‘family owned’ had highest number of connections to piped water with a total of 28 (52%) of households connected followed by 14 (26%) who lived on own houses; Eleven (11) equivalent to 21% of the households connected to piped water were living in rented houses, making it the lowest. From the findings in this regard, it was also established that family house owners had highest connection to piped water access followed by those who owned the houses they lived in. Rented houses did not have good access to piped water and mainly depended water from water vendors as well from a nearby public kiosks.

Table 4.7: Correlation Results for the Relationship between House Ownership and connection to piped water

Variables	Pearson correlation coefficient
Relationship between house ownership and connection to piped water	.760

P < 0. 01

Pearson's Product Moment Correlation was used to test the strength of the relationship between household ownership and connections. The r value of over 0.7 (r = .760, P < 0. 01) depicts a strong positive relationship between house ownership status and household connectivity to piped water.

4.3.2.2 Housing type and rent

Table 4.8: Housing type, rent and water connectivity

Housing Type	Connect- ion to piped water	Amount of rent paid/month (KES)									Total
		800	1,500	1800	2000	2500	3000	3500	4000	5000	
Shared dwelling/ plot	Not answered	0	0	0	0	1	0	0	0	0	1
	No	2	4	0	2	1	1	1	2	0	13
	Yes	0	0	1	1	1	0	0	1	1	5
	Total	2	4	1	3	3	1	1	3	1	19

Regarding the type of housing, amount of rent paid and connectivity to water, it was established that all the respondents irrespective of house ownership status lived under shared plots. However, for those living under rented houses, the amount of rent paid had a significant relationship with connectivity to piped water. Of the total population, those who were paying rent were 19 representing 19% of the total population. Out of the households paying rent and living in shared dwelling plots, only 5 (26%) were living in houses connected to piped water. Thirteen (13) of the households (68%) paying rent were

not connected to piped water as shown in Table 4.9 above. This leads to the conclusion that majority of tenants live in houses that have no water connection.

Table 4.9: Overall household source of water

Location of Water source	No. of Households
At an institution (mosque, church, school, etc.)	9
Metered household connection	39
Metered shared/yard connection (Connection serving neighboring compound)	27
Non metered household connection (Connection serving neighboring household)	2
Other (please specify)	13
Public water kiosk/ tap	10
Water vendor delivering to the house/compound	2
Total	102

The study revealed that a good number of respondents (38%, n=39) reported getting their water source from a metered household connection followed by those who reported getting their source of water from a metered shared/yard connection (connection serving neighboring household) at 26% (n=27). Those who accessed water from a public water kiosk amounted to 10% of the population while 9% obtained water from an institution (mosque, church, school, etc.) nearby. Vendors had the least supply of household water in Maili Saba.

4.3.2.3 Household Income

Table 4.10: Household Income and Source of Water

Water source	Average household's total income in KES per month				Total
	KES. 0.00 – KES 10,000.00	KES 10,000.00 – KES 20,000.00	KES 20,000.00 – KES 30,000.00	KES 30,000.00 – KES 40,000.00	
At an institution (mosque, church, school, etc.)	2	6	0	1	9
Metered household connection	14	20	5	0	39
Metered shared connection (Connection serving	9	15	3	0	27
Non metered household connection (Connection serving neighboring household)	0	2	0	0	2
Other (please specify)	8	5	0	0	13
Public water kiosk/ tap	4	5	1	0	10
Water vendor delivering to the house/compound	0	2	0	0	2
Total	37	55	9	1	102

The study revealed that household income has a direct relationship with household water source. This was indicated by a trend in the analysis showing that lower income households accessed water from public water kiosks more than households with higher incomes. From the study findings as shown in Table 4.11, all the 10 households which bought water from water kiosks, earned less than KES 30,000 per month, with majority of them earning below KES. 20,000 per month. It was also evident that majority of the residents with income over KES 10,000 per month had access to household or yard connection.

Table 4.11: Pearson Product Moment Correlation Analysis Results for the Relationship between household factors and connection to piped water

Variables	Pearson correlation coefficient
Relationship between household factors and connection to piped water	0.482

P < 0.01

Pearson's Product moment correlation statistical technique was used to test the strength of the relationship between household factors and connection to piped water. The Pearson's Product Moment Correlation co-efficient for household factors showed a strong positive relationship with connection to piped water ($r = 0.482$, $P < 0.01$).

Table 4.12: Household satisfaction with utility water supply services

Item	N/A	Not Satisfied	Not sure	satisfied	Very satisfied	Mean	Std. Deviation
Are you satisfied with the frequency of water availability in your company connection/tap?	47	13	1	14	27	3.31	.633
Are you satisfied with the frequency of billing by the water company?	46	10	20	12	7	1.23	.636
Are you satisfied with the price of water that you pay to the water company?	46	10	20	12	7	1.23	.647

Household satisfaction with water source was measured on a scale of 1 to 4 where 1 represented not satisfied while 4 represented very satisfied. The results indicated that majority of the respondents were satisfied with the frequency of water availability from the company supplied network. This was indicated by the mean of 3.31 which showed that majority of the responses leaned towards satisfaction. However, there was high dissatisfaction in regard to the frequency of billing by the water company as was indicated by a mean of 1.23 which showed that majority of responses leaned towards dissatisfaction. There was moderate dissatisfaction with regard to pricing of the water by the companies showing a mean of 1.23. The results in this regard are as shown in the table 4.13 above.

4.3.3 Influence of Communal Factors on Connectivity to Piped Water

Literature reviewed under this study indicated that some of the communal factors that influence community's connectivity to piped water are social perceptions. This meant that perceptions of consumers on service providers can influence demand and hence access to basic services. Another communal factor that was highlighted under literature review was social proximity which is the dense interactions and 'bonding' of social relations in social networks. The study informed by this background sought to assess the communal factors that have significance in determining households' connectivity to piped water for the population under study. The study used a Likert Scale analysis approach using principal component analysis to determine the critical community factors that determined household connectivity to piped water in Maili Saba. The results are as follows.

4.3.3.1 Analysis for Community Factors

Regarding this objective, findings were computed using Factor Analysis. This was informed by the fact that factor analysis is a useful tool for investigating variable relationships for complex concepts where many items are under study. It allows the researcher to investigate concepts that are not easily measured directly by collapsing a large number of items into a few interpretable underlying factors. In this study, twelve items were under consideration and were prudent enough to determine the critical communal factors that influenced household connection to piped water in the study area. Factor analysis on community elements determining household connection to piped water source was done to determine the most significant. Each factor was measured on a scale of 1 to 5 whereby: Strongly Agree = 1; Agree = 2; Nor Agree; Nor Disagree = 3; Disagree = 4; and Strongly Disagree = 5.

Initially, the factorability of the 12 community factors was examined. Several well recognized criteria for the factorability of a correlation were used. The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.790, above the recommended value of 0.6,

and Bartlett's Test of Sphericity was significant ($\chi^2 (45) = 198.57, p < .05$). This is shown in table 4.14 below.

