

**HOUSEHOLDS' WATER ACCESSIBILITY AND ITS INFLUENCE ON  
THEIR QUALITY OF LIFE:  
A Case of Mukuru and Mathare Informal Settlements in Nairobi County**

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## DECLARATION

This project paper is my original work and has not been submitted for examination in any other University.

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This project paper has been submitted for examination with my approval as University Supervisor.

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## **DEDICATION**

This project is dedicated to the Almighty God for having enabled me to come this far. Also it is dedicated to my dear parents for their perseverance and prayers during my study in Kenya.

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I want to thank God for giving me a perfect protection and courage to deal with my study in Kenya. He has prepared all my needs before I had realized and asked for them. I would not have managed this paper and study without His help.

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## ABSTRACT

According to NCWSC (2009), only 20% of slum households in Nairobi County have piped water connections. Most of slum residents buy water in 20 litre jerricans from private vendors or kiosks with far higher prices than middle and high income households, which typically have direct connections to the city's network. The UN (2002) defined water accessibility as the availability of at least 20 litres of drinking water per person per day with maximum water hauling round trip of 30 minutes and should not spend more than 5% of their income on water. Kenya government (2007) set policies that increase access to safe water to the Kenyan from 60% to 80% by 2015. And water points should be located within 30 minutes round trip from house with flat rate of Ksh 204 for up to 6 cubic meters water.

The purpose of this research was to determine the achievement of water accessibility in Mukuru and Mathare slums in terms of international guidelines and Kenya National policies and residents' perceptions of water accessibility to their better quality of life. Three villages in each slum were selected and 192 household heads were sampled. The questionnaire served as the instrument for collecting data and Microsoft excel programme was used to analyze data.

The two slums reached the goal of national policies to access safe water by indoor tap, private vendors and kiosks and the respondents in both slums spent an average of 24 litres of water per day per person. However, over half of them still consumed below 20 liters. They took an average 2 hours 14 minutes to collect water everyday. Around one third of the respondents spent over 5% of their income on water and they paid three or more times higher cost of the flat rate charged by the NCWSC. Water accessibility in Mukuru and Mathare slums met neither international guidelines nor national policies at all. Almost 80% of the respondents in both slums perceived realized access to water was crucial issue to improve their quality of life. Around 60% of respondents expressed their dissatisfaction with the water supply and their daily water consumption. Kiosks which were prevalent in Mathare provided better water service to the residents with short physical distance, high hygiene conditions, low water cost, few price fluctuations and there was high satisfaction of the respondents with their water supply than was the case with water service by private vendors who were dominant in Mukuru slum.

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## ABBREVIATIONS AND ACRONYMS

DeI	Democracy Index
EdI	Education Index
EnI	Environment Index
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Federal
HI	Health Index
JICA	Japanese International Cooperation Agency
JMP	Joint Monitoring Programme
KENSUP	The Kenya Slum Upgrading Programme
KfW	Kreditanstalt für Wiederaufbau (The German Development Bank)
KNBS	Kenya National Bureau of Statistics
KPLC	Kenya Power and Lighting Company
KWAHO	Kenya Water for Health Organisation
MDGs	Millennium Development Goals
MWI	Ministry of Water and Irrigation
m <sup>3</sup>	Cubic meter
NCWSC	Nairobi City Water and Sewerage Company
NGOs	Non Government Organizations
NWSS	The National Water Service Strategy
O&M	Operations & Maintenance
PI	Peace Index
QLI	Quality of Life index
QoL	Quality of Life
RoK	Republic of Kenya
UN	United Nations
UN CESCR	United Nations Committee on Economic, Social and Cultural Rights
UN Habitat	United Nations Human Settlements Programme
UN OHCHR	United Nations Office of the United Nations High Commissioner for Human
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations children's Fund
USAID	U. S. Agency for International Development
WASREB	The Water Services Regulatory Board
WHO	World Health Organization
WHOQOL	World Health Organization Quality of Life
WI	Wealth Index
WSP	Water and Sanitation Program
WSTF	The Water Services Trust Fund
WWAP	World Water Assessment Programme

## CHAPTER ONE: INTRODUCTION

### 1.1 Background to the study

Informal settlements are high density and low income areas that are excluded in the city planning for basic services such as water, sewage, drainage and toilet sanitation. Over 1 billion people, or one sixth of humanity and 32% of the world's urban population live today in informal settlements with inequitable and life-threatening conditions. If urban expansion is taken under business as usual without any innovative action, the number of slum<sup>1</sup> residents worldwide is projected to rise up to 2 billion by 2030 (UN Habitat, 2003; 5).

According to the MajiData<sup>2</sup> Kenya has over 8 million people living in low income areas and the population of slum residents is increasing rapidly at 5% per year (MajiData website 2014). Despite the broad ranging water sector reform and commitment to invest in water supply, Kenya still faces considerable challenges in reaching water supply to informal settlements. To reach MDGs, 15.8 million more people need to obtain access to water in Kenya. Even if the target is met, 8.5 million people still remain without access to safe water (UNDP, 2006a). Amnesty International (2010) pointed out the reason for this as being Kenyan government's low funding to improve basic services provision in informal settlements. The poor economic situation, rapid population growth, limited resources, inefficient revenue collection, strict control by the Nairobi City Council and poor management also hinder its achievement of development goals.

Globally the urban informal settlements have shown phenomenal growth over the last three decades. To control overpopulation in the urban areas, sustainable urban planning and effective management are faced with main challenges in the world's urban areas. According

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<sup>1</sup> There is no official definition of slums or informal settlements and the concepts slums and informal settlements are used interchangeably (Mutullah, 2003).

<sup>2</sup> MajiData is funded by Ministry of Water and Irrigation (MWI), UN-Habitat, the German Development Bank (KfW), Google.org, GIZ and the Water Services Trust Fund (WSTF). MajiData contains a large amount of important information on all urban low income areas of Kenya. MajiData provides the Water Sector with the information required to measure impact and progress towards the achievement of the Millennium Development Goals and the targets set by Vision 2030 (<http://majidata.go.ke/>).

to UN Habitat (2009), over half of the world people live in the urban areas today and, urban residents will have reached 70% of the world's population by 2050. By 2030, the urban population is expected to rise to almost 5 billion people or 60% of global population, concentrated mostly in Africa and Asia's developing countries. The main problem of urban area expansion is that most cities are not able to cope with the rapid urban growth in terms of ability of governments to provide basic services, and to facilitate the provision of urban infrastructures (UN Habitat, 2009; 8).

The unprecedented rates of urban area expansion result to the rapid growth of informal and squatter settlements. Unplanned urbanization in developing countries accelerates the levels of urban poverty and discrimination among people. In Kenya, more than 34% of total population live in urban areas and more than 71% of them live in informal settlements (UN-Habitat, 2009). Urban informal settlements in Kenya do not receive adequate services such as water, electricity, sanitation, health care, solid waste collection and roads improvement from government because of their illegal status (Wambui, Murage & Ngindu, 2007).

According to Kenya National Census 2009, the city of Nairobi hosts over 3.1 million people, that is accounting for 8.1% of the total 38.6 million population, and about 70% of Nairobi population live in informal settlements around the central city which constitutes only 5% of the city's residential land (NCWSC, 2009; 10). Informal settlements in Kenya are increasing at 5% annual growth rate which is the highest rate in the world and it will double in the next 30 years (Mutisya & Yarime, 2011). With this rapid urbanization and population growth in urban areas, access to safe drinking water is likely to worsen unless there is a proper policy change to provide for the needs of the urban slums.

An adequate clean water supply is universally recognized as a basic human need which is one of the barometers used to measure quality of life of human beings. Yet millions of people in the developing world do not have ready access to an adequate and safe water supply. The number of people without access to safe water in urban areas was rising sharply in developing countries as a result of rapid urbanization, much of which was occurring in peri-urban and slum areas (Wambui, Murage & Ngindu, 2007).

Kenya's Vision 2030 was formulated in 2007 and launched in 2008 and outlines the country's long term development by 2030. It provides the economic, social, and political framework, and also shows action to be taken to achieve development goals such as MDGs (JICA, 2014; ch 6; 8). Vision 2030 emphasizes that accessibility to safe and adequate water is

a fundamental human right and a key challenge for national development. One of the Vision's main goals is to improve water availability and accessibility to all (RoK, 2007a; 18). According to the UNICEF/WHO Joint Monitoring Programme (JMP), 59% of Kenya's population (83% of urban populations and 52% of rural population) had access to improved drinking water<sup>3</sup> (WHO/UNICEF JMP, 2012; 27). The MDG target is for almost three quarters (72%) of Kenyans to have access to improved water supply by 2015. However, it is foreseen to be missed by 7 percentage points (WSP, 2011; 8).

Inadequate water accessibility in slums affects not only livelihood and health issues but also children's education, gender equality and income activity which are key elements of quality of life of human beings. The Citizen Report Card Survey (2007) showed that users of water kiosks in cities spent 2 ~ 5 hours per day to fetch water. Some slum residents cannot work during those fetching water days and some children have to help fetching water instead of attending school because they have to store water during its shortage and far distance from house to its supply point (Ben, 2010). Mostly fetching water for cooking, cleaning, washing and so on is assigned to women and very often young girls rather than men and boys (Irura, 2008). WHO/UNICEF Joint Monitoring Programme (JMP) surveyed 45 developing countries and it showed that women and children bear the primary responsibility for water collection in a majority of households (WHO/UNICEF JMP, 2012). Among the slum residents in Nairobi County, about 15% of them have yard tap and in-house water connection respectively (Gulyani & Talukdar, 2009; 200). This shows that over 80% of urban slum residents in Nairobi County still have a problem to access improved water sources.

This study focuses on the effect of water accessibility on the quality of life which is one of the main basic services and right of human beings. Among the basic services, water sector is selected because it is a basic need to maintain life and improve well being of slum residents. Access to water in the urban slums was examined on the basis of Kenyan national

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<sup>3</sup> Access to an improved water source refers to the percentage of the population using an improved drinking water source. The JMP has established a standard set of drinking-water category that is used for monitoring purposes. An "improved" drinking-water source is one that, by the nature of its construction and when properly used, adequately protects the source from outside contamination, particularly fecal matter. Improved drinking water sources include piped water on premises (piped household water connection located inside user's dwelling, yard or plot), and other improved drinking water sources (public tap or standpipe, tube well or borehole, protected dug well, protected spring, and rainwater collection). WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation (<http://www.wssinfo.org/>, accessed on 11<sup>th</sup> September, 2014).

development plans and international guidelines on basic services of water accessibility and quality of life. This study sought to find out the differences in accessibility in two informal settlements, Mukuru and Mathare slums in the city of Nairobi.

## **1.2 The Research Problem**

Nairobi has about 160<sup>4</sup> informal settlements and over half of its population lives in such settlements, more commonly known as slums (Davis, 2006). The Ministry of Water has made piped water available to almost half of the slum residents countrywide, but they are still faced with severe obstacles as the population continue to grow and demand for water continues to increase (Njeru, 2012). Most of the slum residents purchase water in 20 litre plastic jerricans from vendors who store and sell it from standpipes (Crow & Odaba, 2010). A related problem is that the streets in urban slums are narrow, unpaved and uneven. Many streets have open drains, doubling as sewers and spreading garbage. It is difficult to carry heavy loads of water from water source to house.

Water prices in urban slums vary seasonally according to supply. Over 70% of the Nairobi population live in slums and about 20% of slum households have water connections. Slum residents experience water shortages. About 75% of them buy water from kiosks at prices far higher than those paid by middle and high income households, which typically have direct connections to the city's network (UN Habitat, 2006; 10). In August 2008, a Nairobi newspaper, *Standard Digital News*, reported that water in informal settlements was selling for Ksh 15 to 30 per a 20 litre jerrican (Standard, 2008). Water and Sanitation Program's Report estimated that urban slum residents pay higher water prices than average prices in Kenya and maximum prices are about double European prices (WSP, 2005; 6). By depending on private water vendors for their needs, slum residents were inevitably paying higher prices, in some case, they paid as much as ten times more for water.

The Nairobi City Water and Sewerage Company (NCWSC), a subsidiary of the Nairobi County government usually known as Nairobi Water, had got a conditional approval from the Water Services Regulatory Board (WASREB) to increase water tariffs by 104%, but was

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<sup>4</sup> Amnesty International reported that Nairobi has over 200 slums on its report of *Insecurity and Indignity* 2010.

allowed 93% to the domestic and commercial consumers in Nairobi City from the beginning of 2015. The WASREB approved rates of three tariff blocks such as: phase using less than 6 cubic meters pay a flat rate of Ksh 204; 7 to 60 cubic meters pay Ksh 52 for each unit; while those using over 60 cubic meters pay Ksh 64 for each unit. They had also proposed to increase the flat rate for low income earners who live in informal settlements and consume less than 6 cubic meters of water per month, from Ksh 187.10 to Ksh 204 beginning January, 2015 (Mugambi, 2014). Based on the proposed flat rate the residents of slums should pay up to Ksh 204 for 6 cubic meters of water.

Due to lack of water pipe connections in the slums, the main water sources which slum residents use are private vendors, kiosks and handcarts.

**Table 1. New water tariffs from January 2015**

Water (m <sup>3</sup> )	< 6	7~60	> 60
Ksh	204	52	64

(Source: <http://www.businessdailyafrica.com/>, 19<sup>th</sup> November, 2014)

A common price of water kiosk in the informal settlements is Ksh 2~3 per 20 litre jerrican (or Ksh 100~150 per a cubic meter). That is, low income earners are currently paying three to seven times the flat rate. During water shortages the prices become higher, rising to Ksh 5 or even as much as Ksh 10 per 20 litre jerrican (the equivalent of Ksh 250 or Ksh 500 per a cubic meter), which goes to seven or fifteen times the flat rate.

Moreover the water quality from private vendors is not assured, compared to the quality of piped water supply (WWAP, 2006). Although informal settlements in Nairobi have water connections from the City Council, the maintenance of pipes is not done properly and bursting, stealing water through illegal connection with water pipe, unhygienic pipe connection and leakage of water from aged pipes are problems. Many slum residents have limited water for bathing and often use polluted river water (UN Habitat, 2006; 10).

Insufficient access to water increases serious security problems such as water-related crimes, conflicts, stealing, leakage and pollution by illegal connections. The most common crimes are



theft, muggings and illegal disconnections of water pipes by thieves who collect and sell the water. In the report from Thomson Reuters Foundation (2012), Kenya Police reports show that urban slums are undergoing many incidences of water related theft daily, for example, in Kibera reports of as many as 75 cases of water related theft daily. Police say there are many other cases which go unreported due to retaliations by thieves. In Kawangware slum which borders on Lavington, one of the richest suburbs reported half of water related theft as Kibera slum. As police report, the slum residents, instead of stealing from others in the slum, sneak into Lavington to steal water and it affects the security of the residents of the estate (Njeru, 2012).

Not only slums in Nairobi County but also all urban slums in the country experience these insecurity issues. According to the Kenyan newspaper, *Daily Nation*, on July, 2012, the Nakuru High Court in Samburu East fined an old man who killed a villager following a quarrel for jumping a long queue at the borehole to fetch water (Macharia, 2012). This shows that water is a vital resource for human beings and is a matter of life and death.

Insufficient, low quality and irregular water supply also affects health condition. Although slum residents have water supply, the water is not always safe to drink and use due to lack of water quality management, poor performance of water supply systems and irregular water supplies. One of the major water quality problems is microbiological contamination through sewage seeping into broken or loose pipes or irregular water supply. WHO reported that more than 3.4 million people die each year from water, sanitation, and hygiene-related causes, nearly all deaths occur in the developing world (WHO, 2008a). WHO/UNICEF Joint Monitoring Programme (JMP) estimated that over 780 million people still lack access to an improved water source; approximately one in nine people (WHO/UNICEF JMP, 2012; 2). Clean and safe water is essential to healthy living and improved quality of life.

Quality of life was only thought as related to feeling good about person's life and one's self (Flora, 1998). However quality of life has a wide range of contexts, including not only wealth and employment but also the built environment, physical and mental health, education, recreation and leisure time and social belonging (Nussbaum & Sen, 1993; Gregory et. al., 2009).

Although quality of life is more subjective and intangible, access to and quality of basic services such as water, electricity, transportation and sanitation can improve the quality of life of people. Without satisfaction of basic services for human basic rights, high quality of life cannot be expected. Lack of access to water is the core problem facing urban slum

residents in Kenya especially in Mukuru and Mathare slums in the city of Nairobi and has a bearing on the residents' quality of life.

### **1.3 Research Questions**

- 1) What are the characteristics of households in informal settlements?
- 2) What is the level of accessibility of the households to water source?
- 3) What are the perceptions of water accessibility by the slum residents?
- 4) Does the water accessibility in study slums satisfy the international and national water standards?
- 5) Do households in the two informal settlements have different perceptions of water accessibility and quality of life?

### **1.4 Objectives of the Study**

#### **Main Objective**

The main objective of study is to examine how accessibility of households to water affects their quality of life in the informal settlements of Mukuru and Mathare slums, Nairobi County, Kenya.

#### **Specific Objectives**

- 1) To examine profiles of households sampled in Mukuru and Mathare slums.
- 2) To find out the current level of water accessibility of households in Mukuru and Mathare slums.
- 3) To examine perceptions of respondents on their current water accessibility.

- 4) To find out the perceptions of the respondents about their quality of life.
- 5) To assess the achievements of international guidelines and national policies on water accessibility in Mukuru and Mathare slums.

### **1.5 Justification of the Study**

Nairobi County is one of the most rapidly expanding cities in the world and has serious security problem in relation with urban sprawl. Fast city expansion brings informal settlements around the core of the city and most informal settlements experience insufficient basic services such as water supply, electricity, road and health care.

This research seeks to understand current accessibility of households to water in the urban slums. It is to provide up-to-date information about the water sector approach in urban slums and show potential for improving water accessibility in such areas.

### **1.6 Scope and Limitations of the Study**

Data in the study was collected from Mukuru and Mathare slums of Nairobi County. The focus was on heads of households selected from villages in Mukuru Mathare slums. Since the slums and villages sampled were few, the findings from the study might not be generalized to all of the 160 slums in Nairobi County.

The limitations of the study included, first, the difficulty of knowing the population of the informal settlements. The demographic figures which were used in various reports were not referenced. Thus figures of population sizes in slums are sometimes substantially overestimated or underreported (Desgroppes & Taupin, 2009). This lack of accurate information on population of the slums makes sampling difficult and generalization of research results to others difficult.