Table 4.13: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.790
	Approx. Chi-Square	198.574
Bartlett's Test of Sphericity	df	45
	Sig.	.000

The diagonals of the anti-image correlation matrix were all over 0.5, supporting the inclusion of each item in the factor analysis. Finally, the communalities were all above

Table 4.14: Communalities for Community Factors Influencing Connections

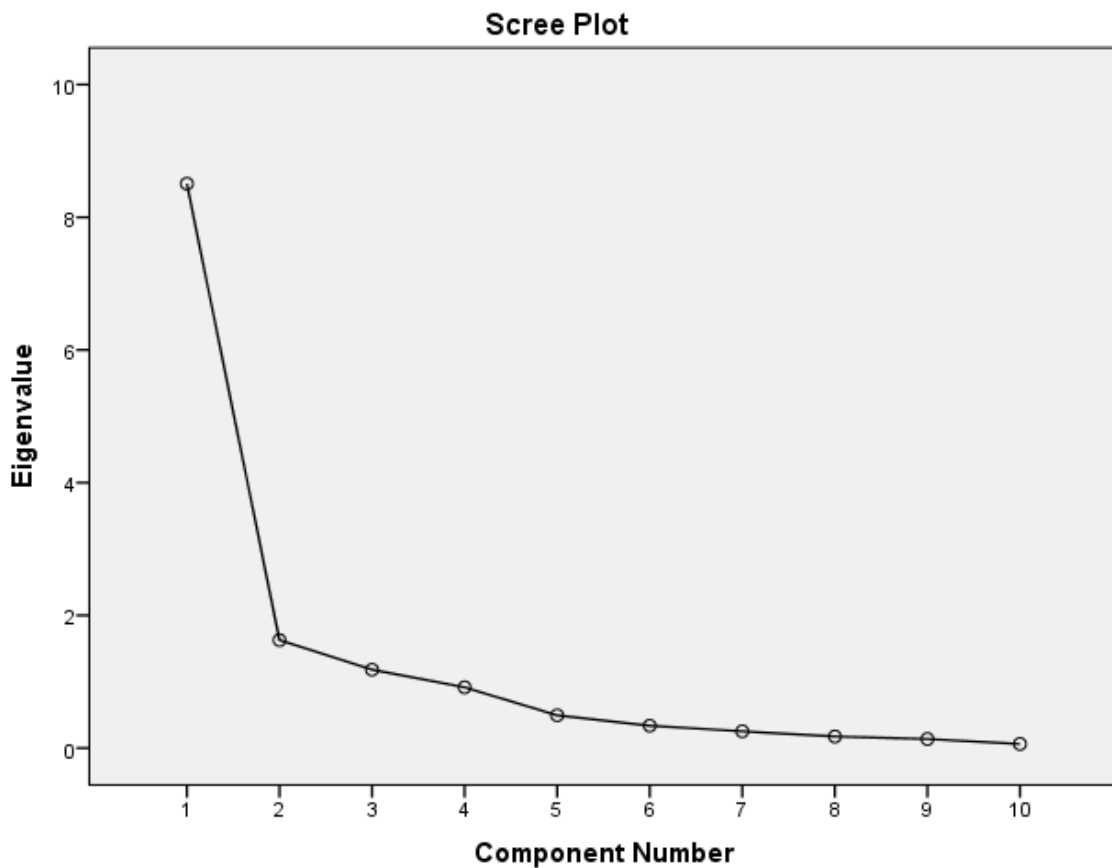
Extraction Method: Principal Component Analysis

Factor communalities	Initial	Extraction
The water company is responsible for the low uptake of connections in the area.	1	0.633
The community's reluctance to initiate application for water connection is the main reason for low connection to piped water.	1	0.729
Community dependence on water vendors is a reason for low piped water connectivity.	1	0.746
Water vendors' sabotage/intimidation is the reason for low piped water connectivity.	1	0.477
Illegal connection by cartels for a small fee and monthly payment is the reason for low piped water connectivity.	1	0.812
Inability to afford/save for connection deposits limit ability to pay for water connection fees.	1	0.859
Lack of trust by the community in the reliability of water company services is the reason for low piped water connectivity.	1	0.454
Poor social cohesion of the community limits application of water connection.	1	0.784
Low community awareness on connection process and costs has led to low connectivity to piped water	1	0.817
Community proximity to water vendor kiosks has led to low demand for household connection to piped water.	1	0.739
Local perception that piped water is expensive is the reason for low uptake of connections	1	0.868
Landlords reluctance/absenteeism is the reason for low uptake of connections	1	0.79
Lack of trust by the community in the reliability of water company services is the reason for low piped water connectivity.	1	0.67
Poor social cohesion of the community limits application of water connection.	1	0.689

0.3 (see Table 4.15 below), further confirming that each item shared some common variance with other items. Given these overall indicators, factor analysis was conducted with all 12 items.

From the factor loadings above, the highest absolute values were obtained for local perception that piped water is expensive is the reason for low uptake of connections with 0.868 and inability to afford/save for connection deposits limit ability to pay for water connection fees with absolute value of 0.859. Figure 4.5 below shows the leveling off point for the factors as at two items. These two items are defined in the subsequent table 4.16 with the variances of the items.

Figure 4.5: Scree Plot for Community factors



This is explained in the total variance computed as per the table below.

Table 4.15 Total Variance for Community Factors

Component	Initial Eigenvalues ^a			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings ^b
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	8.506	62.150	62.150	8.506	62.150	62.150	8.142
2	1.627	11.889	74.040	1.627	11.889	74.040	4.121
3	1.181	8.631	82.671				
4	.916	6.696	89.367				
5	.493	3.604	92.971				
6	.337	2.465	95.436				
7	.252	1.844	97.280				
8	.174	1.274	98.554				
9	.136	.995	99.549				
10	.062	.451	100.000				

Extraction Method: Principal Component Analysis

As shown in the scree plot, three community factors that had leading influence on the connection to piped water can be identified. These factors had the highest mean as computed in the descriptive statistics and had cumulative variance of 83% as shown in the Table 4.16. To determine the three most prominent factors, a component analysis was conducted as shown in Table 4.15 above. The higher the absolute value of the loading, the more the factor influences household connection to piped water. From the table, the items with the highest absolute value of loading were the local perception that piped water is expensive being the main reason for low uptake of connections with 0.868, inability to afford/save for connection deposits with absolute value of 0.859 and low community awareness on connection process and costs with 0.817. It can therefore be

concluded that the three key community factors that influence household connection to piped water are: local perception that piped water is expensive is the reason for low uptake of connections with 62% of variance; inability to afford/save for connection deposits limit ability to pay for water connection fees, with 11% of variance; and low community awareness on connection process and costs with 9% of the variance.

Overall, these analyses indicated that the three factors were most influential in failure of residents to connect to utility water network in Maili Saba, and that these factors were moderately internally consistent. An approximate normal distribution was evident from the composite score data in the current study, thus it can be termed as well suited for parametric statistical analyses.

Table 4.16: Pearson Product Moment Correlation Analysis Results for the Relationship between community factors and connection to piped water

Variables	Pearson correlation coefficient
Relationship between community factors and connection to piped water	0.578*
*. Correlation is significant at the 0.05 level (2-tailed).	

Pearson's' Product moment correlation statistical technique was used to test the strength of the relationship between community factors and connection to piped water. The Pearson's Product Moment Correlation Co-efficient for community factors showed a moderately positive relationship with the connection to piped water ($r= 0.578$, $P<0.05$).

4.3.4 Influence of Water Sector Related Factors on Connectivity to Piped Water

The findings of this study as detailed earlier established that 46% of residents in Maili Saba slums are not connected to piped water supply. This study sought to determine the

water sector factors that influence connection to piped water for poor households in Maili Saba slums.

4.3.4.1 Consumer Awareness on Utility Services

The study sought to assess the effect of awareness levels on household connection to piped water.

Table 4.17: Consumer Awareness

Area of Consumer Satisfaction	Frequency	Percentage
Awareness on location of company office serving the area		
No	18	18%
Not sure	3	3%
Yes	81	79%
Total	102	100%
Satisfaction with convenience of location of the office		
Not Answered	16	16%
Not applicable	7	7%
Not satisfied	2	2%
Satisfied	30	30%
Very satisfied	47	47%
Total	102	100%
Does the respondent know the water utility, the service it offers and how they are offered?		
No	33	32%
Not applicable	8	8%
Not sure	15	15%
Yes	46	45%
Total	102	100%
Knowledge of service procedure if there is a problem with the water supply		
No	29	28%
Not applicable	22	22%
Not sure	2	2%
Yes	49	48%
Total	102	100%

From the study findings it is evident that majority of the respondents (79%) were aware of the location of the service providers' offices while only 18% were totally unaware of the location of water company offices which is located within the LIA. Consequently (75%) of the respondents were relatively satisfied with the convenience of the location of the offices. Despite the high awareness on location of the service provider offices, there was low awareness on the utility services offered by these companies with only 45% of the respondents indicating that they were knowledgeable about it. In addition, 48% were familiar with the process of launching a service failure procedure with the company. This is as outlined in the table 4.18 above.

4.3.4.2 Customer Service

The study assessed how utility customer service affected those connected to piped water.

Table 4.18 Below shows findings in this regard.

Area of Consumer Satisfaction	Frequency	Percentage
Have you ever made any complaint about water services to the water authority/provider?		
No	35	34%
Yes	16	16%
N/A	51	50%
Total	102	100%
If yes, was the complaint handled?		
No	13	13%
Yes	6	6%
N/A	74	73%
Not Answered	9	9%
Total	102	100%
Were you satisfied with the way the complaint was handled?		
N/A	80	80%
Not Answered	3	3%
Not satisfied	12	12%
Not sure	4	4%
Satisfied	1	1%
Very satisfied	2	2%
Total	102	100%

How do you rate the quality of service by water service providers in the area?		
Excellent	6	6%
Fair	38	37%
Good	54	53%
Poor	4	4%
Total	102	100%

From the study findings, 16% of the respondents never had an opportunity to report their complaints. This is not directly related to the earlier finding that majority a 48% of the respondents were aware of the procedure to report complaints, but confirms the earlier findings that close to 86% of the consumers are satisfied with the utility services. However, for those who aired their complaints (n=16), 81% (n=13) of the complaints were not handled. This means that the level of response to customer complaints by the water companies was low at 19%. The level of customer satisfaction with the way water companies handle the complaints was also very low at 3%. Generally, the quality of service provided by the water companies was rated as good as shown by 96% of those who rated the water company's service provision as good and better.

4.3.4.3 Awareness of Government Interventions to Water Provision

This study sought to determine whether there were any favourable government interventions to support access to piped water for the residents of Maili Saba slums.

Table 4.19: Awareness of Government Interventions

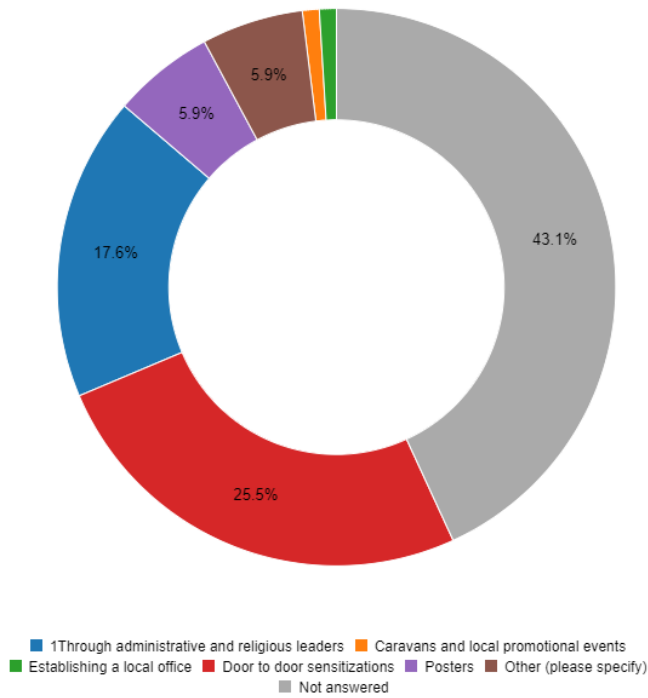
Area of Consumer Awareness	Frequency	Percentage
Are you aware of any social considerations by the government or water company to help people to afford water connections in the area?		
No	61	61%
Not sure	14	14%
Yes	27	27%
Total	102	100%
Are you aware of any effort by the water company or government to educate people in this area to on how to apply for a connection to the water supply network?		
No	51	50%
Not sure	7	7%

Yes	44	44%
Total	102	100%
If yes, how did you get to know about it?		
Caravans and local promotional events	2	2%
Door to door sensitizations	6	6%
Establishing a local office	4	4%
Local Radio/TV promotions	1	1%
Posters	4	4%
Through administrative and religious leaders	22	21%
Friends	1	1%
From neighbors	1	1%
Neighbors with connections	1	1%
Neighbors with metered connection	1	1%
Public meetings	1	1%
Not answered	58	57%
Total	102	100%

The study established that only 27% of the respondents were aware of existing government interventions to improve water connectivity to poor households in Maili Saba slums. The utility in partnership with other partners are putting efforts to sensitize people in the area on how to apply for a connection as reported by 44% of the respondents. According to the respondents, the main sources of information to the residents on water supply connection process was mainly through administrative and religious leaders (21%), followed by door-to-door sensitizations (6%) and the radio/posters (each at 4%).

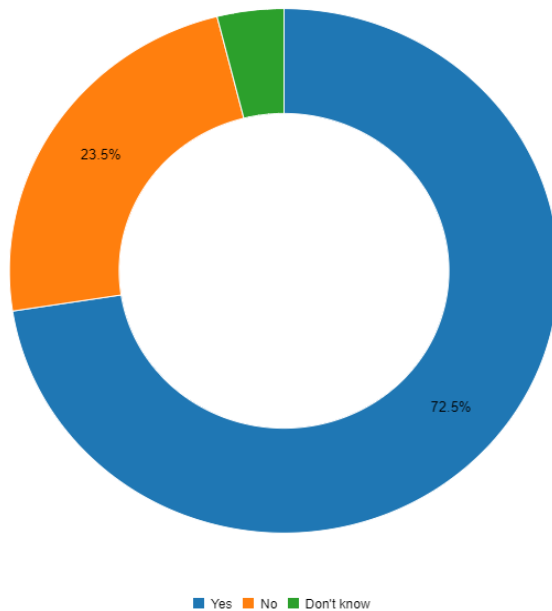
In the quest to understand the most preferred mode of communication in promoting connections, majority (26%) of the respondents preferred door-to-door sensitizations, while 18% would desire messaging from administrative and religious leaders. Apparently, establishing a local office was only preferred by 1% of the respondents as compared to 4% of the current source of connection information in Maili Saba.

Figure 4.6: Mode of connection promotion preferences



The respondents were also asked to rate their general assessment of their satisfaction with government efforts to improve access to piped water for the residents of Maili Saba. The findings were that majority (73%) reported that they were satisfied with the government efforts while 24% were not satisfied. This is as shown in the Figure 4.7|

Figure 4.7: Satisfaction with government’s effort to improve water connectivity



4.3.4.4 Suggestions for Improvement

The study sought to establish the way forward towards improving connection to piped water for households living in the study area. The highest number of people suggested that there be made a plan to allow people to pay connection fee in installments as was suggested by 37% of the respondents. Other suggestions for improvement of utility services included: ensure reliable supply of water to the area; deploy field staff to carry out continuous sensitization on connection process; consistent meter reading and billing cycle; and reduction of connection fees. Accurate meter readings should be taken, frequent reading of meters and billing.