Secondly, the difficulties of getting respondents understand questionnaires which were written in English. The questionnaires had to be translated into their languages or Kiswahili.

Finally, given the language barrier, questions needed to be short and easy to keep respondents focused and to save time.

### **1.7 Definition of Key Concepts**

**Water accessibility:** According to the definition of the WHO, water accessibility is defined as the availability of at least 20 litres of drinking water per person per day within a distance of not more than 1 km of the dwelling and a maximum water fetching round trip of 30 minutes (WHO, 2003; 13). Queuing time is also an important indicator of accessibility in urban areas. In addition to a reasonable distance, access to water includes safety and continuous supply of a minimum amount of water sufficient for drinking, personal and domestic hygiene, for an affordable price. WHO's *Guidelines for drinking water quality* provides that an improved water source is defined as a type of water facility or water delivery point that by the nature of its design protects the water source from external contamination, particularly of faeces origin. Safe water is defined as water with microbial, chemical and physical characteristic that meet WHO guidelines or national policies on water quality. Access to safe water is the proportion of people using improved water facility (Howard & Bartram, 2003; 8). An improved facility would include piped water into dwelling, plot or yard; public standpipe or tap; protected dug well; protected spring; and rainwater. Unimproved water sources include unprotected dug well and spring, cart with small tank or drum, bottled water<sup>5</sup>, tanker truck and surface water such as river, dam, lake, pond, stream, canal and irrigation channels (WHO, 2008b; 92).

Drinking water is defined as water for ingestion, basic personal and domestic hygiene and cooking. It excludes water for clothes washing, an activity that frequently happens at the water source, water point, in rivers or streams (UNESCO, 2006; 226). WHO defines domestic water as being 'water used for all usual domestic purposes including consumption, bathing and food preparation' (WHO, 1993; 2003b). The Guidelines exclude some specific use, for example dialysis and contact lens cleaning, and elevated requirements for some particularly sensitive sub-populations (Howard & Bartram, 2003; 8).

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<sup>5</sup> Bottled water is considered improved only when the household uses water from an improved source for cooking and personal hygiene (WHO/UNICEF JMP, 2012;10).

**Quality of life:** Quality of life is a measure of well being of individuals and societies. Quality of life cannot be simply equated with the terms health status, life style, life satisfaction, mental state or well being (WHO, 1993; 1). It is a multidimensional concept incorporating the individual's perception as subjective and objective quality of life which are the degrees of satisfaction with specific basic services for an individual in life (Kerce, 1992; 2). That is, subjective quality of life is focused on individual levels of happiness, pleasure, fulfillment and the like. On the other hand, objective quality of life is measured by social, economic, and health indicators (Costanza, 2008). Quality of life includes not only wealth and employment but also environment, physical and mental health, education, leisure and social belonging (Nussbaum & Sen, 1993). Thus the concept of quality of life is broader than standards of living which is used to measure adequacy of living conditions.

**Slum/informal settlement:** The term 'informal' is an attempt to encapsulate the characteristics of such settlements. However slum or informal settlement is understood more widely as areas of inadequate housing, basic services, security and right of land. It has typically high population density, low or very low incomes, high risk from environmental disasters and high morbidity and mortality rates caused by diseases. UN Habitat defined slums as areas where people live under the same roof lacking at least one of the basic conditions of access to improved water, sanitation, sufficient living area, durability of housing and security of tenure (UN Habitat, 2003). In this paper, there are no differences between slum and informal settlements which are widely located across the city.

## **CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK**

### **2.1 Introduction**

In this chapter, data are presented covering profiles of the respondents, their accessibility to water and their perceptions of water quality, international and national guidelines and policy on water and respondents' perceived quality of life.

### **2.2 Slum / Informal Settlement**

Among the greatest challenges facing human beings are rapid urbanization and increasing urban poverty. Every year, the world's urban population increases by about 70 million people. The most impact of this increase is felt in the developing world, especially throughout Asia and Sub-Saharan Africa. Africa is experiencing an annual urbanization rate of 5% that is faster than any other continent (UN Habitat & UNEP, 2006; 11). The physical expansion of cities accompanied with inadequate or entirely absent infrastructure development is a challenge owing to limited resources struggle in the cities. As a result of this, urban slums have been spreading rapidly throughout cities across the world (Jackson, 2013). More than 1 billion people across all continents live in slums which are characterized by inadequate housing, lack of basic services, overcrowding, and high levels of violence and insecurity (Amnesty international, 2014).

The term 'slum' is used in the MDGs in general context to describe a wide range of low income settlements and/or poor human living conditions. Target 11 of the MDGs describes typical slums in developing countries as 'unplanned informal settlements where access to services is minimal or non-existent and where overcrowding is the norm. Slum conditions result in placing residents at a higher risk of disease, mortality and misfortune' (Payne & Majale, 2004; 11). Ministry of Housing in Kenya defines slum as a heavily populated urban area characterized by substandard housing and unpleasant conditions. The meaning of slum is now commonly interchangeable with the meaning of informal settlement including the vast informal settlements that are the most visible clarification of the urban poverty in cities of developing countries (RoK, 2013). The Merriam Website Dictionary defines a slum as a

densely populated urban area marked by crowding, dirty run down housing, poverty, and social disorganization (Merriam Website Dictionary, Accessed on August 2014). On the other hand, the Oxford Dictionary defines it as a squalid and overcrowded urban area inhabited by very poor people or a house or building unfit for human habitation (Oxford Dictionary, Accessed on August, 2014). The Wikipedia, the free encyclopedia says that a slum is defined as a run down area of a city characterized by substandard housing and squalor and lacking in tenure security (Wikipedia, Accessed on August 2014). At a UN Habitat experts meeting (2002), slum has been defined as a contiguous settlement where the inhabitants are characterized as having inadequate housing and basic services (UN Habitat, 2003; 6). UN Habitat developed five indicators to define slums/informal settlements by one or more of the following characters;

- a) Poor structural quality and durability of housing;
- b) Insufficient living areas (more than three people sharing a room);
- c) Poor access to water;
- d) Lack of sanitation facilities; and
- e) Lack of secure tenure, or combinations thereof.

A slum is often not recognized and addressed by the public authorities as an integral part of the city. That is one of the reasons why little data on slum residents can be found (UN Habitat, 2003; 7). Although all slums do not have the same characteristics and some provide better living conditions than others, most of the slums have common aspects as follows;

- Poor quality and overcrowded housing in slums have a significant impact on people's lives. It makes diseases spread more easily, the effects of disasters are amplified, and people are denied their privacy and safety (Homeless International, 2014). Over 90 per cent of the slum residents are tenants with the majority of structure owners being "absentee landlords". Most of the housing consists of one room shacks built with poor materials and most of slum residents have no access to affordable credit to improve their structures (RoK, 2013).
- With no legal rights to land, slum residents face the threat of eviction and can find it difficult to secure a job and access credit and finance. Not having a formal, legal

address can prevent slum residents from accessing services including healthcare, education, water and electricity (Homeless International, 2014). Unemployment stands out as one of major threats to stability in the slums. People who were born and raised in the slums have difficulty to take their education to higher levels so as to improve their employment opportunities. The main problem is that majority of the youth remain unemployed (Sana & Okombo, 2012).

- Poor sanitation and unsafe water claim the lives of many slum residents every year. Contaminated water supplies, poor hygiene and lack of decent toilets and sewerage increase the spread of deadly diseases in slums. Without toilets, women and girls suffer from lack of privacy and dignity, and the burden of getting water usually falls on them. The price of available water and sanitation facilities is often unaffordable (Homeless International, 2014).

UN Habitat noted that two thirds of the world slum residents live in Africa (UN Habitat, 2006). In Kenya it is estimated that roughly over 70 per cent of people in urban area live in slums. Most slum residents live below the poverty line with less than 1.25 US dollars per day. Access to basic services such as water, sanitation, waste management, education, health centers, electricity and transportation is minimal (RoK, 2013).

Informal settlements have a long history in Nairobi. During colonial era, most Africans were forbidden from designated residential areas which were reserved for Europeans and Asians. Kenyans who moved to the city in search of work had to settle in informal residential areas outside the central business district and settled down in areas that were neglected by the colonial government (Amnesty International, 2009). The first Nairobi master plan in 1948 set out to shape to Nairobi's growth over the preceding 25 years. The plan heavily targeted administrative buildings, commercial center, industrial area, transport system and new African housing estates which were only meant for African servants working for Whites (Anderson, 2010; 138). Mitullah (2003) also argued that the city's first development plan did not include African inhabited parts of the city (Mitullah, 2003). After Kenya gained independence in 1963, poor governance, autocratic leadership and planning leaned toward the African elite and served to further entrench class segregation and social exclusion of the poor (Huchzermeyer, 2011). Therefore essential services to the settlements and road construction to connect them to other areas of the city were not provided for by the local authorities (Mitullah, 2003).



Moreover the reversal of the native restriction law after independence, poor rural land development and lack of employment opportunities in the rural areas forced people to move to urban areas in large numbers (K' Akumu & Olima, 2007). The population of Nairobi has grown over the years from 11,500 inhabitants in 1906 to 3.1 million people in 2009 with more than half the city's population living in informal settlements and slums occupying less than 1% of Nairobi's area and less than 5% in residential area (Mutisya & Yarime, 2011).

According to the UN Habitat (2008), Nairobi population growth rate is about 4% and is projected to grow to 4.8 million by 2020 and to more than 5.8 million by 2025 (UN Habitat, 2008a; 26 and 238). With a rapid urbanization, Nairobi is not accompanied with equal socio-economic and environmental development. Slums in Nairobi are the consequence of both explicit government policy and decades of official indifference evident from city authority planning and budgeting processes. The lack of recognition of slums by national and local authorities led to absence of a range of essential services including water supply, sanitation, electricity, solid waste collection, health service, education, access roads and transport (Mutisya & Yarime, 2011). Therefore, slum residents pay for inadequate access to privatized water, waste collection and house rents, all in excess of what local government could and should charge for better services (Huchzermeyer, 2008).

### **2.3 Basic service**

In the World Employment Conference in 1976, ILO defined basic needs in terms of food, clothing, housing, education and public transportation and helped lay the foundation for the human development approach for a target year, by twenty-five years into the future (1975-2000) (Emmerij, 2010). This was – and still is – a framework for providing analysis and guidelines in broad ranging and comprehensive strategies for economic and social development. Basic needs is divided with two elements which are required to pay attention; a) ensuring the provision of certain minimum requirements of a family for private consumption such as adequate food, housing, and clothing; and, b) ensuring that essential social services for the community at large such as drinking water, sanitation, public transport, health, and education (UN, 2009). On a more general scale and with a view to facing poverty reduction and human development, the extension of improving basic services to the poor majority

needs to be given priority in the national development plan and is fundamental to the achievement of the Millennium Development Goals (MDGs).

Providing the basic services to all is the duty of government. The basic services are recognized as human being's basic rights or needs. The basic needs are based on the human development theory. This theory assumes that people experiencing a high quality of life have significantly satisfied their developmental needs. The theory is based on Maslow's hierarchy of needs and includes lower level needs such as health, safety, and economic factors, and higher level needs such self esteem, actualization, knowledge and aesthetics (Greyling, 2013).

#### **2.4 Access to safe water**

The United Nations Millennium Development Goals developed in 2000 with eight goals focused on health, education and environmental issues seek to reduce poverty in the Third world. Goal 7, Target 10 aims at halving by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation (UN MDGs, goal 7, 2001). According to the latest report of the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation, the MDG's drinking water target has already been met in 2010 through an increase in coverage from 76% to 88%. Between 1990 and 2012, 2.3 billion people gained access to an improved drinking water source, raising global population coverage to 89% in 2012 except Democratic Republic of the Congo, Mozambique and Papua New Guinea where less than half the population had access to an improved drinking water source. About 56% of the global population, almost four billion people, now enjoy the highest level of access to water (WHO/UNICEF JMP, 2014; 2). The UN MDGs report in 2013 estimated that between 2000 and 2010, over 200 million slum residents benefitted from improved water sources (UN, 2013; 4). Despite strong overall progress, 748 million global population and 325 million (43%) of whom live in sub-Saharan Africa still did not have access to improved drinking water in 2012 (WHO/UNICEF JMP, 2014; 2). Access to water is the proportion of population with access to an adequate amount of safe drinking water located within an affordable distance from the houses (UN, 2000; 67).

#### 2.4.1 International guidelines

Whereas Comment 15 of the United Nation Committee on Economic, Social and Cultural Rights (UN CESCR, 2002), the adequacy of water required may vary according to different conditions, the following factors apply in all circumstances;

(1) *Availability*. The water supply for each person must be sufficient and continuous for individual and domestic uses. These uses ordinarily include drinking, personal sanitation, washing of clothes, food preparation, personal and household hygiene (General Comment No 15; 5). The minimum quantity required is 20 litres per capita per day. Whereas this remains significant health concern, it needs to ensure at least 50 and 100 litres per person per day (WHO & UNICEF, 2000). Most of the people categorized as lacking access to clean water use about 5 litres a day which is one tenth of the average daily amount used in rich countries to flush toilets (UNDP, 2006b).

(2) *Quality*. The water required for personal or domestic use must be safe, free from micro-organisms, chemical substances and radiological hazards that constitute a threat to people's health (WHO, 1993). Everyone is entitled to safe and adequate sanitation. However, close to half of people in developing countries are suffering from health problems caused by poor water and sanitation. Unclean water and poor sanitation and related diseases such as diarrhea are the world's second biggest cause of children death which has been calculated at 1.8 million each year and is also a loss of 443 million school days each year from water-related illness (UNDP, 2006b). Furthermore, water should be of an acceptable color, odor and taste for personal or domestic use (General Comment No 15; 5).

(3) *Accessibility*. Water and water services have to be accessible to everyone without discrimination within the jurisdiction of each state. Four elements of accessibility are presented below.

- *Physical accessibility*: water and adequate water facilities and services, must be within safe physical reach for all sections of the population. Sufficient, safe and acceptable water must be accessible within, or in the immediate vicinity, of each household, educational institution and workplace (UN General Comment No 15; 6). According to the World Health Organization, water source should be located less than 1 kilometer away from home and water collection time should be less than 30

minutes (WHO & UNICEF, 2000). The UN reported that the average distance of collecting water by women in Africa was 6 kilometers (UN OHCHR, 2010).

- *Economic accessibility:* Water, and water facilities and services, must be affordable for to people. The direct and indirect costs and charges associated with securing water must be affordable, and must not compromise or threaten the realization of other Covenant rights (UN General Comment No 15; 6). Cost of water should not exceed 5 per cent of household income, meaning services must not affect capacity of people to acquire other basic services and goods including food, housing, health service and education (WHO & UNICEF, 2000).
- *Non-discrimination:* Water and water facilities and services must be accessible to all, including the most vulnerable or marginalized sections of the population, in law and in fact, without discrimination on any of the prohibited grounds (UN General Comment No 15; 6).
- *Information accessibility:* Accessibility includes the right to seek, receive and impart information concerning water issues. Individuals and groups should be given full and equal access to information concerning water, water services and the environment, held by public authorities or third parties (UN General Comment No 15; 6 and 15).

#### 2.4.2 Kenya's National policies on water

The Kenya government development plan, 1974 sought to ensure safe water to all households by the year 2000. The government established many different plans along the way to manage water effectively, such as the National Water Conservation and Pipeline Corporation (NWCPC). By the year 2000 the NWCPC was managing piped water systems in Kenya which served about 3.8 million people. But the government experienced budget problems along with poor managements and it could not be able to meet its goals by the year 2000. Related to the government's mismanagement is a problem of private investors not willing to provide water services in Kenya (Marshall, 2011).

Being a signatory to the Millennium Declaration and the MDGs, Kenya has to achieve the MDGs in the water sector m by 2015 (target 10); that is, the people without access to safe water need to be halved. This calls for 80% nation-wide coverage of safe water supply by 2015 if the MDG target is to be met (UN Water, 2006; 34). Kenya's national development

strategy “Vision 2030” for the water sector seeks to ensure improved water access to all by 2030 (RoK, 2007a; 18).

The government enacted the Water Act 2002 as the main legislation to regulate the water sector in the country. The Water Act 2002 provides the framework for water sector reforms which means that all policies, regulations and by-law, directives and administrative actions from the ministry, strategic plans and all activities by water sector institutions must be done in accordance with and be consistent with the provisions and content of the Water Act 2002 (KWAHO, 2009). The Water Act 2002 provided the terms of water services which interprets water service to mean ‘any service of or incidental to the supply of water or the provision of sewerage’. The National Water Service Strategy (NWSS) has been established in 2007 to ensure sustainable access to safe water and basic sanitation to all Kenyans. The NWSS covers the period from 2007 to 2015 and gives the strategic framework for water services sub-sector. The main intermediate goal is to meet the water related MDGs by 2015 (RoK, 2007b; 6~7). The goals of NWSS are set based on 2006 Ministry of Water and Irrigation (MWI) estimation such as urban area covered 60% of water service and 55% of sanitation service. On the other hand, rural area covered 40% of water service and 45% of sanitation service. The Goals of the NWSS are;

- a. Increase sustainable access to safe water complying to the Kenyan standards such as drinking water quality from 60% to 80% in the urban area from 40% to 75% in rural areas by 2015.
- b. Reduce the time taken to nearest public/communal outlet and back home to an average of 30 minutes in urban area a distance of 2 km) in rural areas.
- c. Reduce unaccounted for water due to both economical and technical losses from the current average of 60% to 30% by 2015.
- d. Achieve O&M cost recovery of all water service and sewage systems gradually from 2010 with the exception of targeted subsidies to the poor.
- e. Increase access to waste water and sewage collection, treatment and disposal from 30% to 40% in the urban area 5% to 10% in rural areas by 2015)

- f. Increase access to basic sanitation from 55% to 77.5% in the urban and from 45% to 72.5% in rural areas by 2015)
- g. The WASREB approved rates of three tariff blocks such as; using between 0 to 6 cubic meters pay a flat rate of Ksh 204; using between 7 to 60 cubic meters pay Ksh 52 for each unit; and using over 60 cubic meters is to pay Ksh 64 for each unit.

The Kenya Slum Upgrading Programme (KENSUP), was initiated in 2001 and managed by the Ministry of Lands and Housing and is the leading institution for slum upgrading at the national level. KENSUP is coordinated by the Ministry of Lands and Housing, implemented by the Nairobi City Council and funded by UN Habitat. The aim of the program is to improve the livelihoods of people living and working in Kenya's slums through provision of security of tenure, housing improvement, income generation and physical and social infrastructure. The government of Kenya and U.N. Habitat began working together to improve housing and quality of life for residents not only in Nairobi, but also in Mombasa, Mavoko, Kisumu and Thika (UN Habitat, 2008b; 11). Although this is the slum upgrading program at the national level, it is rather limited in the upgrading of Kibera slum (UN Habitat, 2006; 13).

Despite these ambitious objectives, the proportion of people with access to an improved water source remains low. Although 59% of Kenya's population had access to improved drinking water, 16 million Kenyans still lack access to safe water (UNDP, 2011; WHO/UNICEF JMP, 2012). Oxfam reported in their report (2009) that the poor commonly pay eight times as much as the rich for water, as they are forced to buy it from private and that almost 90% of slum residents in Nairobi had no access to piped clean water services (Oxfam, 2009; 20).

## **2.5 Quality of Life**

Prior 1960s, quality of life studies measured development in terms of economic growth of per capita income and gross domestic product (GDP) (Nussbaum and Sen, 1993). Todaro and Smith (2012: pages 6 & 9) pointed out that in the 1950s and 1960s development was widely understood as rapid economic growth measured in terms of GDP. GDP is still often used as a measure of society's welfare despite growing evidence that more wealth and economic output do not always improve quality of life for individuals and society (Easterlin, 2004; Bagstad &

Ceroni, 2008). The economic approach to quality of life was based on the theory of utility which assumes that as income increases the consumption of goods increases, which in turn leads to higher levels of utility and wellbeing (Greyling, 2013).. These economic indicators had several limitations. First, economic indicators are often macro level indices, and they might be useful for large scale planning and analysis of social trends, they explain little about particular aspects of society. Secondly, it was realized that the economic indicators were not sufficient to describe and evaluate the entire person's life conditions. Third, economic objectives were given high priority at the expense of other social objectives. People realized the systematic collection of data on social indicators would be useful for forecasting and analysis, for the understanding of the causes of social trends, and for policy making and evaluation (Bognar, 2005).

To correct the imbalance, social indicators were introduced in 1970s and measure the contribution to well-being, with regard to aspects such as health, nutrition, housing, income distribution, access to resources, security, human rights, self-awareness and clean environment. Access to services and resources plays a great role in people's living conditions and reflects the quality of life that people enjoy. Several studies have used social indicators to measure the quality of life (Darkey & Kariuki, 2013) using both objective and subjective indicators. Objective quality of life is about fulfilling the societal and cultural demands for material wealth, social status and physical well-being. Subjective quality of life is about feeling good and being satisfied with things in general (Kerce, 1992; 2-3). Accordingly, comprehensive quality of life survey must include both types of indicators. However, social indicators have strengths and weaknesses. Among the strengths of social indicators is objectivity in those indicators can be fairly quantified and defined. This enables cross-section and time series comparison with regard to information related with such indicators, be it nationally or globally. In contrast, one of the weaknesses is the inevitable subjectivity that plays a part when a researcher decides on what indicators to select and what values to attach to those indicators. Nevertheless subjective well-being indicators are equally important for people to express their satisfaction or dissatisfaction with the conditions they happen to be in (Diener & Suh, 1997).

Development has physical, economic, social and political aspects. Physical development is aimed at developing a specific area through provision of infrastructure. Economic

development focuses at improvement of agriculture, mining, trade, and industry. Social development is aimed at the welfare of the people while political development is concerned with better governance of society (Lombard, 1991; 212). This four fold development should meet the diverse basic needs and desires of individuals or social groups as it moves them away from condition of life widely perceived as dissatisfactory, towards a situation of life regarded as materially and spiritually better (Young, 1993).

Since 1970s more successful approaches to understanding and improving quality of life have been developed. One of the approaches is the basic needs approach which has been supported by the World Bank and seeks to meet the basic needs of the entire population of developing countries. The concept of basic needs involves basic consumption goods such as food, clothing and shelter; basic services such as education, health, sanitation and clean water supply. It also includes the right to participate in making and implementing decisions which affect one's own betterment. Quality of life comprises two clearly different global concepts. One is perceived quality of life or life satisfaction which is a result of satisfaction with the personal domains of life. It includes family life, friends, spouse, health and oneself. The other one refers to the broader social environment which includes housing, schools, health services, clean environmental services, security and transport infrastructure (Westaway, 2006). Personal satisfaction does not conform to social environment all the time. Some people would rate their quality of life as very good while they are living under extremely difficult environmental conditions. And others would rate their quality of life as poor even when the environmental conditions they live in are excellent (Flora, 1998; Westaway, 2006). This shows how diverse people's views can be on quality of life (Darkey & Kariuki, 2013).

Maslow (1962), a psychologist argued that fundamental human needs are hierarchically structured and established one of the most famous theories about basic human needs. Maslow described the ideal life as a long journey through the eight needs. At the base of the pyramid are the physiological needs like water, food and sleep; higher in the pyramid, after the fulfillment of the basic needs of having enough to drink and eat, and being safe, people feel the urge to create an identity and to develop themselves (Huitt, 2007; Susniene & Jurkauskas, 2009).

A wide variety of methods have been developed to gather information on what people regard themselves as needing or wanting in order to achieve a good quality of life and provide insights into how satisfied they feel with the extent to which they are meeting those needs



(Hgerly et al., 2001). The recent trend of measurement for quality of life is multi-dimension approach including either objective, subjective or both types (Cummins, 2000).

The measures have been developed or published recently and include Your Better Life Index by the Organization for Economic Co-operation and Development (2011), Beyond GDP by European Commission (2007), guidelines of the World Happiness report by United Nations (2012), the Happiness Index of Bhutan, Canadian Wellbeing Index, Happiness Index of the United Kingdom (Greyling, 2013). Although each measure has specific dimensions of quality of life, they have income, education, environment and health as common measurements. The Quality of Life index (QLI) of Nation Ranking used by the WordPress.com quantifies a nation's livability for its average inhabitant including six sub-indexes: health (20%), education (20%), wealth (20%), democracy (15%), peace (15%) and environment (10%) (Nationranking.wordpress.com,, 2014).

Quality of Life Index (QLI):

$$QLI = 0.2 \cdot HI + 0.2 \cdot DdI + 0.2 \cdot WI + 0.15 \cdot DeI + 0.15 \cdot PI + 0.1 \cdot EnI$$

where

- HI: Health Index; Life expectancy at birth, mortality amenable to health care (when available), infant mortality, and access to health care
- EdI: Education Index; Adult literacy rate, school life expectancy, and Programme for International Student Assessment (PISA) results (when available)
- WI: Wealth Index; GDP (PPP) per capita, Gini coefficient of national income distribution
- DeI: Democracy Index; Freedom House political rights index, freedom House civil liberties index, and freedom of the press index
- PI: Peace Index; Global Peace Index
- EnI: Environment Index; Environmental Performance Index

International Living Magazine also provides nine indexes of quality of life under the cost of living (15%), culture and leisure (10%), economy (15%), environment (10%), freedom (10%), health (10%), infrastructure (10%), safety and risk (10%) and climate (10%). Clean and safety drinking water accessibility is a part of health index and calculated percentage of population with access to safe drinking water (Grammy, 2010).

## **2.6 Relation with water accessibility and quality of life**

Water is the basis of life on earth. The quality of life directly depends on water quality. Good water quality links to healthy ecosystems and improves human life while poor water quality affects human life negatively (UN Water, 2010) Water rationing is a serious problem in the slums, yet lack of steady water supply threatens residents of outbreak of water borne diseases such as cholera. Moreover water vendors take advantage of the situation to charge high price for their supply of water thus increasing the cost of living of the residents (Sana & Okombo, 2012).

Improved access to water means more than simply basic survival for households in sub-Saharan Africa (Worldwatch Institute, 2010). In 2002 the UN Committee on Economic, Social and Cultural Rights adopted General Comment No. 15 on the right to water by defining it as the right of everyone to sufficient, safe, acceptable and physically accessible and affordable water for personal and domestic uses. Article 1.1 states that “The right to water is indispensable for leading a life in human dignity. It is a prerequisite for the realization of other human rights” (General Comment No 15; 2). The UN General Assembly recognized in Resolution A/RES/64/292 on July 28, 2010, access to safe and clean drinking water as a human right that is essential for the full enjoyment of life and all human rights (UN Resolution A/RES/64/292).

People live in a world of inequality where abundance exists along with deprivation. People say that the world contains enough resources for everybody’s use including access to the basic services necessary for well-being such as safe water and sanitation (DWAF, 2003). However nearer 1.7 billion people in developing countries and almost 40% of the people in Africa do not have adequate access to safe water supply services. Lack of clean water seriously undermines the positive effects of other basic social interventions. Throughout the

world, low quality of water supply is the leading cause of child illness, disease and death (Mehrotra et al., 2000).

Lack of basic services can lead to violence in the society and threaten security in the country. According to *The Real Agenda News*, recently South Africa has experienced a serious violence by the lack or inadequacy of basic services such as clean water or electricity. The violence is normally focusing on the poorest area such as former black ghettos of the apartheid era and slums where people do not have the basic services. The protesters have taken to the streets to demand their rights to receive basic services and attacked not only public services facilities such as police station, clinics, libraries and municipal offices but also people who live in the areas (Miranda, 2014). Such violence aggravates anxiety among the people and takes away their peace which is directly connected to quality of their life.

Article 43 (1) of Kenyan constitution provide for the right of every person to clean and safe water in adequate quantities (RoK Constitution of Kenya, 2010; 31). Article 56 also provides that the state shall put in place affirmative action programmes designed to ensure that minorities and marginalized groups have reasonable access to water (RoK Constitution of Kenya, 2010; 38). It says “This right like any other human right shall not be limited except by law, and only to the extent that the limitations is reasonable and justifiable in an open and democratic society based on human dignity, equality and freedom”(RoK Constitution of Kenya, 2010; page 22).

Improved access to water supply is fundamental to the elimination of poverty and the achievement of the MGDs. Aside from the health benefits, improved water service delivery increases the economic well being at the household level, mainly through saving large amounts of time and energy than can be used in economic productive or educational activities instead of searching and fetching water. However, access to water for most of urban and rural poor groups in Kenya remains still very poor (Osinde, 2007).

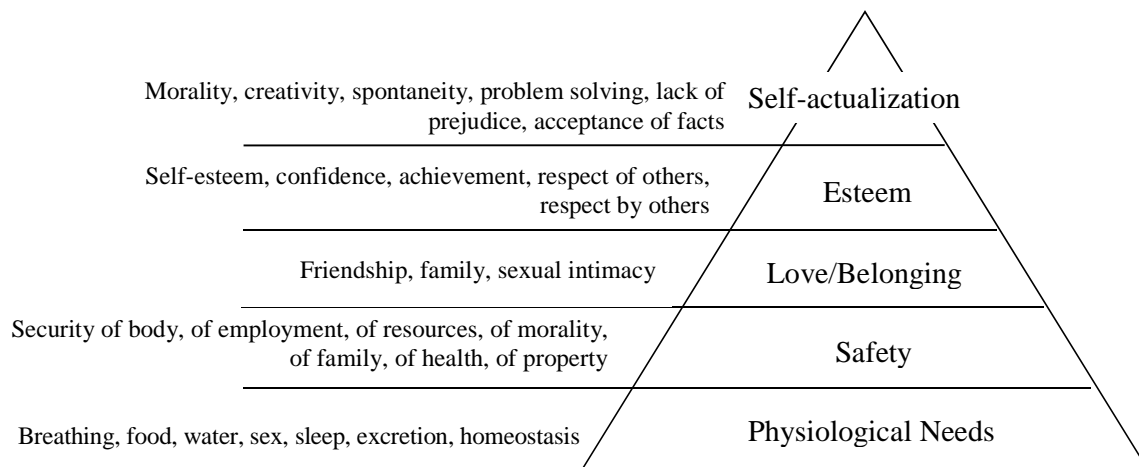
## **2.7 Theoretical Framework**

### **Maslow’s hierarchy of needs theory**

Maslow (1943) developed hierarchy of needs theory in his paper entitled “A Theory of Human Motivation”. He said there are at least five sets of goals pursued by humans and he

formulated these in a hierarchy of five levels of basic needs. There are physiological, safety, belongingness/love, esteem, and self actualization/self transcendence needs to describe the pattern that human motivations generally move through (Maslow, 1943). This hierarchy suggests that people are motivated to fulfill basic needs before moving on to other, more advanced needs. The bottom level needs such as physiological needs must be satisfied before higher level ones are pursued (Lalman, 2012). This means when lower level needs are not satisfied then the next higher needs cannot take place at all. For instance, once the physical needs including the need for food, water, sleep, excretion and homeostasis have been met, people can move on to the next level of needs, which are for safety and security. At the basic level, for instance, the man who is extremely and dangerously hungry, no other interests exist but food. He dreams food, remembers food, thinks about food, perceives only food and wants only food (Maslow, 1943). Maslow's hierarchy of needs is shown in the Figure 1

**Figure 1. Model of Maslow’s hierarchy of needs**



(Source: Wikipedia, the free encyclopedia)

Maslow 1943 classified the four lowest group of needs (physiological needs, safety, belongingness and love, and esteem) on his hierarchy as *deficiency needs* and the highest (self-actualization) as *growth needs*. Deficiency needs means that these needs arise due to deprivation. Satisfying these lower level needs is important in order to prevent unpleasant feelings or consequences. Growth needs do not stem from a lack of something, but rather from a desire to grow as a person (Cherry, 2014).

The physiological needs at the bottom of the hierarchy are the most basic needs that a human has to have to survive. Maslow said the physiological needs are the most pre-potent of all needs. For the human being who is missing everything in his/her life, it is most likely that the major motivation would be the physiological needs rather than any others. A person who is lacking food, safety, love and esteem would most probably hunger for food more strongly than for anything else (Maslow, 1943).

Islam and Clarke (2001) said that the hierarchy of needs is used widely to measure social welfare alongside several existing social welfare measures. Along with sleep and food, water is the most basic of human being's requirements. Without sufficient amount or quality of water, survival is not possible. At the first level of needs calories per person, personal income per capita, air pollution and access to clean water are chosen as indicators. Islam and Clarke concluded that improving social welfare is dependent on fulfilling a given set of hierarchical needs rather than increasing economic growth.

However Maslow's hierarchy of needs has several limitations such as the degree of fixity of the hierarchy of basic needs, the degree of relative satisfaction, unconscious character of needs, cultural specificity and generality of needs and multiple motivations of behavior so on. Main limitation is the degree of fixity of the hierarchy of basic needs which sometimes not rigid. For instance, self esteem seems to be more important than love to some people. Moreover, the degree of relative satisfaction is not clear. If we say that 'one needs is satisfied then another emerges', this statement might give the false impression that a need must be satisfied 100% before the next need emerges. In actual fact, most members of our society who are normal, are partially satisfied and dissatisfied in all their basic needs at the same time (Maslow, 1943). Despite these limitations, Maslow's hierarchy of needs based on the concept of human basic needs is considered a consistent theory of quality of life (Ventegodt et al., 2003).

Maslow's model shows that the basic social services are located at lower levels of basic human needs, for instance, food, water, health, and property (housing, land etc) are at physiological and safety levels. It is now widely acknowledged that there is a co-relationship between basic services, social well being, and economic development. To achieve basic needs based on Maslow's model, the adequate role of agents for services delivery is a fundamental requirement. Dr. Stephen Commins reported in the UNESCAP Regional Technical Seminar (2009) that increased attention has been given by international donors,

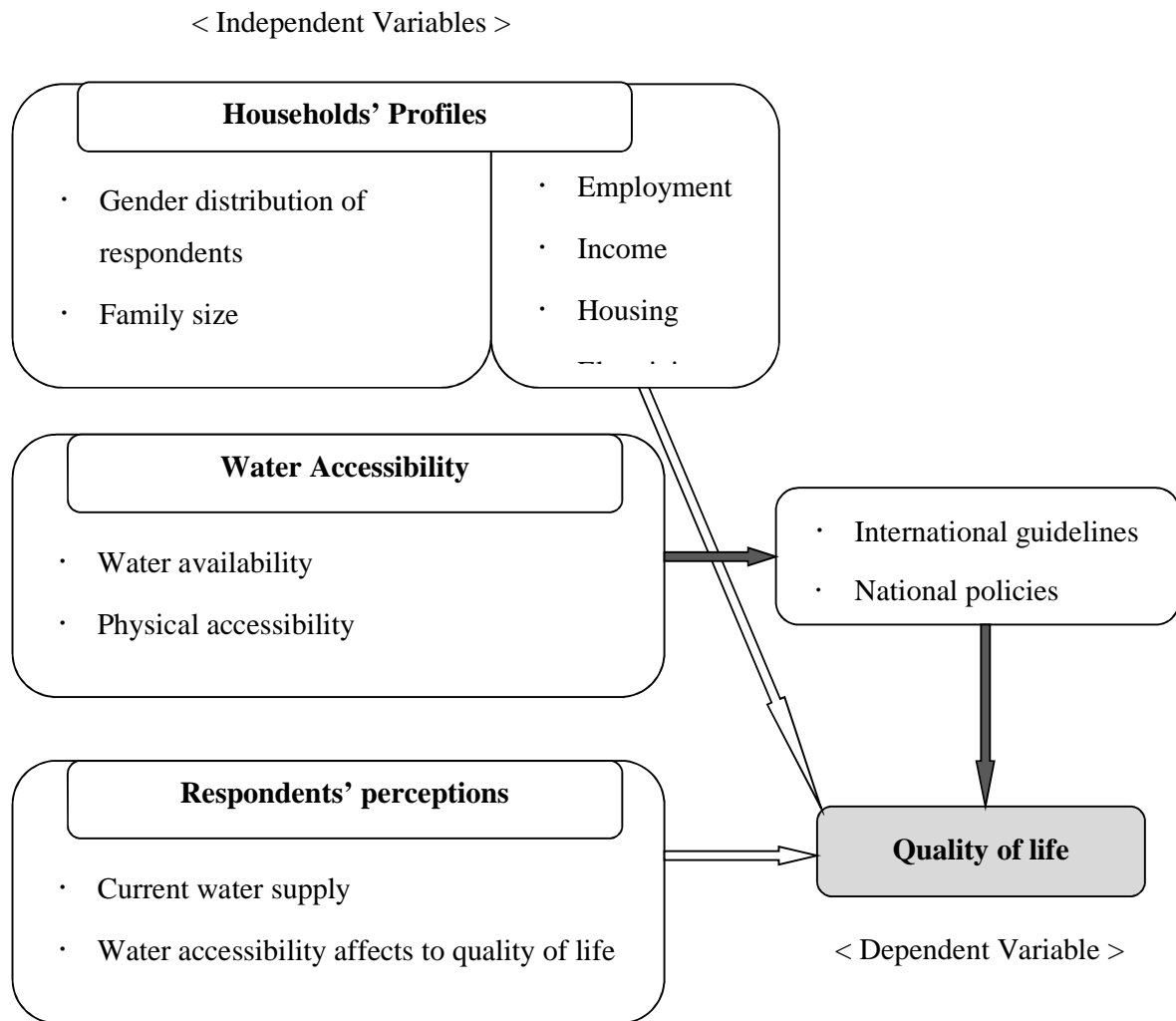
national governments and communities levels to the importance of linking these processes with the distribution of basic services. Essential to the well being of all people are the effective delivery of basic services such as health, education, water and satiation. Accessible, quality services contribute to the achievement of the MDGs and the achievement of human rights. Commins (2009) notes that there is widespread evidence showing that services are frequently failing poor people in a large number of countries, with negative impacts on their human development outcomes. Governments do not always provide urban residents with basic services, but they are invariably involved in their provision and usually claim to be working to ensure that all residents have access to adequate services. Governments are working with many different agencies such as municipal councils, international organizations, NGOs, civil society organizations, and residents themselves to provide the services (UN Habitat, 2005).