4.4: Tests of Hypotheses

4.4.1: Introduction

This section presents the results of tests of hypotheses and quantitative analysis and interpretations of the relationships amongst the various variables of the study in two main sections. The first hypothesis was to test whether H_1 : Individual and household characteristics have a significant effect on whether households connect to piped water for residents in low income urban areas. The second hypothesis tested H_2 : There is a

significant influence of community characteristics on household connection to piped water in low income urban households, while the third hypothesis tested whether H_3 : Utility, county and national government policies and regulations have a significant effect on household connection to piped water in low income urban settlements. First, bivariate analysis was done followed by multiple regressions.

4.4.1.1 T Statistic and Standard Error

The t statistic is the coefficient divided by its standard error. The standard error is an estimate of the standard deviation of the coefficient, the amount it varies across cases. It can be thought of as a measure of the precision with which the regression coefficient is measured. If a coefficient is large compared to its standard error, then it is probably different from zero.

4.4.1.2 Decision Rule

$$d.f = n - 1 = 102 - 1 = 101 \quad t\text{-critical} = 1.664$$

Decision rule: reject H_0 (null hypothesis) if $t - \text{calculated} < 1.664$

Accept alternative hypothesis when t calculated is > 1.664 .

4.4.2: Individual Factors

The following hypothesis was derived from the first objective, the reviewed literature and the conceptual framework. The dependent variable (Y) was connection to piped water. The following null and alternative hypotheses were tested.

Hypothesis 1 (H_1)

H_0 : Individual and household characteristics have no significant effect on whether households connect to piped water for residents in low income urban areas

H_1 : Individual and household characteristics have a significant effect on whether households connect to piped water for residents in low income urban areas.

Table 4.20: Results of the Regression Analysis for the Relationship between household characteristics and connection to piped water

Model	Unstandardized		Standardized		
	Coefficients		Coefficients		
	B	Std Error	Beta (β)	T statistic	P-value
(Constant)	0.63	0.230		2.739	0.021
Household factors	0.591	0.265	0.972	2.230	0.02
Predictors: (Constant), Household factors.					
Dependent Variable: Household connection to piped water, t-critical = 1.671					

From Table 4.21, individual and household factors explains 59.1% of variation in household connection to piped water ($t= 2.230$, $P=0.02$). Thus the t -calculated (2.230) value is greater than t -critical (1.664) and the P -value is statistically significant.

H₁: Individual and household characteristics have a significant effect on whether households connect to piped water for residents in low income urban areas.

Hence null hypothesis is therefore dropped and therefore fail to reject the hypothesis H₁. Individual and household characteristics have a significant effect on whether or not households connect to piped water for residents in low income urban areas.

4.4.3: Community Factors

This hypothesis was derived from this objective, the reviewed literature and the conceptual framework. The following null and alternative hypotheses were tested.

Hypothesis 2 (H_2)

H_0 : There is no significant influence of community characteristics on household connection to piped water in low income urban households.

H_1 : There is a significant influence of community characteristics on household connection to piped water in low income urban households.

Table 4.21: Regression Analysis Results for the Relationship between Community factors and piped water connection

Model	Unstandardized		Standardized		
	Coefficients		Coefficients		
	B	Std Error	Beta (β)	T statistic	P-value
(Constant)	0.63	0.051		12.27	0.000
Community factors	0.64	0.24	0.368	2.63	0.002
Predictors: (Constant), Community factors.					
Dependent Variable: household connection to piped water, t-critical = 1.664					

There was a positive linear relationship between the predictor and outcome variable, $t=2.63$, $\beta =0.640$, $p = 0.002$. The findings indicate that the t-calculated value (2.63) is greater than t-critical (1.664) and the P-value is statistically significant.

H_2 : *There is a significant influence of community characteristics on household connection to piped water in low income urban households.*

Hence null hypothesis is therefore dropped and hence fail to reject the hypothesis H2. There is a significant influence of community characteristics on household connection to piped water in low income urban households.

4.4.4: Sector Factors

This hypothesis was derived from this objective, the reviewed literature and the conceptual framework. The following null and alternative hypotheses were tested.

Hypothesis 3 (H_3)

H_0 : Utility, county and national government policies and regulations have no significant effect on household connection to piped water in low income urban settlements.

H_3 : Utility, county and national government policies and regulations have a significant effect on household connection to piped water in low income urban settlements.

Table 4.22: Regression Analysis Results for the sector factors and connection to piped water

Model	Unstandardized		Standardized		
	Coefficients		Coefficients		
	B	Std Error	Beta (β)	T	P-value
(Constant)	0.63	0.163		3.87	0.000
Sector Factors	0.66	0.14	0.39	4.714	0.000
Predictors: (Constant), Sector factors.					
Dependent Variable: household connection to piped water, t-critical = 1.664					

From the table 4.20, there exists a positive linear relationship between the predictor and outcome variable, $t = 4.714$, $\beta = 0.66$, $p = 0.000$. The findings indicate that the t-calculated value (4.714) is greater than t-critical (1.664) and the P-value is statistically significant.

H₃: Utility, county and national government policies and regulations have a significant effect on household connection to piped water in low income urban settlements.

Hence null hypothesis is therefore dropped and consequently fail to reject the hypothesis H₃. Utility, county and national government policies and regulations have a significant effect on household connection to piped water in low income urban settlements.

4.5 Analytical Model Generation

Table 4.23: Multiple linear regression results on connection influencing factors

Constant	Un-standardized		Standardized		T	P	VIF
	Coefficients		Coefficients				
	Beta β	Std. Error	Beta β	Statistic	Value		
Constant	0.63	0.27		2.33	0.021		
Household factors	0.59	0.265	0.28	2.23	0.020	2.16	
Community factors	0.64	0.24	0.33	2.67	0.002	2.30	
Water sector factors	0.66	0.14	0.19	4.71	0.000		

From Table 4.24, the study results shows that water sector factors amongst the three explanatory variables were more significant with a beta value of 0.66 while community factors and household factors had beta value of 0.64 and 0.59 respectively.

The bigger the difference of T-calculated and T-critical (it can be either positive or negative), the bigger the evidence against the null hypothesis that there is no significant difference. The closer T is to 0, the more likely there isn't a significant difference. If the P-value is less than 0.05 ($p < 0.05$), the decision rule is that we reject the null hypothesis since there are significant differences between the variables we are comparing. The study results shows that water sector factors amongst the three explanatory variables was more significant in influencing the household connection to piped water with the highest Beta β value of 0.66.

β_0 is the autonomous components which are piped water connection influencers that are not influenced by the independent variables considered in the study. It also gives the Y intercept of our curve. From Table 4.24 on multiple linear regression, **$\beta_0 = 0.63$**

β_1 is the coefficient of proportionality which tells the variation to which household factors causes on connection to piped water. From the table 4.24 on multiple linear regression, **$\beta_1 = 0.59$**

β_2 is the coefficient of proportionality which tells the variation to which community factors causes on household connection to piped water. From Table 4.24 on multiple linear regression, **$\beta_2 = 0.64$**

β_3 is the coefficient of proportionality which tells the variation to which water sector factors causes on household connection to piped water. From Table 4.21 on multiple linear regression, **$\beta_3 = 0.66$**

The model is then generated as follows;

$$Y = 0.63 + 0.59X_1 + 0.64 X_2 + 0.66 X_3 + e$$

From the model, the households will record an index of 0.63 in connection to piped water when coefficients for all the other variables are zero. The model also shows that a change in one unit towards household factors will lead to 59% rate of household connection to piped water. The model also indicates a change in one unit towards community factors explains a 64% rate of household connection to piped water, a unit change in water sector factors explains 66% rate of household connection to piped water. The model results show that all the independent variables positively affected the dependent variable though at varying extremes.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the main findings, conclusion and recommendations emanating from the results of this study. Research findings were aligned to the objectives of the study which were: to investigate the effect of individual factors that determine low income household connection to piped water; to investigate the effect of household factors that influence connection to piped water in low income areas; to investigate the communal factors that influence connection to piped water by low income households; and to determine policy and regulatory factors that influence connection to piped water by low income households.

5.2 Summary of Key Findings of the Study

5.2.1 Influencing Individual Factors

The individual factors that were of main focus in the study included the gender and education levels.

5.2.1.1 Education

This study established that of all individual factors, education had no significant influence on household connection to piped water with higher percentage of those who had accomplished university education having the lowest level of connection to piped water at 44%. This pattern is repeated with respondents with secondary school education at 52%, those with primary school education at 53%, and the ones with no education registering 100% connections. This interesting observation strongly contradicts previous studies that access to higher levels of education translates to better understanding of relationship between water and health, and hence, the likelihood that these households will invest more in safe water supply. It is also believed that education, particularly of household head, is a key indicator of economic and social empowerment which in turn

enables access to information inhibits perceptions that are a key impediment to connecting to utility water services by the poor. The finding in Maili Saba strongly contradicts this belief by indicating that the lower the level of education, the higher the rate of connection. This could be due to the fact that education can also inhibit social transformation, in the sense that learned people tend to exude greater skepticism towards reform efforts by the public system than less educated ones. Higher education also means that there is likelihood of better income prospects, and this category of residents may associate LIAs with their short-term, transitional type of residency, and hence may be unwilling to invest for the long-term in the area.

5.2.1.2 Gender

From the study findings, gender was found to have little influence on household connection to piped water. In this regard, there was a meager gender difference in household connection to piped water of 2% in favour of males. High level of connectivity in male-headed households in Maili Saba can be deduced from the general fact that majority of the men are possibly married, control more resources and have higher education and income as compared to women in African setting. This makes it likely that a male-headed low-income household would be in a better position to connect to networked water services as opposed to the female-headed one. This confirms the opinion of DFID (2013) that investment decisions to improve water sources at the household level usually rest with men in their role as household heads.

5.2.1.3 Marital Status

Qualitatively, marital status did not have much influence as majority of the respondents were married and the difference between married and unmarried respondents was very minimal and hence insignificant to draw analytical conclusions. However, qualitative findings of this survey pointed to the fact that even though men head households and control resources, they do not have time to make and applications for water connections. Discussions in FGDs revealed that it is their wives who actually lead the process from application through to connection. It was repeatedly mentioned in the interviews during

this study that men control the family resources and sanction key decisions but they do not have time to make applications while some women have time yet they do not have the resources to start the application.

This conforms to the view of Totoum (2012), who suggests that female-headed households are more likely to adopt private tap or collective tap as main water source, compared with male-headed households. From a general perspective, individual factors had little influence to household connection to piped water as was indicated by a low Correlation co-efficient of 0.321.

5.2.2 Influencing Household Factors

5.2.2.1 Housing Ownership

The study revealed that family-owned dwellings had a higher level of connection as opposed to tenant-occupied plots. Further statistical analysis revealed that house ownership has a strong relationship with level of water connectivity in Maili Saba. House owners in this area have land allotment certificates, which despite not being the real formal land ownership documents, basically provides a quasi-permanent land tenure, good enough to warrant long-term development, including installation of services. Home owners have the ability to make the choice to connect or not, unlike tenants, who rely on decision by the landlord, and often with implication on rent increase. This validates the findings of Bakker & Kooy (2008) which observed that households with insecure tenure are significantly less likely to have a household water supply connection as compared to households owning their home and possessing land ownership documents. Additionally, home owners are likely to have higher incomes than tenants, and this again increases the probability of connection in family-owned residences as compared to rented ones.

5.2.2.2 Household Income

The study revealed that household income has a direct relationship with household connection to piped water source. This was shown by the fact that, households registering higher household incomes registered higher rates of connection to piped water sources

and vice versa. This was also indicated by a trend in the analysis showing that lower income households accessed water from public water kiosks more than households with higher incomes. This can be explained by one of the key findings in this study that ability to afford the initial connection fee is arguably the biggest barrier to households' connection. The lower the household income, the less the ability to pay the one-off connection fees, and the higher the likelihood of depending on alternative water sources despite the existence of a water supply network in close proximity. In addition to fixed connection costs, new utility customers face a number of undocumented transaction costs. According to Bakker & Kooy (2008), potential transaction costs may include bribes demanded by contractors and water utility staff or the trepidation that such bribes may be incurred in the process. These real or imaginary transaction costs realistically diminish the willingness and hence likelihood that a poorer household would consider connecting to a networked supply, and as a result, is more likely to rely solely on a water vendor or other alternative sources.

5.2.2.3 Housing Type

The study established that housing type was almost similar amongst all households in Maili Saba slums irrespective of house ownership status. Most of the households in the area can be described as shared plots. However, for those who lived in rented houses, there was a consistent trend showing that households paying higher rents had higher chances of connection to a piped water source. Most of the houses that were rented had connection to piped water source at a rate of 87% leaving only 13% of households living in rented houses without piped water connection. From a general perspective, household factors had a high influence on connection to piped water by households in Maili Saba slums. These findings disagree with findings by Kitunka (2013) who argued that lack of access to social amenities by households in slums was mainly due lack of government support and due to informal land ownership. This is true, but household factors come into central play in this study. This study provides a new line of argument that access to piped water by poor households in informal settlements is also influenced by household factors.

5.2.3 Influencing Community Factors

Community factors were assessed using Factor Analysis of 14 items which sought to determine the ranking of communal elements influencing household connection to piped water. These factors would be considered as prominently influencing the households in deciding whether or not to connect to piped water supply. From the study findings, three distinct factors emerged as key to influencing household connection to piped water. These were: local perception that piped water is expensive is the reason for low uptake of connections with 62% of variance; inability to afford/save for connection deposits limit ability to pay for water connection fees, with 11% of variance; and low community awareness on connection process and costs with 9% of the variance in influencing poor household connection to piped water. These study findings are consistent with similar findings by Cronin & Taylor (1992), who argued that performance perceptions are proxy variables for the evaluation of service quality and therefore determine household preferences to social amenities.

Perceptions may be emanating from a number of sources. Price perception may be emanating from the historical marginalization and failure by the utility to provide a service to the low income areas in the city, while being seen as adequately servicing the well-to-do in the society. The exclusive provision of network services in higher income areas over the years has embedded the notion that low income people cannot afford connections, and therefore, should rely on informal water sources such as vendors, or on public water points like kiosks, at the best.

Another critical contributor to negative perceptions is probably historical mistrust of the water utility due to little interaction with low income people. This can be argued in line with Bendapudi and Berry (1997) who suggest that, interaction between the customer and the service provider has the potential to strengthen, weaken or even destroy the relationship between them. This lack of interaction denies basic access to public services information to the poor, leads to lack of awareness on connection process and cost, thus further marginalizing them in service provision. The perception of high cost of networked

water sources are not just about the initial connection fees, but also on the tariff and associated billing and maintenance transaction costs to be borne by the households once the connection is in place.