## **2.8 Conceptual Framework**

Figure 2 describes the conceptual framework of the study showing the relationships between the independent and dependent variables.

The independent variables in this study are water accessibility in the urban slums measured in terms of residents' perceptions of current water supply, cost and effects on their households. Another variable is International guidelines and national policies about access to water and how far they are being met. Quality of life depends on both of water accessibility, which is one of the basic services' requirements for human well-being and human rights, and households' perceptions of the water supply system in their areas. Enough access to water or positive perceptions on water service can be associated to high quality of life. On the contrary, low water accessibility or negative perceptions on water service can make residents dissatisfied with their quality of life.

**Figure 2. Conceptual Framework, Researcher (2014)**



### 2.8.2 The operational definitions of variables

In this study the variables are respondents' profiles, water accessibility in terms of international guidelines and national policies (objective variable) and households' perceptions (subjective variable), international guidelines and national policies and quality of life. The operational definitions of these factors are presented below.

#### (1) Households' profiles

- These are gender, family size, education level, employment, income, housing and electricity use, etc.

## (2) International guidelines and national policies

### *International*

- Availability: The minimum quantity of water required is 20 litres per capita per day.
- Physical accessibility: Water source should be located less than 1 kilometer from home and it should take less than 30 minutes to collect water.
- Economic accessibility: Cost of water per month should not exceed 5% of household monthly income.

### *National s*

- Availability: Sustainable access to safe water at 80% in the urban area by 2015.
- Physical accessibility: Water source should be located nearby and take less than 30 minutes to collect water.
- Economic accessibility: Payment of Ksh 204 for below 6 cubic meters of water from 2015.

## (3) Respondents' perceptions (Subjective variable)

- Whether they satisfy their current water supply in terms of availability, physical and economic accessibilities?
- Whether they think that water accessibility affects their quality of life?
- Whether there are differences in perception of quality of life between two slums based on water accessibility.



## **CHAPTER THREE: RESEARCH METHODOLOGY**

### **3.1 Introduction**

This chapter outlines the methodology that was used in this study. The first section describes the study areas selected within the informal settlements in Nairobi County. Two informal settlements were selected to examine their quality of life in terms of water accessibility and compare water services and quality of life between them. The methods of sampling and data collection using the questionnaire are also explained.

### **3.2 Study areas**

Nairobi County, the capital city of Kenya, covers an area of approximately 695.1 square kilometers, has population estimated at over three million and is East Africa's most populous city (KNBS, 2009; UN Habitat, 2010b; 63). It also has various socio-economic challenges including insufficient infrastructure, unemployment, sprawl, informal and high density settlements, lack of basic services such as water service and inadequate waste management and electricity connections (Darkey & Kariuki, 2013). Nairobi's informal areas commonly tend to occupy marginal lands such as flood plains, valleys, wetlands and waste dumps. Some of the areas are along railway tracks lacking infrastructure, facilities, and basic services. The settlements are overcrowded and have makeshift and substandard structures (CBS, 2001). Due to lack of enough finances and time, Mukuru and Mathare slums were selected for the study (Figure 3).

**Figure 3. Informal settlements in Nairobi County**



(Source: adapted from Mitullah, 2003; 9)

### 3.2.1 Mukuru slum

Mukuru is a slum located to the South eastern side of Nairobi, in Embakasi sub-county and is one of the largest slums in the city along with Kibera and Mathare. The population size of Mukuru slum ranges from 100,000 to 700,000. Not only Mukuru slum but all urban slums do not have official demographic numbers because slums are not recognized officially. Maps of Nairobi almost universally show slums as unoccupied land (Karanja & Makau, 2006). According to the UN Habitat (2010), the actual number of people living in slums in many cities in Africa is unknown because urban slum populations are highly mobile and fluid and tend to change relentlessly thereby rendering slum enumeration problematic. It is therefore common to see wide variations in the population figures quoted by different programmes and studies for the various informal settlements in city of Nairobi (UN Habitat, 2010b). For example, a Non-Governmental Organization, *Covenant Children and Community Foundation* estimated the population of Mukuru at a high of 700,000 while other agencies *Nairobi studio* and *Practical Action-Eastern Africa* placed the population of this area at approximately 100,000 and 250,000 respectively (Table 2). The 2009 Census results show the population of Mukuru as 255,094, spread into 4 main villages, namely Mukuru Nyayo

(53,303), Mukuru Kwa Njenga (130,401), Landi Mawe (26,509), and Viwandani (44,881) (KNBS, 2010a; 34-36). The 2009 census had likely undercounted population. Oxfam and EuropeAid estimated the population of Mukuru slum at 600,000 people (Table 2).

**Table 2. Mukuru population, Researcher (2014)**

<b>Organization</b>	<b>Estimated population</b>
Nairobistudio	100,000
Mukuru Promotion Centre	600,000
Ruben Centre	600,000
Covenant Children and Community Foundation	700,000
Harambee Mukuru	500,000
Practical Action-Eastern Africa	250,000
Umande Trust (Mukuru Kwa Njenga only)	100,000
Oxfam	600,000
EuropeAid	600,000

(Source: Google web searching. <http://www.google.com>, Access date: September 30, 2014)

Parts of the area later became a dumping site for industrial as well as household waste. Mukuru is one of the largest informal settlements in Kenya, and is divided into two main areas by a railway – Mukuru Kwa Reuben to the west and Mukuru Kwa Njenga to the east (Figure 4). Each of these areas has been divided into several villages. The name of Mukuru literally means dumping site in Swahili. The neighborhood is the site of an old quarry where most of the stones used to build the surrounding factories were excavated. Mukuru Kwa Reuben is named after Jack Reuben, a British Army veteran and a white farmer who used the area to keep his livestock. After independent, many villages were formed, each with their own particular history and name. For example, Reuben employed a few Kenyan workers including Cucu Gatope, who built shelters on the land in 1979 with her three daughters. One of the villages Gatope is named after this settler. The village “Bins” was established next to Gatope around the same time. The area is named after the company “Bins-scape” which collects waste materials around the area. After the population of Bins village grew and people

spread to east of Feed the children area and established “Ruriie (or Rurii)” village which means “free land” in Kikuyu (Nairobi Studio Blog, Access September 2014).

Mukuru is located in the middle of the main industrial area of the city by 20~30 minutes drive from the city center. The Mukuru settlement comprises of thousands of single room houses. Most of the houses are built with corrugated iron sheets on wooden frames measuring 10 x 10 feet and one plot is occupied by five to ten different families. Typically the houses are built in blocks of six, eight or ten single rooms on a plot of land with shared walls and a single pitched roof covering all the rooms. Most houses are predominantly single rooms. Each room has a door and a small window (Practical Action, 2010). The single room acts as a bedroom, sitting room, store, shower room, kitchen and so on. Family members who average five members share this single room or tiny rooms. It is estimated that Mukuru slum houses 318 households per acre (The Independent News, 2012).

The roads are in bad shape with running water due to poor drainage system. The streets are unpaved, there is no official electricity supply and no sanitation system (Practical Action, 2010). Many of the slum residents in Mukuru work as casual laborers and sell fruit or hawk various items (Kenya Jubilee, access on July 2014). The living conditions in Mukuru are challenging and the residents are very poor with an average monthly income of just Ksh 3,200 (NCWSC, 2009).

Water is mainly supplied by vendors. Mukuru relies on the hundreds of small water vendors for its supply. Majority of these vendors are illegal having made connections by breaking into the water service provider’s pipelines from which they drew water and sell it at higher prices. The residents pay sometimes as much as Ksh 2,500 per m<sup>3</sup> of water. This is over five times what the Nairobi City Water and Sewerage Company (NCSWC) charges, i.e., Ksh 45 per m<sup>3</sup> (NCWSC, 2009; Practical Action, 2010).

**Figure 4. Mukuru slum**



(Source: <http://1.bp.blogspot.com/>)

This study narrowed down to Mukuru Kwa Reuben, located in Imara Daima ward, Embakasi Constituency. The physical location of Mukuru Kwa Reuben is between Enterprise road on the Southern side, Nairobi-Mombasa railway line on the Eastern side and Ngong River on the North Western side. Mukuru Kwa Reuben is divided into two basic settlements i.e., Old Reuben (Gatope, Mombasa, Bins, and Feed the children) and New Reuben (Kosovo, Gateway, Railway, Diamond, Wesinya, Rurii, and Simba cool). Three survey areas were selected in New Reuben, namely Simba cool, Rurii, and Kosovo (called as Kosovo Mukuru to distinguish it from Kosovo in Mathare). Muungano Support Trust<sup>6</sup> reported the Inventory of Mukuru (Wairutu, 2012) as follows;

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<sup>6</sup> Muungano Support Trust (MuST, Muungano wa Wanavijiji as Swahili) is a federation is a settlement based network of slum dwellers that was started in 1996. Muungano, a movement of the urban poor was formed by slum dwellers to address the challenges of forced eviction, with a keen interest of addressing matters of secure tenure and livelihoods of the poor communities. Muungano has since then spread to 15 counties in Kenya. The movement represents over 64,200 members in 300 informal settlements. Muungano is comprised of activists, planners, sociologists, architects, surveyors, and organizers headquartered in Nairobi. It serves as a technical team to facilitate Muungano

- *Kosovo Mukuru*: The settlers of this area got the land through sale by the people who were given by the administration in 1995. There is dumping site behind Kosovo area near the Ngong River where people dispose waste. Kosovo consists of about 10 acres owned by individual landlords. This area has approximately 5,500 people and 500 structures with about 2,000 rooms and each room measuring 10 x 10 feet. Nearly 70 per cents of the rooms are built by iron sheets and 30 per cent are permanent built by stone. The rent fee is between Ksh 800 ~ 2,500 per month. Around 60 per cent of residents are casual laborers earning about Ksh 200 per day, 10 per cent of them are doing self-employed business and the rest are unemployed. There are about 20 stand-point water sources owned by individuals and small groups connected to City Council. The price of 20 litre jerrican of water was Ksh 5 ~ 15.
- *Ruriie*: Ruriie is a kikuyu word meaning ‘free land’. This area is approximately 20 acres owned by individuals 10 per cent by landlords and the remained by tenants. The settlement has around 5,830 people with 2,000 families. There are around 3,000 structures and 9,000 rooms measuring 10 x 10 feet and build of timber and iron sheets. The rent was between Ksh 500 ~ 1,000 per month. The residents paid for water at Ksh 5 ~ 15 per 20 litre jerrican and for public toilets at Ksh 3 per usage. There were 15 stand-point water sources owned by individuals. Electricity was available but most of it was connected informally.
- *Simba cool*: This was located in the south of Ruriie and has four clusters i.e., V.C.T, Simba cool, Kwa Uwanja, and Maendeleo (Wairutu, 2012). The settlement in Simba cool has 1,897 people with 1,100 males and 797 females. Simba cool has about 736 households living in 10 x 10 iron sheet rooms (Boit, 2014).

### 3.2.2 Mathare Valley slum

The meaning of Mathare is ‘dracena trees’ in Kikuyu. Mathare<sup>7</sup> is one of the oldest and the second biggest slum in Nairobi, following Kibera which is the biggest slum in Africa (UN

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members in acquiring tenure security, services, improved livelihoods, and shelter (refers to website: <http://www.mustkenya.or.ke/>, Corburn et al., 2011).

<sup>7</sup> The use of the geographical names ‘Mathare’ and ‘Mathare Valley’ varies. Sometimes Mathare and Mathare Valley use as the same meaning or Mathare designates the larger area that embraces areas

Habitat, 2010b). Like many informal settlements, Mathare is characterized by unsafe and overcrowded housing, elevated exposure to environmental hazards, high prevalence of communicable diseases, and a lack of access to essential services, such as water, sanitation, and electricity (Corburn et al., 2011). Mathare was established on government land by a group of independence fighters and built over many years on top of a garbage dump as more and more people settled there (COHRE, 2008).

The first residents began arriving after 1920 and some of Pangani's displaced people moved to Mathare in the 1930s. Villages spread from the 1930 ~ 1950s along Juja Road and in the eastern edge of the valley. During colonial era, Mathare used to be a stone quarry owned by an Indian businessman. When several sites of the quarry were closed down, people started settling there. Mathare villagers participated in the nationalist movement and this area was believed to harbor a Mau Mau core (Pamoja Trust, website <http://www.pamojatrust.org>). The British destroyed housing and detained Mathare residents as part of the State of Emergency in 1952. Residents later returned and by 1963 Mathare were rapidly growing again (Corburn et al., 2011).

The total number of inhabitants in Mathare is also unknown as is the case of Mukuru but most community sources put Mathare as home to about 600,000 people (Dignitas project, 2008). Mathare settlement covers an area of two miles long by one mile wide. It is located about 5 kilometers from the Nairobi Central Business District (CBD) between two main highways: Juja Road to the south and Thika Road to the north. Mathare has high density with most people living in corrugated iron shacks (called *mabati*). There are small streets between houses and the houses are very close together (Darkey, 2013). The major ethnic groups in Mathare were Kikuyu and Luo with small proportion of Kisii, Kamba, and Luhya. The Kikuyu and Luo groups are generally clustered together in certain areas (Chepkemei, 2012).

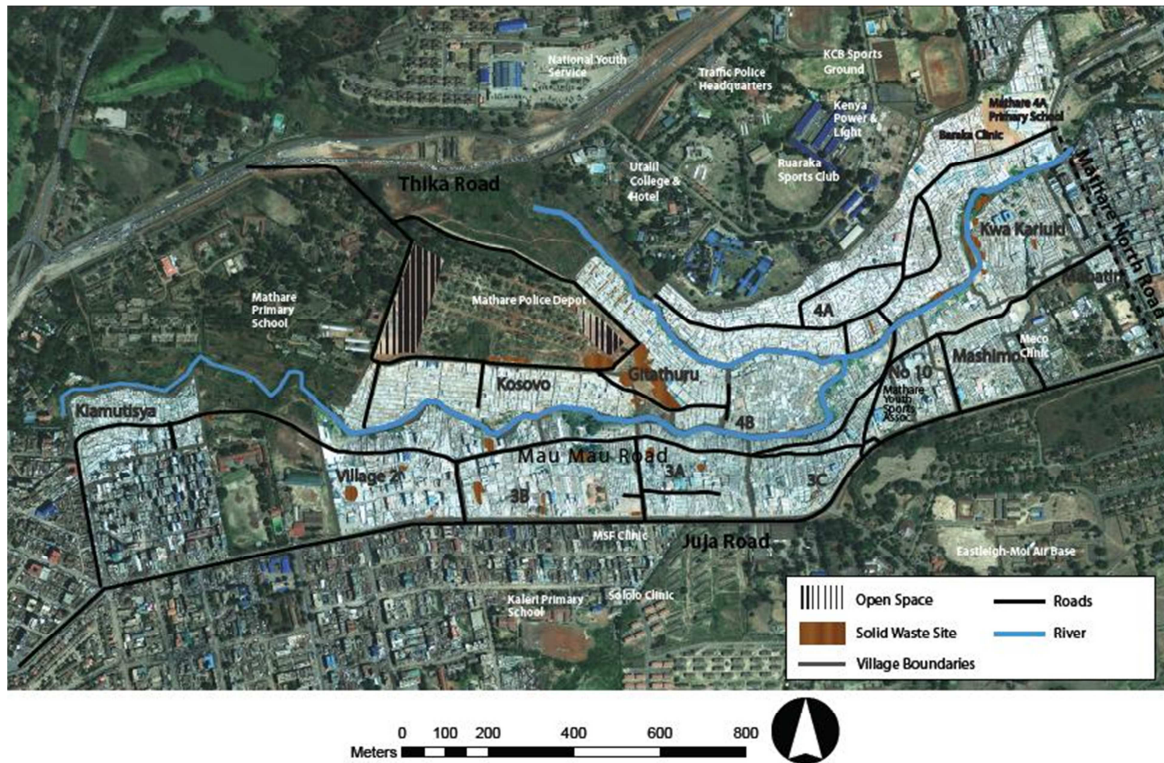
Mathare slum (Mathare Valley) is found in the two constituencies of Starehe and Kasarani and comprises of thirteen villages (Figure 5) i.e., Mabatini, Mashimoni, 4A, 4B, 3A, 3B (Bondeni), 3C, Village 2, Kiamutisya, Kosovo, Gitathuru, No.10 and Kwa Kariuki (Dignitas project, 2008).

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like Mlango Kubwa, Huruma, Mathare North, etc. This paper uses the term of Mathare and Mathare Valley as same areas.



**Figure 5. Mathare slum**



(Source: Corburn et al, Mathare valley 2011 collaborative upgrading plan)

According to MapMathare.org (2011), the slum had 167 access water points like piped or tap water and water kiosks managed by private vendors (60%) and Muungano community (40%). About 3,600 people shared one water point (Website: MapMathare.org & Mapping, 2014). The charges were usually Ksh 2 per a 20 litre jerrican.