Bakker & Kooy (2008) argue that long waiting times at water utility offices to pay bills and deal with meter mis-readings raise transaction costs compared to the ease of complaint handling and convenience of home visits by vendors to deliver water and collect payments. This means that even if utility connection costs were in full disclosure to potential low income customers, there is a big doubt about hidden and usually unofficial transaction costs that will have to be incurred in the process. This further exacerbates the high connection cost perception by low income people.

Further from real and cost perceived costs, global water and electricity sectors' experience has shown that inability to afford/save is a critical factor when connecting low income households to networked services, and this has been strongly confirmed in the findings of this study. Bakker & Kooy (2008) argue that connection costs not only depend on the utility fees, but also on the distance from the network. In certainty, poor households live in areas of lower network density, making it more likely to pay higher fees for connecting due to extension requirements. This lack of intensified water supply network in the neighborhoods translates into an additional barrier for poor customers wishing to acquire connects.

5.2.4 Policy and Regulatory Factors

According to Evans (2007), many utility companies and local government providers appear to prefer not to work with low income people particularly those living in areas characterised as slums – where planning is weak and the information base may be limited. Tremolet & Hunt (2006), predicted that concerns about providing service to poor households is likely to be more central to policy makers and regulatory and oversight bodies in developing countries because the poor represent a higher percentage of the population, up to 80 percent in some countries, and therefore of the market for water

services. Plummer & Slaymaker (2007) further notes that the regulatory environment can severely affect poor people's livelihoods, and in inference - access to basic services.

This study reveals that despite the presence of a local office of the service provider in Maili Saba, only 45% of the respondents seemed to have an idea of the services it offers. This basically means that low income residents view the utility presence with a hint of aloofness due to historical reasons – mainly marginalization and unreliability of service. This basically means that establishment of a local office in itself does not necessarily drive awareness on connection process, not to mention the general knowledge of what services the utility can offer.

The study further established that 48% were familiar with the process of launching a service failure procedure with the company. However, only a paltry 16% had the opportunity to launch complaints, and out of these, a whopping 81% of them were not satisfactorily handled. Bad customer service is a key deterrent to access to basic services by the poor, not only in the water sector, but across many public provided services. It is interesting to note that the utility has an office in the location, but according to the findings of this study, this does in no way contribute to better customer service, and improved relations between the service provider and its current and prospective customers.

It is attention-grabbing to note that the satisfaction rating for the water company is pretty high at the moment, and so is the feeling that the government is doing the best it can to provide a good service to the people of Maili Saba. However, it is difficult to conclude at this point if this is because the service is somehow new, or this will continue to be the case in even in future. Despite this high rating, there are serious concerns on reliability of service, and inconsistent billing and revenue collection. Lack of guaranteed reliability makes it difficult for households to invest substantial part of their savings in a service they are uncertain of enjoying in future. On the other hand, erratic billing leads to estimations and accumulation of bills, that become difficult to settle along the way.

Estimations also demand launching of complaints with the utility, and with poor customer service, frequent visits and disconnection ensue, increasing frustration and unsustainable transactional costs.

Availability of information on utility services and general awareness on connection process seems to be a role perceived as lacking from the institutions in general. Despite the effort put in by the utility and its partners in promoting demand from creation and demystifying the connection process through door-to-door campaigns, it is noteworthy that the traditional social channel of communication through local religious and administrative leaders still remains most valued in Maili Saba. However, door-to-door campaigns are still seen as a more effective in driving demand upwards in future.

5.3 Conclusions

After careful analysis of field data, three conclusions can be drawn in line with the study objectives. First, individual factors have little effect on access to clean drinking water by households. Secondly household factors as well as community and water sector factors play a crucial role in influencing connection to piped water in low income urban households.

This study therefore brings a new social dimension consideration for policy makers and service providers in trying to increase access to networked services for households living in low income urban settlements. Drawing from these study findings, policy makers can now focus on mainly on household and communal factors as determinants of household connection, and draw clearer strategies for driving demand and improving long-term service provision.

In conclusion, the study observes that it is practically possible to connect low-income customers to networked water system through a well thought-out connection process. The most effective approach can be focused on: reducing negative perceptions on cost and process of connection; reducing the burden of one-off payments and transactional costs of

connections; improving relations at utility-customer interface; and ensuring efficiencies in the reliability, billing and revenue collection.

5.4 Recommendations

Based on the findings of the study, the researcher wishes to make the following recommendations;

- (a) When utility companies plan to extend water supply networks and connect low income households, they should design and implement awareness campaigns to root cost and connection process perceptions since this is the biggest barrier to gaining new customers on low income areas.
- (b) Connection and transactional costs are a big barrier to accessing networked services. Service extensions should only be done with a clear strategy that enables staggered payments for those who cannot afford one-off connection fees. In this case, social connection considerations and targeted subsidies should be a key consideration depending on the situation.
- (c) Improving relations at utility-customer interface is critical to driving demand for networked services in low income areas. Utilities should therefore establish local presence to mainly address customer complaints, improve service reliability and billing process on continuing basis. This will create a dependable and loyal clientele in the long-term.

5.5 Limitations of the study

The findings of this study are interpreted in light of some limitations. One of the limitations was the design of the study which was a cross-sectional in nature that only allowed the analysis of association not the cause and effect. Thus the causality of the findings could not be analyzed. Another limitation is time and resources, which inhibited the researcher from conducting deeper research and further analysis on the findings of this study.

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APPENDICES

APPENDIX I: SURVEY QUESTIONNAIRE

Dear Participant,

I invite you to participate in a research study entitled *‘Factors Determining Low Income Households’ Connection to New Piped Water Services in Maili Saba, Nairobi, Kenya.’*

I am currently enrolled as a student in the Master of Arts in Rural Sociology at the University of Nairobi, and in the process of writing my Master’s Project. The purpose of the research project is to determine what enables and what hinders households in low income areas to connect/not connect to a new piped water system in urban and peri-urban areas.

Your participation in this research project is completely voluntary. You may decline altogether, or request to skip any questions you don’t wish to answer. Your responses will remain confidential and anonymous and the information gathered during this study will remain in secure premises during this process. Only the researchers will have access to the study data and information. There will not be any identifying names on the surveys or interview transcripts. No one other than the researchers will know your individual answers to this questionnaire and your names and any other identifying details will never be revealed in any publication of the results of this study.

This survey will take about 40 minutes to complete.

Thank you for your assistance in this important study.

Sincerely yours,

Kariuki MUGO

Questionnaire No./Ref.:.....

Name of Interviewee:.....

Date of Interview:.....

Place:.....

GPS Reading:

Additional Household Identifiers:.....

SECTION A: DEMOGRAPHIC INFORMATION

Please, tick (√) or *circle* the answer as appropriate,

I: Personal Data

Q1. What is the Sex of the respondent? (1) *Male* (2) *Female*

Q2. What is the Age of the respondent? (1) *10-17yrs* (2) *18-30yrs* (3) *31-40yrs* (4) *40-50yrs*
(5) *50+yrs*

Q3. What is the respondent’s Marital Status? (1) *Married* (2) *Single* (3) *Divorced/Separated*
(4) *Widowed*
(5) *Other*

Q4. How many members live with you in your

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 household?