- *Mabatini*: Mabatini covered about 1.1 acre of land which was owned by Nairobi City Council. The settlement started in the 1970s when a few people were allocated portions of the land for construction of structures by the area chief. Mabatini means ‘inside iron sheets’ in Swahili. Mabatini had 386 households with 200 structures. The main income source was self-employment about 57%. Small drainage channels usually did not flow properly due to waste dumps and there was no organized system of solid waste disposal and thus dumping in the settlement was the most common way.

Though Mabatini is closely located to a main sewer line, the settlement itself lacked sewerage infrastructure. The large majority of residents bought water from water kiosks,



public standpipes and water vendors for Ksh 2 per a 20 litre jerrican. Around 80 per cent of the households did not have individual toilets in their houses (Pamoja Trust, 2010).

- *Bondeni (3B)*. Bondeni<sup>8</sup> was located near Mathare/Nairobi River and domestic waste was mainly directed into the river (Amnesty International, 2009). The first settlers who were workers at the neighboring quarry site arrived in 1960. The houses they built were of cartons and polythene papers which were burnt frequently. Bondeni Properties Company purchased the upper section of the settlement. The new owners constructed story blocks offering single room accommodation. Residents who could not afford to participate in the land buying were squeezed on and near the riparian reserve (Karanja & Makau, 2006).

In 2009 Kenyan Census, the population of Bondeni was 7,434 people comprising about 2,681 households living in 3,000 rooms measuring 10 x 10 feet built of iron sheets, timber and plywood (Corburn et al., 2011).

A water service was provided by water kiosks mainly at a cost of Ksh 2 per a 20 litre jerrican. Residents maintained narrow open drainage channels for sewage disposal into the Mathare River, but the risk of flooding remained high, particularly during heavy rains. As there was no common garbage disposal site, the Mathare River received most of domestic waste from settlements (Karanja & Makau, 2006).

- *Kosovo*. The settlement started in 2001 and is located near Thika Road Off Muthaiga Road with an estimated land of 12 acres. Kosovo borders Mathare police deport to the North and borders 4B. The total population of Kosovo was estimated to be about 25,000 comprised of 3,200 households. Most of the houses were constructed using iron sheets and cement and the rooms were 10 x 12 feet. A few occupants had more than one room. About 90 per cent of the population was made up of tenants while 10 per cent were landlord owners. Water sources were provided by individuals who sold water at Ksh 2 per a 20 litre jerrican. The electricity service was provided permanently

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<sup>8</sup> Bondeni sometimes embraces Mathare 1A (?), 3A, 3C, Mabatini, and Thayu, roughly the area of Mathare Valley to the south of Mathare River (Corburn, 2010). However Bondeni is more often considered in a narrow sense as the part of 3B that borders 3A or the whole Kikuyu dominated parts of Mathare that are located south of Mathare River (Andvig & Barasa, 2014).

by the Kenya Power and the residents paid a standard fee of Ksh 300 per month. However the drainage system, garbage management and road were poor. All the garbage and sewer were dumped into the river or in drains (Karanja & Makau, 2006).

### **3.3 Design of study**

The study was descriptive and examined the water situation in the selected sites and level of water of households to various sources of water which included handcrafts, kiosks and taps at connected points.

### **3.4 Units of analysis and observation**

The units of analysis were the various sources of water and units of observation were the households' situation in the selected sites.

### **3.5 Sampling of Sub-sites and Households**

#### **3.5.1 Sub-sites**

Through purposive sampling method, three areas of Mukuru Kwa Reuben and Mathare slums were selected, respectively after consultations with village elders based on the difficulty of access to water and water sources such as kiosk, water tap or moveable private vendors (handcart, donkey and bicycle). Simba cool, Ruriie and Kosovo (called as Kosovo Mukuru) in Mukuru slum and Bondeni, Kosovo (called as Kosovo Mathare) and Mabatini in Mathare slum were sampled.

#### **3.5.2 Households**

Purposive sampling was used to select 192 households i.e., 32 from each of the six villages: Simba cool, Ruriie, Kosovo Mukuru, Bondeni, Kosovo Mathare and Mabatini.

### **3.6 Data Collection and Analysis**

#### **3.6.1 Questionnaire**

The questionnaire comprised five sections on households profile; water access; household water use behavior; perception of water supply, cost and effect on household and quality of life. In addition, basic information such as demography, income, education and family, were also collected. Information was obtained on the type of water facility used, major water sources, cost, fetching time and their implications on water accessibility and quality of life in the households.

Each interview took about 30 ~ 40 minutes depending on the respondents' literacy and understanding level. Pilot interviews were done at Mukuru slum to clarify whether some of the questions were unnecessary or repetitious and to identify likely difficulties during the interview.

#### **3.6.2 Data collections**

Six research assistants who were residents of the slums were identified and hired. They were trained by the researcher both on how to sample and administer the questionnaire. The respondents were sampled at the time of interview and effort was made to get firsthand information from them about their lives including housing, electricity, water usage etc. The assistants visited each household and identified the respondents. Initially the respondents were expected to fill in answers themselves after reading questions carefully but where they were unable to understand, the assistants were allowed to explain by translating the questions to local vernacular or Swahili. The assistants were also requested to consider gender equality and the selected respondents had to be household heads.

#### **3.6.3 Observations**

These included conversations, participation in the community activities such as Muungano community's regular meeting, visiting their community center, visiting assistants' house and spending time walking around the area and talking with the residents about their water supplies. The aim of these activities was to discover patterns that were not visible or detectable through interviews.

#### 3.6.4 Data analysis

Microsoft excel program was used in the analysis. The data was sorted, filtered and formatted and descriptively presented in the form of frequencies, graphs and charts. Rating scales were also used in analysis.

## CHAPTER FOUR: DATA ANALYSIS, PRESENTATION AND INTERPRETATION

### 4.1 Introduction

In this chapter, the findings of the study are presented. The Main concern of the study was to examine the influence of water accessibility on the quality of life, and factors such as households' profiles which influenced it. Accessibility was assessed in terms of current water supply in slums, observation of international guidelines and national policies and the perceptions of households on their accessibility to water.

### 4.2 Households' Profiles in the study areas

The first objective of this study was to examine profiles of households sampled in Mukuru and Mathare slums. The indicators of households' profiles were gender, age, family size, dwelling units, residence period, education, employment, income, housing and electricity. Data on each of these indicators are presented below.

#### 4.2.1 Gender distribution of the respondents

Table 3 shows the gender distribution of the respondents. The number of male respondents was higher than that of female. Out of the sample of 192, 55% of the respondents were males while 45% were females. There was no marked difference in the distribution of the respondents according to their gender in the two study slums (Table 3).

**Table 3. Distribution of the respondents by their gender**

Slum	Gender	Males	Females	Total
	Mukuru	Number	54	42
%		57	43	100
Mathare	Number	51	45	96
	%	53	47	100
Total (%)		55	45	100

#### 4.2.2 Age of the respondents

Eighty eight percent (88%) of the respondents in Mukuru and 45% of the respondents in Mathare were below 30 years old. There were no respondents over 41 years old in Mukuru but around 20% of the respondents in Mathare were over 41 years old. The mean ages were 24 and 34 years for Mukuru and Mathare slums, respectively (Table 4).

**Table 4. Distribution of the respondents by age**

Slum		Age					Total
		18~24	25~30	31~40	41~50	> 51	
Mukuru	Number	57	28	11	0	0	96
	%	59	29	12	0	0	100
Mathare	Number	15	28	33	15	5	96
	%	16	29	34	16	5	100
Total (%)		37	29	23	8	3	100

#### 4.2.3 Family size

In Mukuru slum, 28% of the respondents were single families who lived alone compared to Mathare slum with about 21%. Families with over 5 members in Mukuru and Mathare slums accounted for 30% and 46%, with means of 3.5 and 4.1 family members, respectively (Table 5).

**Table 5. Number of family members of the respondents**

Slum		Members				Total
		1	2~4	5~7	> 8	
Mukuru	Number	27	40	22	7	96
	%	28	42	23	7	100
Mathare	Number	20	32	36	8	96
	%	21	33	38	8	100
Total (%)		24	38	30	8	100

Considering the number of single families, about 13% of the respondents in Mukuru and 7 % of those in Mathare did not have children. There were 26% of the respondents in Mukuru and 37% of those in Mathare with over 3 children. Both slums had same mean of adult's

members as 2 people per family. However, Mukuru showed the average 1.5 children while Mathare showed an average 2.1 children (Table 6).

**Table 6. Number of children among the households sampled in the two slums**

Slum \ Children		None	1	2	> 3	Total
Mukuru	Number	40	13	18	25	96
	%	41	14	19	26	100
Mathare	Number	27	14	19	36	96
	%	28	15	20	37	100
Total (%)		35	14	19	32	100

#### 4.2.4 Size of dwelling units

Among the respondents, 60% of them lived in one room. Considering single family (28% of Mukuru and 21% of Mathare as single family), 32% and 39% of respondents in Mukuru and Mathare slums shared one room with other family members (Table 7).

**Table 7. Respondents reports of Room sharing with family members**

Slum \ Room		1 room	2 rooms	> 3 rooms	Total
Mukuru	Number	58	25	13	96
	%	60	26	14	100
Mathare	Number	58	22	16	96
	%	60	23	17	100
Total (%)		60	24	16	100

#### 4.2.5 Period of residence

A majority of the respondents in Mukuru (77%) and Mathare (80%) slums had been settled in their areas for over 3 years. The rest of the respondents had been living for between 1 and 3 years (21%). About 8% of the respondents in Mathare had lived there for over 30 years while none of those in Mukuru had lived there so long. This can be understood as an aspect of their history as Mukuru had shorter history than Mathare (Table 8). For instance, one of the

respondents, Miriam Mombi who was born in 1944 has been living for over 60 years in Bondeni of Mathare slum.

**Table 8. Respondents' reported period of residence in the two slums**

Slum \ Period		< 3 year	4~9 year	10~20 year	21~30 year	> 31 year	Total
		Mukuru	Number	22	24	43	7
%	23		25	45	7	0	100
Mathare	Number	19	23	32	14	8	96
	%	20	24	33	15	8	100
Total (%)		22	24	39	11	4	100

#### 4.2.6 Education level

Table 9 shows that over 90% of all respondents had completed basic education which means they could understand the English used in the questionnaire in this study. Mukuru slum had higher primary education level (55%) rather than Mathare slum (46%) but less secondary education level completed (38%) as compared to 43% in Mathare slum. However during the study especially the respondents in Mukuru showed difficulties in understanding the questionnaire and in communicating with the researcher which can be interpreted that respondents deceived about their education level or that people who live in the two slums had not received proper education services. Darkey and Kariuki (2013) reported most of primary schools in Mukuru and Mathare slums as informally managed. This meant that the schools did not have qualified teachers and had not received support from the Government for text books (Darkey & Kariuki, 2013).

**Table 9. Distribution of Education level in two slums**

Slum \ Education level		Primary education level	Secondary education level	No response	Total
		Mukuru	Number	53	36
%	55		38	7	100
Mathare	Number	44	41	11	96
	%	46	43	11	100
Total (%)		51	40	9	100



#### 4.2.7 Employment of the respondents

Almost half of the respondents were self-employed and a quarter was working as casual labour (Table 10). Most of the labourers had been casual workers working in building constructions, civil services such as road or drainage work and quarrying. Respondents in Mukuru and Mathare slums who had difficulty to get regular occupation were selling vegetables, fruit, chips, chapatti, githeri and secondhand clothes on the roadside or at the informal markets. A few of the men surveyed said that they worked in their own workshop as carpenters or cyber café. Mukuru slum had twice the number of jobless than Mathare slum with 12% and 6%, respectively. Women who did not have jobs had domestic works such as cooking, laundry, cleaning and child care. However unemployed men typically stayed at home without any activity in the household. They had been hanging around and chatting with other people or going to pubs and drinking illicit brews (*Changaa*).

**Table 10. Distribution of the respondents according to their employment situation**

Employment	Slum	Mukuru		Mathare		Total	
		Number	%	Number	%	Number	%
Self employed *		42	44	51	53	93	48
Labor **		28	29	20	21	48	25
Hair dresser		6	6	6	6	12	6
Civil servant		0	0	10	11	10	5
Nursing		2	2	1	1	3	2
Engineer		4	4	1	1	5	3
Tailor		2	2	0	0	2	1
Teacher		1	1	1	1	2	1
Jobless		11	12	6	6	17	9
Total		96	100	96	100	192	100

\* Self employed: people are selling drinks, vegetables, fruit, chips, chapatti, githeri and secondhand clothes etc on the roadside stand or operating small shop in the corner of bystreet.

\*\* Most of laborers are casual workers and working in the building construction, civil services such as road or drainage work and quarrying

#### 4.2.8 Income

Kenya's Labour Act No. 12 of 2007, on regulation of wages, shows the minimum wage as Ksh 9,280 per month (Republic of Kenya Subsidiary Legislation, 2013; 2, 191). In this study, about 41% of the respondents in Mukuru had an income of below Ksh 9,000 per month whereas almost half of the respondents in Mathare had an income of below Ksh 9,000 (Table 11). The average incomes were showed as Ksh 10,484 in Mukuru slum and Ksh 9,884 in Mathare slum (see Appendix 1). Although the average incomes were higher than the minimum wage in both slums, over 45% of the respondents were earning below the minimum wage. One of the respondents with the highest income of Ksh 35,000 per month was a civil servant in Mathare slum.

**Table 11. Distribution of the respondents by Income they earned**

Income (Ksh)		< 5,000	5,001 ~ 9,000	9,001 ~ 13,000	13,001 ~ 17,000	17,001 ~ 21,000	> 21,001	No response	Total
		Slum							
Mukuru	Number	12	27	24	21	6	3	3	96
	%	13	28	25	22	6	3	3	100
Mathare	Number	13	35	22	6	7	7	6	96
	%	14	37	23	6	7	7	6	100
Total (%)		13	32	24	14	7	5	5	100

#### 4.2.9 Housing

Majority of the respondents (91% in Mukuru and 85% in Mathare) were tenants who rented houses and 6% of respondents (5% in Mukuru and 7% in Mathare) were house owners known as landlords (Table 12). Table 13 shows that the distribution of housing rent fee in the two slums; the average rents per month in Mukuru and Mathare slums were Ksh 2,319 and 2,595 respectively implying that the residents in both slums were spending a quarter of their monthly income on rent.

**Table 12. Distribution of the respondents by house ownership**

Slum \ House type		Rent	Own	Free Rent*	Total
Mukuru	Number	87	5	4	96
	%	91	5	4	100
Mathare	Number	81	7	8	96
	%	85	7	8	100
Total (%)		88	6	6	100

\* Free rent is living without payment for rent with no ownership of housing such as depending on relatives, hostel living and public houses.

**Table 13. Distribution of the respondents by the monthly housing rent fee**

Slum \ Rent fee (Ksh)		< 1,000	1,001~ 2,000	2,001~ 4,000	> 4,001	No response	Total
Mukuru	Number	9	37	34	3	13	96
	%	9	39	35	3	14	100
Mathare	Number	15	39	29	8	5	96
	%	16	41	30	8	5	100
Total (%)		12	40	33	6	9	100

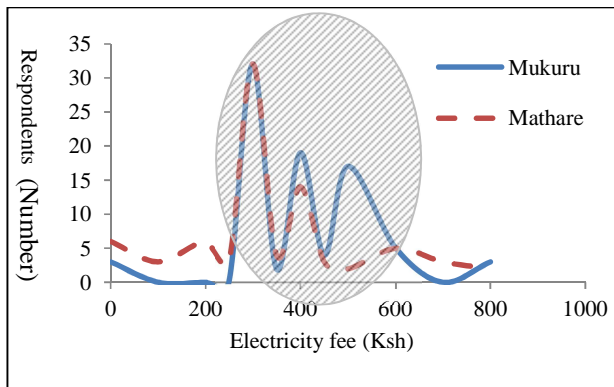
#### 4.2.10 Electricity

Table 14 shows that about 90% of households in both slums had electricity in their houses. However most of them had connected electricity illegally and paid an average Ksh 300 to 500 per month for it (Figure 6). Illegal live wires tangling on wood and metal poles from rusty roofs and cables without protective insulation were common sights in the slums studied Patinkin (2013) reported that most wires were installed by cartels that steal electricity directly from transformers of Kenya Power and Lighting Company (KPLC) which is the sole distributor of electricity in Kenya while others set up by people who legally buy electricity and then share for a fee, with their neighbors. During the study, we observed wires which were connected like a bunch of thread on the roofs of houses without power gauges at all in both slums. Based on this and brief interviews with the respondents, it was clear that people were using illegally connected electricity in their houses and/or paying for electricity to their house owners.

**Table 14. Electricity Connections in Mukuru and Mathare slums**

Slum		Electricity	Exist	Non-exist	No response	Total
Mukuru	Number		85	5	6	96
	%		89	5	6	100
Mathare	Number		83	7	6	96
	%		87	7	6	100
Total (%)			88	6	6	100

**Figure 6. Distribution of the respondents according to monthly payments for electricity**



#### 4.2.11 Conclusion

Mukuru and Mathare slums showed similar gender distribution of respondents with slightly more men than women while Mukuru had more young respondents than Mathare with an average age of 24 in Mukuru slum and 34 in Mathare slum.

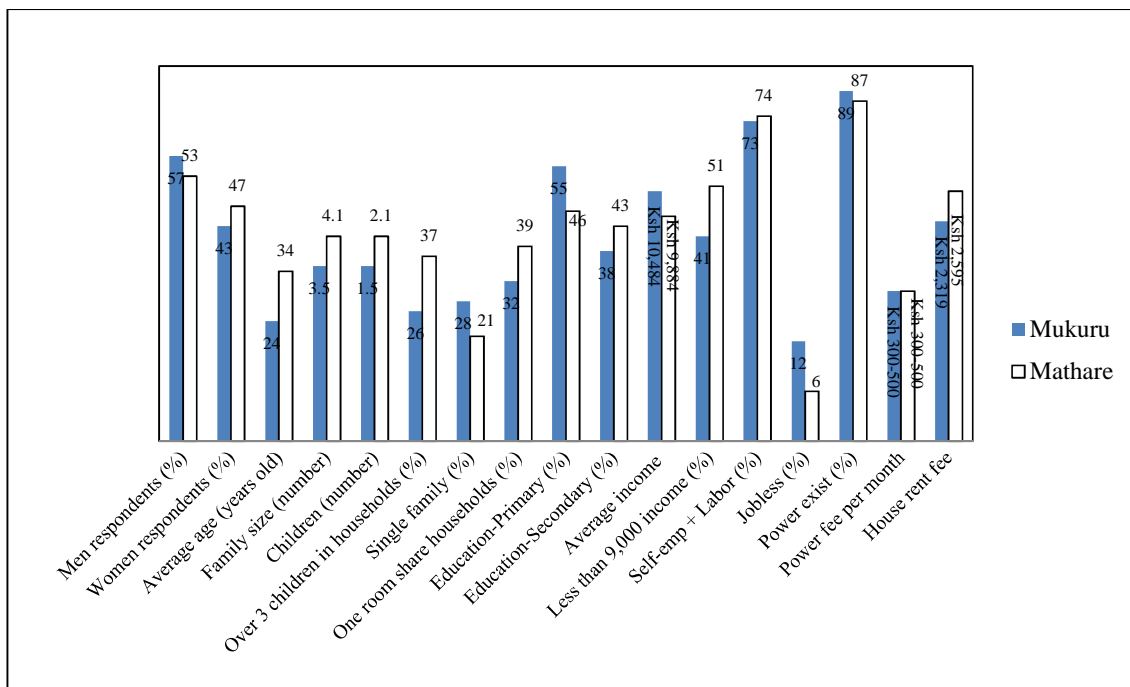
In regard to family size, Mukuru had an average of 3.5 while Mathare had 4.5 family members. Similarly, Mukuru had a higher proportion of single households which lived alone than Mathare. More respondents shared one room with their family members in Mathare than in Mukuru. Nearly 77% and 80% of residents in Mukuru and Mathare slums, respectively had been settled in the areas over 3 years age.

Mukuru had more respondents with primary while Mathare had more with secondary education level.

Although the average monthly income in both areas was more than the minimum wage, over 40% and 50% of respondents in Mukuru and Mathare slums, respectively earned monthly income below Ksh 9,000. Over 70% of the respondents in Mukuru and Mathare slums engaged in self-employment and irregular labour and there were more jobless respondents in Mukuru slums.

Whereas almost 90% of the respondents had electricity in their houses, most of them did not have its meters and paid for it to their landlords which were around 5% of their monthly income. This meant that many people in both slums were using electricity which had been connected illegally. The illegal electricity wires which are stretched like cobwebs in the high density areas were exposed to serious electric tragedies like shock, black out and fire by short circuit.

**Figure 7. Summary of Households' profile in Mukuru and Mathare slums**



### 4.3 Current Water accessibility in Mukuru and Mathare slums

The second objective of this study was to find out the current level of water accessibility of households in Mukuru and Mathare slums. The indicators of accessibility were sources of

water supply, physical accessibility, fetching water, economic accessibility and price fluctuation.

#### 4.3.1 Sources of water supply

There were no respondents in Mukuru who had indoor taps at all while about 6% of the respondents in Mathare had indoor taps in their houses. Those respondents who had indoor taps in Mathare slum were house owners or living in high rent houses paying for over Ksh 4,500 per month. Among the respondents, 84% of those in Mukuru and Mathare slums relied on the shared water sources such taps in a plot, private vendors and kiosks. Over 80% of respondents in Mukuru bought water from private vendors, while about 60% of those in Mathare bought water from kiosks mainly (Table 15).

**Table 15. Distribution of water sources in two slums**

Slum \ Type		Indoor tap	Shared tap*	Private vendor**	Kiosk***	Handcart	Total
Mukuru	Number	0	5	79	11	1	96
	%	0	5	82	11	1	100
Mathare	Number	6	19	15	56	0	96
	%	6	20	16	58	0	100

\* Tenants share a tap with their neighbors living in same plot under same landlord who drew water pipeline into the plot and collect water charges from tenants.

\*\* This is private water supply system that is self-employed water suppliers connected pipelines from main pipe illegally (or legally) and extended pipelines to the inside of slums and provide water to other slum residents. They controlled water motor in their houses and cost also.

\*\*\* Kiosk has two to four taps on the outside and faucets and a water gauge inside supplied safe water from Nairobi water supplier (NCWSC) and operated by employees or members of community. Kiosk has a water storage tank over the roof for unexpected water cut off. Operators of kiosk pay monthly to NCWSC based on the water gauge.

#### 4.3.2 Physical water accessibility

Table 16 shows that around 80% of all respondents used less than 80 litres (4 jerricans) per day for their families. In Mukuru slum, the consumption averaged 3.3 jerricans per household per day, that is, 66 litres per day for whole family while Mathare slum, consumption averaged 3.6 jerricans per household per day, that is, 72 litres per day per family. Considering age

distribution and their family size data, residents in Mukuru and Mathare slums were consuming water average 24 litres per person per day.

**Table 16. Number of 20 litre jerrican consumption by households**

Slum \ Jerrican		< 0.5	1~2	3~4	5~6	7~9	10	Total
		Mukuru	Number	1	32	44	12	6
%	1		33	46	13	6	1	100
Mathare	Number	0	26	45	19	0	6	96
	%	0	27	47	20	0	6	100
Total (%)		0	30	47	16	3	4	100

When the respondents were asked to calculate daily water consumption in liters, 46% and 51% of them in Mukuru and Mathare slums, respectively indicated that they consumed below 20 litres per person per day. Although calculating daily jerrican consumption is more reliable than amount of litres per day, it was clear that high proportion of residents in the study slums consumed below 20 litres per day (Table 17).

**Table 17. Distribution of water consumption per person per day**

Slum \ L/day/person		> 20	20*	21 ~ 30	31 ~ 40	41 ~ 50	51 ~ 80	81 ~ 100	No response	Total
		Mukuru	Number	44	13	11	10	1	13	4
%	46		14	11	10	1	14	4	0	100
Mathare	Number	49	24	6	6	1	2	2	6	96
	%	51	26	6	6	1	2	2	6	100

\* 20 litre per day is the minimum quantity of water per person per day (International guidelines)

#### 4.3.3 Fetching water

Private water sources and kiosks as main water sources in the two slums were located near the houses, i.e., less than 1km which met the requirement of the international guidelines of minimum physical accessibility of water. The respondents were asked about time they spent on a round trip to fetch water with a 20 jerrican from their houses to water sources. Table 18 shows the time spent on a round trip to fetch water with a 20 liter jerrican. A high proportion

of the respondents in Mukuru (92%) and Mathare (88%) spent between 15 to 30 minutes on a round trip of fetching water with a 20 litre jerrican.

**Table 18. Time spent by respondents on a round trip from houses to water sources to fetch 20 litre jerrican of water**

Slum \ Time		< 15 min	15~30 min	30~60 min	1~2 hrs	2~3 hrs	> 3 hrs	Total
Mukuru	Number	0	88	7	0	0	1	96
	%	0	92	7	0	0	1	100
Mathare	Number	8	84	4	0	0	0	96
	%	8	88	4	0	0	0	100

Fetching and queuing time were related with the type and number of water sources. More respondents in Mukuru relied on private vendors to get water who supplied water with a tap and which took longer waiting time. Based on Table 19, the mean of queuing time in Mukuru slum was about 32 minutes. However, kiosks which were the main water supply system in Mathare had at least two taps at reasonable distances inside of the slum. The mean of queuing time in Mathare was about 16 minutes which was half the time in Mukuru. Mathare also had a quarter of households having indoor taps or shared taps in a plot while only 5% of respondents in Mukuru had shared taps in a plot. Well-managed and developed water sources help to shorten the fetching time as well as waiting time to get water.

**Table 19. Queuing time for a round trip from home to water point**

Time \ Slum	Mukuru		Mathare	
	Number	%	Number	%
< 20 min	20	21	53	55
21-30 min	9	9	11	12
31-40 min	42	44	32	33
> 41 min	25	26	0	0
Total	96	100	96	100

Assuming the minimum of round trip time from houses to water source as 15 minutes, then the respondents in Mukuru slum spent a minimum of 2 hours 35 minutes per day to collect



water. On the other hand, the respondents in Mathare slum spent about 1 hour 52 minutes per day to collect water. On average, respondents of both slums spent 2 hours 14 minutes to collect daily water.

< Mukuru slum >

$$\begin{aligned} \text{Time spent} &= (\text{round trip 15 minutes} + \text{queuing 32 minutes})/\text{jerrican} \times 3.3 \text{ jerry can/day} \\ &= 155 \text{ minutes that is, 2 hours 35 minutes/day} \end{aligned}$$

< Mathare slum >

$$\begin{aligned} \text{Time spent} &= (\text{round trip 15 minutes} + \text{queuing 16 minutes})/\text{jerrican} \times 3.6 \text{ jerry can/day} \\ &= 112 \text{ minutes that is, 1 hour 52 minutes/day} \end{aligned}$$

#### 4.3.4 Economic accessibility

About 74% of respondents in Mukuru paid Ksh 5 for a 20 litre water jerry can, whereas 61% of those in Mathare paid Ksh 2 for 20 litre jerrican. The mean of water price per 20 litre jerrican was Ksh 4.99 (about Ksh 5) in Mukuru and Ksh 1.99 (about Ksh 2) in Mathare (Table 20).

**Table 20. Respondents' reports about amount of money they paid for a 20 litre jerrican**

Slum \ Price		Price						Total
		Ksh 1	Ksh 2	Ksh 3	Ksh 4	Ksh 5	Ksh 10	
Mukuru	Number	0	0	18	0	71	7	96
	%	0	0	19	0	74	7	100
Mathare	Number	2	59	18	3	13	1	96
	%	2	61	19	3	14	1	100

Table 21 shows the distribution of monthly water expenditure of the respondents in two slums. About 68% of the respondents in Mukuru spent between Ksh 251 and 650 monthly and their average expenditure per month was Ksh 522, whereas 70% of those in Mathare spent below Ksh 450 and their average expenditure per month was Ksh 404.

The international water indicators prescribed that water should not take an undue proportion of the household income, i.e., it should be less than 5%. Based on these data, 28% of the

respondents (35% of Mukuru and 21% of Mathare) were spending over 5% of household monthly income on water.

**Table 21. Respondents’ reports on their monthly water payments**

Expenditure Slum		< Ksh 250	Ksh 251 to 450	Ksh 451 to 650	Ksh 651 to 850	Ksh 851 to 1,050	> Ksh 1,051	Total Number (%)
		Mukuru	Respondents	12 (13)	41 (43)	24 (25)	7 (7)	6 (6)
Over 5% of income	11 (11)		14 (15)	5 (5)	2 (2)	1 (1)	1 (1)	34 (35)
Mathare	Respondents	29 (30)	38 (40)	20 (21)	5 (5)	2 (2)	2 (2)	96(100)
	Over 5% of income	8 (8)	6 (6)	6 (6)	0 (0)	0 (0)	1 (1)	21 (21)

Table 22 shows that over 90% of the respondents in Mukuru were paying water to private vendors along with 5% to landlords and 4% to communities and none paid to the NCWSC directly. This can be interpreted that respondents in Mukuru slum seldom, if ever, paid proper charges for water they consumed.

Mathare slum showed the same situation that over 95% of the respondents were not paying water charges to NCWSC directly. However 56% used kiosks which were legally connected to piped water supply and were controlled by communities. Communities controlled water gauges of kiosks, collected money from kiosks’ users and paid water charges to NCWSC.

**Table 22. Respondents reports on the place of water payment**

Payment Slum		NCWSC	Landlords*	Communities**	Private vendors	Total
Mukuru	Number	0	5	4	87	96
	%	0	5	4	91	100
Mathare	Number	4	20	54	18	96
	%	4	21	56	19	100

\* Landlords set the water pipes illegally or (legally) for their tenants who rent their plots and collect water charges from their tenants.

\*\* Communities (or groups like Muungano community) control kiosks and sell water to the slum residents with a specific amount of money like Ksh 2 per a 20 jerrican in Mathare. Every month the staffs of NCWSC check water gauges inside of kiosks then communities pay water charges to NCWSC.

#### 4.3.5 Price fluctuation

Water price fluctuation was a very common issue in the slums. Slum residents experienced water price changes without notice from water vendors (especially private vendors) and they were obliged to pay high price. The fluctuations broke out when water supply was not constant for several reasons such as dry season, vendors' intentions, broken down pipes and so on. The change in water prices affected the quantity of water storage in households and their daily water usage per person.

When the respondents were asked whether they have experienced water price fluctuations during a year, 66% of them (74% of Mukuru and 57% of Mathare) answered that they had experienced price fluctuations during a year. However 43% of the respondents in Mathare answered that they paid constant water price per year compared to 26% of those in Mukuru (Table 23).

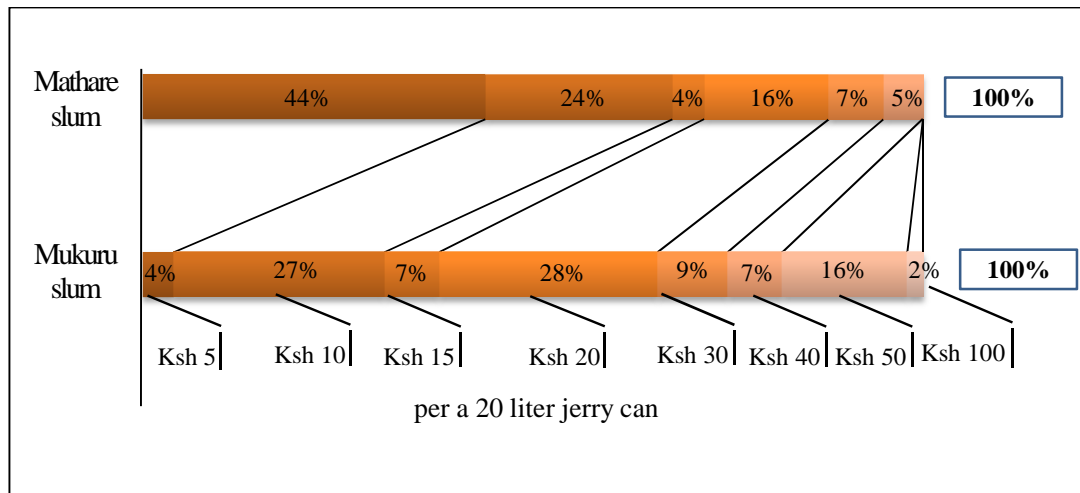
**Table 23. Water price fluctuation experienced by the respondents during a year**

Slum		Times							Total
		0	1~3	4~6	7~9	10~15	16~20	> 21	
Mukuru	Number	25	5	8	13	14	17	14	96
	%	26	5	8	13	15	18	15	100
Mathare	Number	41	30	12	6	2	2	3	96
	%	43	31	13	6	2	2	3	100
Total (%)		34	18	11	10	8	10	9	100

Mukuru had experienced an average of 10 times price fluctuation per year while Mathare had done so 3 times. This meant that kiosks which were the main water supply sources in Mathare slum provided more stable water supply to the respondents than private vendors.

During the water fluctuation period, they paid from 2 times to the maximum 20 times of usual prices. Figure 8 shows that Mukuru had experienced high price fluctuation than Mathare. The respondents in Mathare paid maximum Ksh 40 while respondents in Mukuru paid maximum Ksh 100 per 20 litre jerrican during a time of water scarcity. The means of price fluctuations were Ksh 25 (5 times) in Mukuru and Ksh 13 (6 times) in Mathare.

**Figure 8. Distribution of price fluctuation**



#### 4.3.6 Conclusion

Respondent in Mathare consumed more water per day than those in Mukuru because of bigger family size and the average daily water consumption was the same of less than 24 litres per person per day.

In relation to water accessibility, about 84% of the respondents used water from private vendors and kiosks. Mukuru’s situation was worse than Mathare. The main water supply system in Mukuru slum reported by 82% of respondents was private vendors who sold water in front of their houses by illegal (or legal) connections from main water pipes. The private vendors controlled water supply by managing motors or meters in their houses. It meant that Mukuru slum experienced more water fluctuation because of price control by private vendors. Sometimes residents in Mukuru slum paid 20 times for a 20 litre jerrican than the usual price.

On the other hand, 58% of the respondents in Mathare slum used kiosks as the main water supply system which were controlled by communities for instance, Muungano community. The officer of NCWSC came and checked the water gauge regularly and the members of Muungano community managed kiosks and collected the water charges. Except when NCWSC cut water supply for certain reasons, community operated kiosks everyday.

Both slums paid different price for a 20 litre jerrican. Kiosks, which were controlled by communities (or groups) and paid to NCWSC directly, charged Ksh 2 while private vendors who were controlled by private water sellers charged Ksh 5.

Travelling to collect water per day in Mukuru and Mathare slums averaged 2 hours 14 minutes per day. Queuing was the main reason to spend long time for a day rather than the time of reaching sources and fetching water. Respondents in Mukuru spent 2 hours 35 minutes per day while those in Mathare respondents spent 1 hour 52 minutes per day to collect water for their family.

#### 4.4 Perception of the respondents on water accessibility

The third objective of this study was to examine perceptions of respondents on their current water accessibility. The perceptions were on current water supply, satisfaction of water consumption, satisfaction with distance from house to water source, satisfaction with facilities hygiene conditions, monthly water expense by households and aspects of improvement on water supply.

##### 4.4.1 Satisfaction with current water supply

Respondents were asked about their satisfaction on current water supply system including service, water quality, waiting time and seller’s attitude etc. About 60% of them (67% of Mukuru and 53% of Mathare) answered that they were dissatisfied with their current system. Respondents from Mukuru showed higher proportion of dissatisfaction than Mathare ones as over 20% of respondents in Mukuru answered that their water supply system was very poor while only 9% of those in Mathare expressed similar dissatisfaction (Table 24). This implies that the kiosks water supply system provides more satisfactory services to the respondents than private vendors.

**Table 24. Respondents’ perceptions on the current water supply system**

Slum \ Scope		Very good	Good	Fair	Poor	Very poor	Total
Mukuru	Number	2	1	29	44	20	96
	%	2	1	30	46	21	100
Mathare	Number	6	11	28	42	9	96
	%	6	12	29	44	9	100
Total (%)		4	6	30	45	15	100

#### 4.4.2 Satisfaction with water consumption

Nearly 57% of (60% in Mukuru and 56% in Mathare) of respondents answered that they were consuming lower water amounts per person per day. On the other hand, almost one third of the respondents thought that they were consuming fair amount of water per person per day (Table 25).