Q5. What is your highest level of education? (1) *No education* (2) *Primary School* (3) *Secondary School* (4) *College/University* (5) *Tertiary Tech/Vocational Institute*

Q6. What do you do for a living or what is your occupation?

- 1) *Formal employment*
- 2) *Informal employment*
- 3) *Self-employment/business*
- 4) *Casual employment*
- 5) *Retired from employment*
- 6) *None*
- 7) *Other (Please specify).....*

Q7. Please provide me with the following information about your household:

NO.	GENDER (M/F)	AGE	OCCUPATION
1.			
2.			
3.			
4.			
5.			
6.			

SECTION B: HOUSEHOLD RELATED FACTORS

I: Housing and Household Income

Q8. Who owns the house you live in?

- 1) *Self*
- 2) *Family*
- 3) *Landlord*
- 4) *Live-in landlord*
- 5) *Don't know*
- 6) *Other, (specify).....*

Q9a. What is the type of housing you live in?

- 1) *Standalone family dwelling*
- 2) *Shared dwelling/plot*
- 3) *Flat/apartment*
- 4) *Other*

--	--

(specify).....

Q9b. For how years have you been living in this residence?

Q10. What is your average household's total income in KES per month?

- 1) *KES. 0.00 – KES 10,000.00*
- 2) *KES 10,000.00 – KES 20,000.00*
- 3) *KES 20,000.00 – KES 30,000.00*
- 4) *KES 30,000.00 – KES 40,000.00*
- 5) *KES 40,000.00 – KES 50,000.00*
- 6) *KES. 50,000.00 – KES 100,000*
- 7) *Over KES 100,00.00*

Q11. If a tenant, could you please tell me how much monthly rent you pay in KES?

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Instruction: If not a tenant, proceed to Q12

II: Household Access to Water Supply

Q12a. Are you connected to the new water supply network? 1) Yes 2) No 3) Don't know 4) No response

Hint: Probe if it is a formal connection by the water utility, whereby deposit was paid and bills are received.

Instruction: If the answer is *not YES*, please proceed to Q22.

Q12b. Is it a formal or informal connection? (Enumerator deduction from probing only!)

1) Formal 2) Informal 3) I can't tell

Q13. Can you please tell me what is the main reason (s) that made you connect to the water company system?

1) *I could afford the connection charges*

2) *It could reduce my walking distance/time*

3) *It could save my waiting time*

4) *It is cheaper than other sources*

5) *It is more reliable than other sources*

6) *It is of better quality than from other sources*

7) *It offers convenience and accessibility most times of the day*

8) *It is prestigious*

9) *Other, (specify).....*
.....

Q14. What is the frequency of water availability in your water company connection/tap?

1) *Once a week*

2) *Twice every week*

3) *Thrice every week*

4) *Daily*

5) *Never*

- 6) *I can't tell*
- 7) *Other,*
(specify).....
.....

Q15. Are you satisfied with the frequency of water availability in your company connection/tap?

- 1) *Very satisfied*
- 2) *Satisfied*
- 3) *Not satisfied*
- 4) *Not sure*

Not applicable Instruction: If the answer above is 1) or 2), please proceed to Q17.

Q16. If you are not satisfied with the frequency of water availability in your water company connection/tap, how often would you prefer?

- 1) *Once a week*
- 2) *Twice every week*
- 3) *Thrice every week*
- 4) *Daily*
- 5) *Never*
- 6) *I can't tell*
- 7) *Other,*
(specify).....
.....

Q17. How often do you receive your water bill from the company?

- 1) *Twice every month*
- 2) *Once every month*
- 3) *I am not sure*
- 4) *I have never received one*

5) *Other,*
(specify).....
.....

Q18. Are you satisfied with the frequency of billing by the water company?

- 1) *Very satisfied*
- 2) *Satisfied*
- 3) *Not satisfied*
- 4) *Not sure*
- 5) *Not applicable*

Instruction: If the answer above is 1) or 2), please proceed to Q20.

Q19. If you are not satisfied with the frequency of billing by the water company now, what is your preference?

- 1) *Once every week*
- 2) *Twice every month*
- 3) *Once every month*
- 4) *I am not sure*
- 5) *Other,*
(specify).....
.....

Q20. Are you satisfied with the price of water that you pay to the water company?

- 1) *Very satisfied*
- 2) *Satisfied*
- 3) *Not satisfied*
- 4) *Not sure*
- 5) *Not applicable*

Q21. What was your previous main source of drinking water?

- 1) *Mobile vendors*

- 2) *Unprotected well or spring*
- 3) *Water point / kiosk / standpipe supplied by network or borehole*
- 4) *Shared network connection*
- 5) *Household network connection*
- 6) *Other, (specify).....*
.....

Instruction: Please proceed to Q29

Q22. If you have no water connection, what are the reasons for not connecting to the main water supply network?

- 1) *I have no information on how to go about it*
- 2) *I cannot afford the connection charges*
- 3) *It is more expensive than other sources*
- 4) *It is not reliable*
- 5) *There is no accessible network available in my area*
- 6) *Illegal/non-formal connection is cheaper*
- 7) *It cannot reduce my walking distance/time/queuing time*
- 8) *It is not of better quality than from other available sources*
- 9) *It does not offers convenience and accessibility most times of the day*
- 10) *Other,*
(specify).....
.....

Q23. What is the location of the water point used by your household?

- 1) *Metered household connection (Connection serving neighboring household)*
- 2) *Non metered household connection (Connection serving neighboring household)*
- 3) *Metered shared connection (Connection serving neighboring compound)*
- 4) *Non metered shared connection (Connection serving neighboring compound)*

- 5) *Public water kiosk/ tap*
- 6) *Water vendor delivering to the house/compound*
- 7) *At an institution (mosque, church, school, etc.)*
- 8) *Other,*
(specify).....
.....

Q24. In your opinion, do you find this water source reliable? 1) *Yes* 2) *No* 3) *Not sure* 4) *No answer*

Q25. Are you satisfied with the price of water that you pay?

- 1) *Very satisfied*
- 2) *Satisfied*
- 3) *Not satisfied*
- 4) *Not sure*

Q26. Are you satisfied with your main water source in terms of distance from home?

- 1) *Very satisfied*
- 2) *Satisfied*
- 3) *Not satisfied*
- 4) *Not sure*

Q27. Are you satisfied with your main water source in terms of queuing time taken to fetch water?

- 1) *Very satisfied*
- 2) *Satisfied*
- 3) *Not satisfied*
- 4) *Not sure*
- 5) *Not applicable*

SECTION C: COMMUNITY FACTORS

Q30. Indicate your thoughts on the statement below regarding community factors that determine household connectivity to piped water. *Tick (X) as appropriate in the columns under.*

Community factors	Strongly Agree=1	Agree=2	Nor Agree, Nor Disagree=3	Disagree=4	Strongly Disagree=5
(a) The water company is responsible for the low uptake of connections in the area.					
(b) The community's reluctance to initiate application for water connection is the main reason for low connection to piped water.					
(c) Community dependence on water vendors is a reason for low piped water connectivity.					
(d) Water vendors' sabotage/intimidation is the reason for low piped water connectivity.					
(e) Illegal connection by cartels for a small fee and monthly payment is the reason for low piped water connectivity.					
(f) Inability to afford/save for connection deposits limit ability to pay for water connection fees.					
(g) Lack of trust by the community in the reliability of water company services is the reason for low piped water connectivity.					
(h) Poor social cohesion of the community limits application of water connection.					
(i) Low community awareness on connection process and costs has led to low connectivity to piped water					
(j) Community proximity to water					

vendor kiosks has led to low demand for household connection to piped water.					
(k) Local perception that piped water is expensive is the reason for low uptake of connections					
(l) Landlords reluctance/absenteeism is the reason for low uptake of connections					
(n) Other (specify)					

SECTION D: WATER SECTOR RELATED FACTORS

Q31. Do you know where the water company office to serve this area is located? 1) Yes 2) No 3) Not sure

Hint: Interviewer assessment to ascertain that a YES is correct.