**Table 25. Respondents' perceptions on water consumption per person per day**

Slum \ Scope		Very good	Good	Fair	Poor	Very poor	Total
Mukuru	Number	3	5	31	35	22	96
	%	3	5	32	37	23	100
Mathare	Number	2	5	36	40	13	96
	%	2	5	37	42	14	100
Total (%)		3	5	35	39	18	100

#### 4.4.3 Satisfaction with distance from house to water source

Nearly 77% of respondents in Mathare slum replied that they travelled long distance from house to water source to fetch water while only 28% of Mukuru replied that they covered long distance (Table 26). This result is closely related with the types of main water source. Respondents in Mukuru relied on private vendors who provided water at short distance while Mathare relied on kiosks which were mainly located outside of the plots.

**Table 26. Respondents' perceptions of the distance from their houses to water source**

Slum \ Scope		Very Far	Far	Fair	Short	Very short	Total
Mukuru	Number	9	18	38	20	11	96
	%	9	19	40	21	11	100
Mathare	Number	28	46	12	7	3	96
	%	29	48	13	7	3	100

#### 4.4.4 Satisfaction with facilities hygiene conditions

Table 27 shows that 95% the respondents in Mathare answered the water facilities such as jerrican, water point structures, and water taps were clean and fairly clean compared to 67% of those in Mukuru. This result shows that kiosks with permanent structures had higher

hygiene condition than water source from private vendors. Communities controlling kiosks charged a little higher water price to collect maintenance expenses of kiosks so they could manage facilities with good hygiene conditions. On the other hand, private vendors rarely invested in the maintenance of their water supplies.

**Table 27. Respondents' perceptions of the facilities' hygiene conditions**

Slum		Scope	Very good	Good	Fair	Poor	Very poor	Total
Mukuru	Number		7	23	35	19	12	96
	%		7	24	36	20	13	100
Mathare	Number		26	43	22	4	1	96
	%		27	45	23	4	1	100

Figures 9 and 10 show the various sources of water.

**Figure 9. Private vendors (photo by researcher, 2014)**



**Mukuru slum**



**Mathare slum**

**Figure 10. Kiosks (photo by researcher, 2014)**



**Mukuru slum**



**Mathare slum**

**Figure 10. Kiosks-continued (photo by researcher, 2014)**



**Mathare slum**



**Mathare slum**

#### 4.4.5 Monthly water expense by households

Table 28 shows that 57% of the respondents in Mukuru mentioned that the water expense per month was high compared with their income and 43% of them replied that the water cost was reasonable. However, 68% of the respondents in Mathare agreed that their water expense per month was fair and 32% of them mentioned that the water cost was high. This result was caused by different water prices between two slums as Ksh 5 in Mukuru and Ksh 2 in Mathare with similar income levels and water consumptions in both slums.

**Table 28. Monthly water expense by households**

Slum	Scope	Very High	High	Fair	Low	Very low	Total
	Mukuru	Number	9	46	37	4	0
%		9	48	39	4	0	100
Mathare	Number	11	20	61	4	0	96
	%	11	21	64	4	0	100

#### 4.4.6 Aspects of improvement on water supply

Over half of the respondents mentioned that the pipe maintenance was the most important service to improve water supply (Table 29). It was easy to see water pipes in both slums (especially, Mukuru slum) passing through open sewage lines or under solid waste in the streets. The aged pipes and roughly taped pipes after illegal connections from the main water pipes were exposed and likely to contaminate easily during flood or civil construction. Pipes



maintenance was informally done and was accompanied by the high pollutions likely affect to the quality of water.

**Table 29. Respondents’ perceptions of aspects of water supplies improvement**

Sector		Continuity	Cost	Distance	Hygiene	Pipe Maintenance	Total
Slum							
Mukuru	Number	8	19	2	14	53	96
	%	8	20	2	15	55	100
Mathare	Number	7	10	21	9	49	96
	%	7	11	22	9	51	100
Total (%)		8	15	12	12	53	100

Figure 11 shows the connection of water pipes in Mukuru and Mathare slums.

**Figure 11. Water pipes (photo by researcher, 2014)**



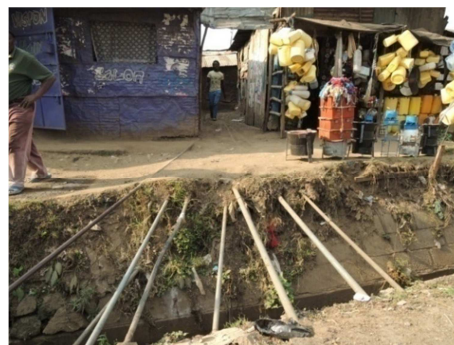
**Mukuru slum**



**Mukuru slum**



**Mathare slum**



**Mathare slum**

#### 4.4.7 Conclusion

Nearly 60% of the respondents mentioned dissatisfaction about their current water supply and consumption per person per day. Depending on the types of main water source (private vendors in Mukuru and kiosks in Mathare), the respondents in Mathare replied that they had longer distance travelling from house to water source to fetch water, higher water hygiene conditions and quite fairly water expense per month than Mukuru. However, the respondents in both slums mentioned that pipe maintenance was the most important service to improve water supply.

#### 4.5 Respondents perceptions of their quality of life

The fourth objective of this study was to find out the respondents' perceptions about their quality of life. The perceptions were on quality of life scores, respondents' suggestions on how quality of life could be improved and water accessibility and the quality of life.

##### 4.5.1 Quality of life scores

Respondents were asked to give a score to their quality of life with high quality score of up to 10 points, poor quality score of zero point. In Table 30, 76% of the respondents in Mukuru responded that their quality of life was "Very Poor" or "Poor" compared to only 25% of respondents in Mathare responded in the same manner. In this case, respondents in Mathare showed higher satisfaction with their quality of life compared to those in Mukuru. The mean of quality of life in Mukuru and Mathare slums were 3.6 and 5.6 points, respectively.

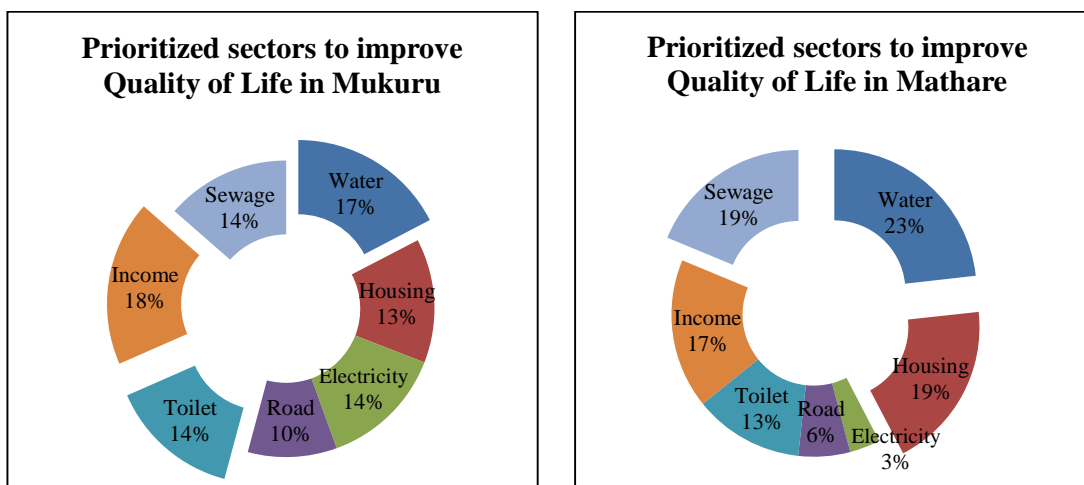
**Table 30. Respondents' scores on their quality of life**

Slum		Score											Total
		Very Poor			Poor		Normal	Good		Very Good			
		0	1	2	3	4	5	6	7	8	9	10	
Mukuru	Number	0	2	36	22	12	7	7	5	2	3	0	96
	%	0	2	38	23	13	7	7	5	2	3	0	100
Mathare	Number	0	0	7	7	11	20	15	19	13	4	0	96
	%	0	0	7	7	11	21	16	20	14	4	0	100
Mukuru (%)		40			36		7	12		5			100
Mathare (%)		7			18		21	36		18			100

#### 4.5.2 Respondents' suggestions on how quality of life could be improved

Respondents were asked to select 3 sectors among water, housing electricity, road, toilet, income and sewage which could be prioritized to improve their quality of life. Respondents in Mukuru selected income (18%), water (17%) and toilet (14%) as priorities while those in Mathare selected water (23%), housing (19%), and sewage (19%) as priorities (Figure 12). Both slums put water sector as a priority to be developed for better life. As shown the ranking results put water on high priority affecting their better quality of life.

**Figure 12. Respondents' ranking of sectors to improve their quality of life**



#### 4.5.3 Water accessibility and the quality of life

Around 80% of respondents (75% of Mukuru and 81% of Mathare) replied that access to water affected their quality of life while 14% of them (20% of Mukuru and 9% of Mathare) responded that access to water did not affect their quality of life (Table 31).

**Table 31. Respondents' perception of effect of water accessibility on their quality of life**

Water accessibility		Very agree	Agree	Fair	Disagree	Very disagree	Total
Mukuru	Number	42	30	5	12	7	96
	%	44	31	5	13	7	100
Mathare	Number	38	39	10	5	4	96
	%	40	41	10	5	4	100
Total (%)		42	36	8	9	5	100

Based on these results, kiosks provided better water service to the residents with short physical distance, high hygiene conditions, low water cost, few price fluctuations and respondents had high satisfactions of the water supply than the service by private vendors.

#### 4.5.4 Conclusion

In terms of quality of life scores, 76% of the respondents in Mukuru mentioned that their quality of life was “Poor” with 3.6 points of quality of life score out of 10 points compared to only 25% of the respondents in Mathare mentioned in the same manner with 5.6 points of quality of life score. Both slums put water sector as a priority to be developed for better life and around 80% of the respondents in the two slums replied that access to water affected their quality of life.

### **4.6 International guidelines and national policies on water supply levels**

The fifth objective of this study was to assess the achievements of international guidelines and national policies on water accessibility in Mukuru and Mathare slums.

#### 4.6.1 Summary of International guidelines and national policies

This is summary of international guidelines and national policies on water accessibility which are used as indicators to evaluate current water accessibility in slums.

International guidelines to access water are (General Comments No. 15; 5~6; WHO & UNICEF, 2000);

- a) Availability: 20 litres per person per day (for survival not concerning health issue)
- b) Physical accessibility: Less than 1 km or 30 minutes for water collection
- c) Economic accessibility: Not exceed 5% of household income

National policies to access water are (RoK, 2007b; 6~7; Mugambi, 2014);

- a) Increase sustainable access to safe water from 60% to 80% in the urban area by 2015
- b) Physical accessibility: Average 30 minutes
- c) According to the Water Services Regulatory Board, slum residents will pay Ksh 204 for less than 6 cubic meters of water from 2015.

#### 4.6.2 International guidelines

##### *Availability*

According to the daily jerricans consumption, both slums consumed water averaging 24 litres per person per day. However, in view of daily water litres consumption, almost half of the respondents consumed below 20 liters. Almost half of the respondents in slums studied were still not consuming the minimum quantity of water per day required. Private vendors' water prices fluctuated on an average of 10 times per a year while those of kiosks 3 times per year. During the water scarcity period, respondents paid double or much more for a 20 litter jerrican.

##### *Physical accessibility*

Water sources in both slums were located less than 1 km, as almost 90% of the respondents in both slums spent between 15 to 30 minutes on a round trip to fetch water with a 20 jerrican. The crucial variable was queuing time for water. Considering queuing time, respondents in Mukuru spent 2 hours 35 minutes per day to collect water while those in Mathare spent 1 hour 52 minutes per day to collect water.

##### *Economic accessibility*

Table 32 shows that 35% and 21% of the respondents in Mukuru and Mathare respectively spent over 5 % of household income on water. Those in Mukuru spent more money for water averaging Ksh 522 compared to Ksh 404 in Mathare because respondents in Mukuru paid an average Ksh 5 per 20 jerrican while those in Mathare paid an average of Ksh 2 per 20 jerrican. The main reason of high price for water in slums was lack of water pipe connections and

maintenance by NCWSC. There being no water pipes in their plots, the respondents had to buy water at high price from indirect water suppliers like private vendors, kiosks and handcarts.

**Table 32. Summary of survey results compare with international guidelines**

Type	Content	Condition	Results
International guidelines	Availability	20 L/person/day	<ul style="list-style-type: none"> <li>· Mukuru: 24 L/person/day</li> <li>· 46% ; below 20 litres consumption</li> <li>· Mathare: 24 L/person/day</li> <li>· 51% ; below 20 litres consumption</li> </ul>
	Physical accessibility	Less than 1 km/day or 30 minutes/day	<ul style="list-style-type: none"> <li>· Mukuru: 2 hours 35 minutes/day</li> <li>· Mathare: 1 hour 52 minutes/day</li> </ul>
	Economic accessibility	No excess 5% of income	<p>Excess 5% of income</p> <ul style="list-style-type: none"> <li>· Mukuru: 35% of respondents</li> <li>· Mathare: 21% of respondents</li> </ul>

#### 4.6.3 National policies

##### *Availability*

All respondents, except one in Mukuru who used hand cart water source, could access improved water facilities like indoor taps, shared taps, private vendors and kiosks. Those water supply systems provided annual service to the respondents but, Mukuru using private vendors as a main water supply system experienced an average of 10 times water fluctuation per year while Mathare using kiosks as a main water supply system experienced an average of 3 times fluctuations per a year.

##### *Physical accessibility*

The situation was the same as that presented under the international guidelines (see 4.6.2).

*Economic accessibility*

When average income and water expenditure per month were compared, it was clear that 5% of income was spent on water per month. Moreover 41% and 51% of the respondents in Mukuru and Mathare, respectively who had less than Ksh 9,000 income were paying over 5% of their income for water.

According to the new tariff blocks by the Water Services Regulatory Board (WASREB) from 2015, slum residents were to pay Ksh 204 for less than 6 cubic meters of water. Since most of the respondents bought water from indirect sources in jerricans, they paid from Ksh 600 to Ksh 1,500 for 6 cubic meters of water. This meant that the respondents paid three or seven times the prices set by the new tariff regulation (Table 33).

- $\text{Ksh } 2 / 20 \text{ litres} \times 50 \text{ times of a cubic meter} \times 6 \text{ cubic meters} = \text{Ksh } 600$
- $\text{Ksh } 5 / 20 \text{ litres} \times 50 \text{ times of a cubic meter} \times 6 \text{ cubic meters} = \text{Ksh } 1,500$

**Table 33. Summary of survey results compare with national policies**

Type	Content	Condition	Results
National policies	Availability	80% of access to sustainable safe water	<ul style="list-style-type: none"> <li>• All respondents (except 1 hand cart user) can access to improved water facilities as indoor tap, shared tap, private vendor and kiosk</li> </ul>
	Physical accessibility	Less than 30 minutes/day	<ul style="list-style-type: none"> <li>• Mukuru: 2 hours 35 minutes/day</li> <li>• Mathare: 1 hour 52 minutes/day</li> </ul>
	Economic accessibility	Below 6 cubic meters pay a flat rate of Ksh 204	<ul style="list-style-type: none"> <li>• Mukuru: average Ksh 5/jerrican Ksh 1,500 for 6 cubic meters</li> <li>• Mathare: average Ksh 2/jerry can Ksh 600 for 6 cubic meters</li> </ul>

#### 4.6.4 Conclusion

Although respondents in Mukuru and Mathare slums were using improved water supplies such as kiosks and private vendors through water pipes, access to water in terms of availability, physical accessibility and economic accessibility based on international guidelines and national policies was not sufficient.



## CHAPTER FIVE: SUMMARY, CONCLUSIONS, AND RECOMMENDATION

### 5.1 Summary

This study was conducted for the purpose of determining the relationship correlation between water accessibility and quality of life in Mukuru and Mathare slums in Nairobi. The questionnaire served as the instrument for collecting data and Microsoft excel programme was used to analyze data. Three sub-areas in each slum were selected and heads of households were sampled and interviewed.

#### 5.1.1 Households' Profiles in the study areas

**Gender distribution:** The proportion of men (55%) was higher than that of women (45%). The average age of the respondents was 24 years in Mukuru slum and 34 years in Mathare slum.

**Family size:** Mukuru slum had an average of 3.5 members per households and 1.5 children while Mathare had an average 4.1 members per household and 2 children. Except for single families, 32% and 39% of respondents in Mukuru and Mathare slums shared one room with whole family members.

**Education level:** Almost half of the respondents had finished primary education and around 40% of them had finished secondary education. However, the respondents in both areas had difficulties in understanding the questionnaires which had been written in English. This could be interpreted that respondents deceived about their education level or they had not continuously updated their education since leaving school.

**Employment:** Nearly 70% of the respondents were self-employed and 20% worked as casual labour while 10% of them were walking around without jobs. This meant that most of the slum residents had no regular monthly income.

**Income:** Over 45% of respondents had income below Ksh 9,000 which was lower than Kenya's minimum wage of Ksh 9,280 per month. Low income made it difficult for the

respondents to access basic services such as water, sanitation, housing, education and electricity.

**Housing:** About 88% of the respondents lived in rental houses. They rented one or two rooms from landlords and paid about Ksh 2,000 per month for one room which had been built with corrugated iron sheets on a wooden frame measuring 10 x 10 feet.

**Electricity:** Around 90% of the respondents had electricity in their houses and paid Ksh 300 ~500 per month which were nearly 5% of their income. However power gauges could not be found in the respondents' houses at all and wires which were tangled on wood and metal poles from rusty roofs and cables without protective insulation were common sights in the slums studied. Households in both slums were exposed to electric accidents.

#### 5.1.2 Water accessibility and quality of life

##### *Water Availability*

Respondents relied on private vendors and kiosks as the main water supply. They spent around 3.5 of jerricans of 20 litres (3.3 in Mukuru and 3.6 in Mathare) for their households. Consumption of water was highly depended on household size and type of water supply. Whereas some respondents spent an average of 24 litres of water per day per person, half of them (50%) spent below 20 litres per day per person. Private vendors' price fluctuated on average 10 times per year while those of kiosks about 3 times per year. During the water scarcity periods, respondents paid nearly double the usual price for a 20 litter jerrican.

Whereas the international guidelines required 20 litres per day per person as the minimum quantity of water and the Kenya government established strategic frameworks for 80% access of households to sustainable safe water, the respondents in this study were not accessing sufficient amount of daily water for their daily consumption.

##### *Physical accessibility*

In regard to physical accessibility, water supply points were located less than 1 km from respondents' houses but collecting water per day took an average of 2 hours (2 hours 35

minutes in Mukuru and 1 hour 52 minutes in Mathare ) because of long queuing time for fetching water.