Q32. If yes, are you satisfied with the convenience of location of the office?

- 1) *Very satisfied*
- 2) *Satisfied*
- 3) *Not satisfied*
- 4) *Not sure*
- 5) *Not applicable*

Q33. Does the respondent know the water utility, the service it offers and how they are offered?

Hint: Interviewer Assessment

- 1) *Yes*
- 2) *No*
- 3) *Not sure*
- 4) *Not applicable*

Q36. Does the respondent know the right person to talk to or complaint procedure if there is a problem with the water supply? *Hint: Interviewer assessment to interrogate*

- 1) *Yes*
- 2) *No*
- 3) *Not sure*
- 4) *Not applicable*

Q37. Have you ever made any complaint about water services to the water authority/provider?

- 1) *Yes*
- 2) *No*
- 3) *Not applicable*

Q38. If yes, was the complaint handled?

- 1) *Yes*
- 2) *No*
- 3) *Not applicable*

Q39. Were you satisfied with the way the complaint was handled?

- 1) *Very satisfied*
- 2) *Satisfied*
- 3) *Not satisfied*
- 4) *Not sure*
- 5) *Not applicable*

Q40. How do you rate the quality of service by water service providers in the area?

- 1) *Poor*
- 2) *Fair*
- 3) *Good*
- 4) *Excellent*

Q41. Are you aware of any social considerations by the government or water company to help people to afford water connections in the area?

- 1) *Yes*
- 2) *No*
- 3) *Not sure*

Q42. Are you aware of any effort by the water company or government to educate people in this area to on how to apply for a connection to the water supply network?

- 1) *Yes*
- 2) *No*
- 3) *Not sure*

Q43. If yes, how did you get to know about it? For purposes of analysis provide choices.

- 1) *Through administrative and religious leaders*
- 2) *Local radio/TV promotions*
- 3) *Caravans and local promotional events*
- 4) *Establishing a local office*
- 5) *Door to door sensitizations*
- 6) *Posters*
- 7) *Others*

Q44. If no, what would be the best way for the water company to relay this information?

- 1) *Through administrative and religious leaders*
- 2) *Local radio/TV promotions*
- 3) *Caravans and local promotional events*
- 4) *Establishing a local office*
- 5) *Door to door sensitizations*
- 6) *Posters*
- 7) *Others*

Q45. Do you feel the government is doing enough to provide water and sewerage services to the poor in Nairobi?

- 1) *Yes*
- 2) *No*

Q46. What other suggestions do you give to water service providers in order to improve water connectivity and sewerage services to low income households in Nairobi City?

.....
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.....
.....
.....
.....

**APPENDIX II:
KEY INFORMANT INTERVIEW GUIDE**

INTERVIEW QUESTIONS FOR WATER COMPANY STAFF

Date of Interview: ----- **Venue:** -----

--

Time interview started ----- **Time interview ended**-----

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Dear Participant,

I invite you to participate in a research study entitled *‘Factors Determining Low Income Households’ Connection to New Piped Water Services in Maili Saba, Nairobi, Kenya.’*

I am currently enrolled as a student in the Master of Arts in Rural Sociology at the University of Nairobi, and in the process of writing my Master’s Project. The purpose of the research project is to determine what enables and what hinders households in low income areas to connect/not connect to a new piped water system in urban and peri-urban areas.

Your participation in this research project is completely voluntary. You may decline altogether, or request to skip any questions you don’t wish to answer. Your responses will remain confidential and anonymous and the information gathered during this study will remain in secure premises during this process. Only the researchers will have access to the study data and information. There will not be any identifying names on the surveys or interview transcripts. No one other than the researchers will know your individual answers to this questionnaire and your names and any other identifying details will never be revealed in any publication of the results of this study.

This survey will take about 60 minutes to complete.

Thank you for your assistance in this important study.

Sincerely yours,

Kariuki MUGO

6. What do you think would encourage low income people from Maili Saba and other areas to apply for formal connections?

7. What do you think discourages people from Maili Saba and other areas to apply for formal connections?

8. What mechanisms/ structures/ would the utility use to carry out promotions for landlords to apply for connections?

9. What are the best methods of reducing illegal connections to the new water system?

10. What do you think can be done by the national/county government to support poor people to connect to formal water supply networks in low income areas like Maili Saba?

11. Do you have any other thing you would like the interviewer to know?

Thank you for your participation!

APPENDIX III

KEY INFORMANT/FOCUS GROUP DISCUSSION INTERVIEW GUIDE

INTERVIEW QUESTIONS FOR COMMUNITY LEADERS

Date of Interview: ----- **Venue:** -----

Time interview started ----- **Time interview ended**-----

Dear Participant,

I invite you to participate in a research study entitled *‘Factors Determining Low Income Households’ Connection to New Piped Water Services in Maili Saba, Nairobi, Kenya.’*

I am currently enrolled as a student in the Master of Arts in Rural Sociology at the University of Nairobi, and in the process of writing my Master’s Project. The purpose of the research project is to determine what enables and what hinders households in low income areas to connect/not connect to a new piped water system in urban and peri-urban areas.

Your participation in this research project is completely voluntary. You may decline altogether, or request to skip any questions you don’t wish to answer. Your responses will remain confidential and anonymous and the information gathered during this study will remain in secure premises during this process. Only the researchers will have access to the study data and information. There will not be any identifying names on the surveys or interview transcripts. No one other than the researchers will know your individual answers to this questionnaire and your names and any other identifying details will never be revealed in any publication of the results of this study.

This survey will take about 60 minutes to complete.

Thank you for your assistance in this important study.

Sincerely yours,

Kariuki MUGO

A. Individual Factors Affecting The Uptake Connections

1. Do people in low income areas think water network connections are good or bad thing?
2. What do you think are the key factors that encourage the local community to apply for water connections?
3. What are the existing challenges that are that discourage the local community from applying for water connections?
4. Who do you think has a key role in ensuring that the communities in Maili Saba positively embrace water connections?
5. What do you think is your direct role in ensuring that the people of Maili Saba get connections?
6. Generally and in your opinion, what more do you think should be done by the water company to encourage people to apply for water connections in low income areas?

B. Community Factors Affecting The Uptake Connections

1. What are the existing challenges with the current supply network?
2. Are water cartels are real challenge in promoting connections in the area?
3. If they are, what can the company/county government do to help the people make applications and get services without fear of intimidation or sabotage by these cartels?

4. Why are some people not willing to connect to the water network? (Probe Issues of social cohesion, ethnicity, culture and existing perceptions on water connections and any other existing reasons)

Sector Factors Affecting The Uptake Connections

1. At the sector level/water company level, what do you think is the cause to the slow uptake of water connections?
2. What do you think should be done at the policy level to encourage people in low income areas to apply for connections?
3. What are some of the areas that you feel the water company needs to improve on a strategy to encourage people in low income areas to get water connections. (*Probe on: Convenience, Respect, Quality, Reliability, Regulations and Policies, Current tariffs and billing systems*).
4. If you were to give final advice the water utility management on turning around the slow uptake of connections in Maili Saba, what would you tell them?

Thank you for your participation!