In the requirements by international and national levels, water source should be located less than 1 km and it should take 30 minutes per day to collect water. The slums studied still suffered from a long time taken to collect water every day.

### *Economic accessibility*

Respondents paid water charges ranging from Ksh 2 to 5 for a 20 litter jerrican. Because of high price of water, respondents from Mukuru spent more money per month on water which averaged Ksh 522. On the other hand those of Mathare spent an average Ksh 404 per month on water. International guidelines suggested that no more than 5% of income should be paid for water per month. However over a quarter of respondents (35% of Mukuru and 21% of Mathare) spent over 5% of their income on water.

Kenya Water Services Regulatory Board approved new flat rate water tariff from 2015 as Ksh 204 for less than 6 cubic meters. However the respondents were paying more than three times the new water tariff because they had to buy water from water sellers. Consequently, the fundamental reason of high water charge in slums was lack of water pipe connection and maintenance by NCWSC.

### *Quality of life*

Nearly 75% of the respondents in Mukuru compared to 26% of those in Mathare answered that they had poor quality of life. On the other hand, only 18% of respondents in Mukuru compared to 53% of those in Mathare slum answered that they had good quality of life. Respondents in Mukuru prioritized income, water and toilet services as likely to improve their current quality of life while those in Mathare selected water, sewage and housing as likely to improve their better quality of life among seven items which were water, housing, electricity, road, toilet, income and sewage.

### 5.1.3 Perception of water accessibility to the respondents

About 60% of the respondents expressed their dissatisfaction of the current water supply system including entire service, water quality, waiting time and seller's attitude etc. In terms of water consumption, 42% of the respondents were dissatisfied with it. Even though respondents in Mathare slum had taken shorter time to collect water than Mukuru ones, they felt that there was long physical distance from their houses to water points. The reason was the different location of the main water sources in Mukuru and Mathare slums. The main water source in Mukuru slum was private vendors which were located in plots and just next to neighbors while the main water source in Mathare slum was kiosks which were located outside plots. Respondents in Mathare slum had to travel more to collect water than those of Mukuru. Although private vendors were located in plots but they controlled only one tap while kiosks had at least two or three taps. This made Mathare residents to take half of queuing time compared to Mukuru ones.

According to the facilities hygienic conditions, 95% of the respondents in Mathare slum who used kiosks as the main water source answered that the water facilities were clean and fairly clean. On the other hand, 67% of the respondents in Mukuru who used private vendors as the main water source answered that the water facilities were clean and fairly clean. The reason for these differences was that kiosks were built on permanent structures and managed by communities to keep high hygiene conditions while private vendors rarely managed their water source well.

In terms of perception of monthly water expenses, 32% of the respondents in Mathare answered that their water cost was too high while 57% of those in Mukuru answered that their water was too expensive.

We can conclude that kiosks provided better water service to the residents with short physical distance, high hygiene conditions, low water cost, few price fluctuations and high satisfactions of water supply rather than water service by private vendors.

## 5.2 Conclusions

The households' profiles in the study areas showed typical urban slum forms like sharing one or two rooms measuring 10 x 10 feet with iron sheets and timber with their whole families,

irregular employment or self employment, low income level and high housing rent and illegal electricity connections.

Respondents in Mukuru and Mathare slums rarely had piped water in their houses and most of them used water services from private vendors and kiosks. While a few of the respondents in both slums spent water average of 24 litres per day per person, over half consumed below 20 liters. They took an average 2 hours 14 minutes to collect water everyday. Around one third of the respondents used over 5% of their income for water and they paid three or seven times higher cost of the flat rate. Water accessibility in Mukuru and Mathare slums met neither international guidelines nor national policies at all. Therefore, current water accessibilities in Mukuru and Mathare slums do not meet the minimum requirements of water supply service which human beings should be provided as a basic right for their better quality of life.

Around 80% of the respondents recognized that water service affects their quality of life. Respondents in both slums mentioned pipe maintenance as the most important issue to improve water service. Although satisfaction with water service was depended on water supply system (private vendors and kiosks), about 60% of the respondents expressed their dissatisfaction with the current water supply system.

Kiosks which were the main water supply in Mathare slum showed less price fluctuation at an average of 3 times per a year than private vendors which were the main water supply in Mukuru slum with fluctuations averaging 10 times a year. Moreover, kiosks provided better water service to the residents within short physical distance, high hygiene conditions, low water cost, and high satisfactions of the respondents with water supply rather than water service by private vendors.

### **5.3 Recommendations**

The following recommendations are offered for policy makers and practitioners in the field of water accessibility.

1. Slum upgrading projects should be actualized gradually in terms of not only water supply system but also basic services such as housing, electricity, road and sanitation etc. Without improving housing and electricity, providing indoor water tap is not practicable.

2. Illegal electric wires which are stretched like cobwebs are threatening majority people in the high density areas by serious electric tragedies for instance electric shock, black out and fire by short circuit. Although high proportions of the slum residents use electricity, electric service should be improved as soon as possible because most of them are using illegal connected power.

3. Improvement of water supply service in low-income communities should be a priority for most government. Because water is a basic need for human beings survival and human right to receive proper service, there is a need for review and reform of relevant policies and strategies to focus attention on the needs of low-income communities and to create an enabling environment for service delivery. The multi-sectoral nature of the problem requires a collaborative approach that involves key stakeholders in identifying constraints and in developing a framework for action.

The Kenyan government should make decentralized development plan according to rural area, urban area, county, city, rich as distinct from poor counties. Development at national level does not currently cover poor areas. Government should seek out and support each local government and institutions that can help promote water policies and programs in the counties. Not only long term development plan like Vision 2030 for national level but also short term development plan like biennial improvement plans for poor areas (slums) with practical action plan should be set. For example, build more (5%) kiosks compared to the previous year in poor areas to increase hygiene conditions, continuity and management and to reduce travel distance, price fluctuation and spending time for water. County governments should consider reducing water price to Ksh 1 per a 20 litre jerrican or less to the poor areas occupied by a high proportion of lower income earners or supporting community groups to manage the kiosks.

4. Communities based participation should be emphasized to increase water accessibility in slums. This survey showed that kiosks water service managed by community groups provided more affordable and stable water cost, less time consuming to collect water and higher hygiene conditions rather than private water vendors. Community groups can build responsibility to manage water supply systems and provide better water service to the residents. Moreover, they can prevent illegal private water connections which affect water quality and quantity supply to the majority. Managing water service by community groups can also reduce the rate of water payment to NCWSC and lead to better water service provided to them.

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**ANNEX. Questionnaire**



Date: \_\_\_\_\_

**Department of Sociology, University of Nairobi**

Hi, my name is **Kim Usuk**, a student of University of Nairobi and doing Master course of sociology. I am conducting a survey concerning water accessibility in the urban slum to identify quality of life, and suggest ways that water supply and service could be improved in future. The information gathered will be used only for **ACADEMIC RESEARCH** and will not be shared with any organization, political and economic interests and will be kept confidential. Your participation will be a great support developing my research and I hope that you will be willing to help with this study.

My assistant \_\_\_\_\_, who lives in \_\_\_\_\_, selected your house skipping two households after prior household taken survey. She/he will guide you for this survey. This survey will be taken about 20 to 40 minutes. Thank you for your permission to carry out this survey.

*Note: Please over 18 years adults answer to ALL questions as fully as possible and tick appropriately.*

**YOUR DETAILS:**

- **Name** \_\_\_\_\_ **Gender** ( ) Male ( ) Female
- **Phone number** \_\_\_\_\_ **Birth(yy/mm/dd)** \_\_\_\_\_
- **Household Address** \_\_\_\_\_  
(Write your location: **Mukuru** - Simba cool, Ruriie, Kosovo & **Mathare** - Bondeni, Kosovo, Mabatini)

**Part One : Households Profile Data**

1. **How long have you been living in this area?** \_\_\_\_\_
2. **How many family members do you have?** Adults \_\_\_\_\_ Children \_\_\_\_\_
3. **How many rooms does your family have?** \_\_\_\_\_
4. **What is the type of housing ownership?** \_\_\_\_\_  
( 1 ) Public ( 2 ) Own ( 3 ) Rent ( 4 ) Rent free ( 5 ) Other:
5. **How much is paid as rent?** \_\_\_\_\_ / (month , week)
6. **Does your landlord live in same area with you?** ( ) Yes ( ) No **Where?**
7. **Is the household connected to electricity?** ( ) Yes ( ) No
8. **What is the "Monthly" expense for various utility service? (Ksh)**

Items	Electricity	Food	Telephone	Education	Transport	Others
<b>Amount</b>						
9. **How many members of the household have cash income?** \_\_\_\_\_
10. **Who is the main income earns of this household?** \_\_\_\_\_

11. **What work do you do (main income maker's occupation)?**  
 ( ) Nursing ( ) Hired Labour ( ) Engineer ( ) Tailoring ( ) Hair dressing  
 ( ) Teaching ( ) Civil servant ( ) Self employer ( ) Others (specify) \_\_\_\_\_
12. **How many days do you work for a week? (average)**  
 ( 1 ) 5 days ( 2 ) 4 days ( 3 ) 3 days ( 4 ) 2 days  
 ( 5 ) 1 days ( 9 ) Other: \_\_\_\_\_
13. **How long do the adult's income activities take for a day? (average)**  
 ( 1 ) 8 hours ( 2 ) 8 to 5 hours ( 3 ) 5 to 3 hours ( 4 ) Less than 3 hours ( 5 ) Other: \_\_\_\_\_
14. **How many members of the household have their education (adults and children):**  
 Below secondary school ( ) Above secondary school( )?
15. **What is the level of education attained by the "main income maker" of household?**  
 ( 1 ) Primary school ( 2 ) Secondary school ( 3 ) University ( 4 ) Technical school  
 ( 5 ) No schooling ( 9 ) Others (specify) \_\_\_\_\_
16. **How about the school attendance of children per week?**  
 ( 1 ) 5 days ( 2 ) 4 days ( 3 ) 3 days ( 4 ) 2 days  
 ( 5 ) 1 days ( 6 ) Other: \_\_\_\_\_
17. **How much average monthly income (Ksh) does your family earn?**  
 ( 1 ) Less than 5,000 ( 2 ) 5,000 to 9,000 ( 3 ) 9,001 to 13,000 ( 4 ) 13,001 to 17,000  
 ( 5 ) 17,001 to 21,000 ( 6 ) Above 21,000 (specify) \_\_\_\_\_

**Part Two : Water Access Data**

18. **What is the major source of your household water supply?**  
 ( 1 ) Indoor tap ( 2 ) Shared tap ( 3 ) Kiosk ( 4 ) handcart ( 5 ) Other
19. **Have you been receiving water supply by "Tap" and "Kiosk" since ( \_\_\_\_\_ )**
20. **How would you rate the main source of water for your household? (Please tick)**

	( 1 ) Very Good	( 2 ) Good	( 3 ) Fair	( 4 ) Poor	( 5 ) Very Poor
Cost					
Purity					
Color					
Taste					

21. **Who is directly managing the water supply ?**  
 ( 1 ) City council ( 2 ) Landlord ( 3 ) Community ( 4 ) Private vendor ( 5 ) Nobody ( 6 ) Don't know
22. **What is the major source of household drinking water?**  
 ( 1 ) Indoor tap water ( 2 ) fetching water ( 3 ) bottle water ( 4 ) spring/well water ( 5 ) Other: \_\_\_\_\_
23. **How much do you pay for water ?** \_\_\_\_\_ Ksh / 20 Liters
24. **How much of water does your household consume each day?** \_\_\_\_\_ Liters/day
25. **How many 20 litres containers do you fetch in a day?** \_\_\_\_\_

26. **How frequently do you pay?** ( ) Daily ( ) Monthly ( ) Other(specify)  
**Directly to** ( ) City council ( ) Landlord ( ) Community ( ) Vendor or others( )
27. **How many days per week do you receive water supply?**  
 \_\_\_\_\_ Times per Week (if you can access everyday, write 7 times per week)
28. **Among the family members, who is main fetcher of water?**  
 ( 1 ) Mother ( 2 ) Father ( 3 ) Child-school boy ( 4 ) Child-school girl  
 ( 5 ) Preschool child ( 6 ) Other:
29. **What time usually are you going to fetch water to the water supply place?**  
 ( 1 ) Before 7 am ( 2 ) 7 to 9 am ( 3 ) 9 to 11 am ( 4 ) 11 am to 1 pm  
 ( 5 ) 1 to 3 pm ( 6 ) 3 to 5 pm ( 7 ) After 5 pm
30. **How long does it take time to go water point and return to home? (a 20 litre jerry can, round trip)**  
 ( 1 ) less than 15 min ( 2 ) 16 to 30 min ( 3 ) 31 to 1 hour ( 4 ) 1 to 2 hours  
 ( 5 ) 2 to 3 hours ( 6 ) more than 3 hours (specify: \_\_\_\_\_)
31. **How long do you wait to fetch water?** \_\_\_\_\_ Hours \_\_\_\_\_ Minutes
32. **Does your household collect rain water at your house?** ( ) Yes ( ) No  
**If YES, what is the water used for? (If NO, you don't need to answer)**  
 ( 1 ) Drinking ( 2 ) Cooking ( 3 ) laundering ( 4 ) Bathing ( 5 ) Cleaning ( 6 ) All of these
33. **Does seasonal issue affect to water price change to your area?** ( ) Yes ( ) No  
**If YES, how much have you paid for the maximum cost?** Ksh / 20 Liters
34. **How often did you experience the water price change?** Times / (Year , Month)

### Part Three : Household Water use Behavior

35. **In a typical week, how often do you clean clothes for members of household?**  
 ( 1 ) Everyday ( 2 ) Once three days ( 3 ) Once a week ( 4 ) Others:
36. **When you clean clothes, how amount of water do you spend?**  
 ( 1 ) 20 litres ( 2 ) 40 litres ( 3 ) 60 litres ( 4 ) 80 litres ( 5 ) 100 litres ( 6 ) Others:
37. **In a typical week, how often do family members bath?**  
 ( 1 ) Everyday ( 2 ) Once three days ( 3 ) Once a week ( 4 ) Others:
38. **For your family members bath, how amount of water do you use? (whole family)**  
 ( 1 ) 20 litres ( 2 ) 40 litres ( 3 ) 60 litres ( 4 ) 80 litres ( 5 ) 100 litres ( 6 ) Others:
39. **Have you done any of the following to purify your water?**  
 ( 1 ) Boiling water before drinking ( 2 ) Adding alum ( 3 ) Filtration ( 4 ) Others:

### Part Four : Perception of water supply, cost and effects on the household

40. **How would you rate the water supply services?** (service, water quality, waiting time, supplier attitude, etc)  
 ( 1 ) Very Good ( 2 ) Good ( 3 ) Fair ( 4 ) Poor ( 5 ) Very Poor
41. **Do you think your family members are using enough amount of water per day?**  
 ( 1 ) Very Good ( 2 ) Good ( 3 ) Fair ( 4 ) Poor ( 5 ) Very Poor

42. **Do you think the water point is located enough to close from your household?**  
 ( 1 ) Very Good      ( 2 ) Good      ( 3 ) Fair      ( 4 ) Poor      ( 5 ) Very Poor
43. **How expensive do you think about the current water cost?**  
 ( 1 ) Too high      ( 2 ) High      ( 3 ) Normal      ( 4 ) Low      ( 5 ) Too low
44. **If you think current water price is 'Too High' or 'High', what is the maximum amount are you willing to spend for 20 litres of water?** \_\_\_\_\_ Ksh/20 liters
45. **Do you think spending time to collect water affects to the adult's income activities?**  
 ( 1 ) Very Agree      ( 2 ) Agree      ( 3 ) Fair      ( 4 ) Disagree      ( 5 ) Very Disagree
46. **Do you think spending time to collect water affects to the children's school attendance?**  
 ( 1 ) Very Agree      ( 2 ) Agree      ( 3 ) Fair      ( 4 ) Disagree      ( 5 ) Very Disagree
47. **Do you think improving access to water can make your household's quality of life better?**  
 ( 1 ) Very Agree      ( 2 ) Agree      ( 3 ) Fair      ( 4 ) Disagree      ( 5 ) Very Disagree
48. **Have you heard of any water supply development plan from city council, private sectors or international organizations in this area?**      ( ) Yes      ( ) No      ( ) Don't know
49. **If the government (county) offered subsidies 60 per cent of the overall cost to households to improve the existing water system, would you be willing to participate in the program? Your charge will be over 10,000 Ksh for improving system** ( ) Yes      ( ) No      ( ) Do not know
50. **If NO, what is the reason for not paying?**  
 ( 1 ) I can't trust the fund-raising from government or city council  
 ( 2 ) I satisfy current water supply.  
 ( 3 ) I can't afford to pay for it.  
 ( 4 ) Government or city council should pay for all amount of money for improving system.

### Part Five: Quality of Life

51. **How about the perception of your current quality of life? (Look at the scores and Circle)**  
 (0~2) Very Poor      (3~4) Poor      (5) Normal / Fair      (6~7) Good      (8~10) Very Good
52. **To improve your quality of life, which issues should be improved? Select three of them.**  
 ( ) Water      ( ) Housing      ( ) Electricity      ( ) Road      ( ) Toilet      ( ) Income      ( ) Sewage
53. **Which of the following aspects of your water supply need improvement? (circle one)**  
 ( 1 ) Continuity      ( 2 ) Cost      ( 3 ) Distance      ( 4 ) Pipe maintenance      ( 5 ) Hygiene
54. **Have you ever been affected by water-related diseases before from water supply in the last one year?**      ( ) Yes      ( ) No      ( ) Don't know  
**If your answer is YES, please go following questions. (If NO, you don't need to answer.)**
55. **What kinds of diseases?**  
 ( 1 ) Cholera      ( 2 ) Diarrhea      ( 3 ) Dysentery      ( 4 ) Enteritis vibrio      ( 5 ) Other:
56. **Has this sickness killed any member of household?**      ( ) Yes      ( ) No

## APPENDIX 1. Distribution of Income

Ksh \ Slum	Median	Mukuru		Mathare	
	(1)	Frequency(2)	(1)*(2)	Frequency(3)	(1)*(3)
0 to 5,000	2,500	12	30,000	13	32,500
5,001 to 9,000	7,001	27	189,014	35	245,018
9,001 to 13,000	11,001	24	264,012	22	242,011
13,001 to 17,000	15,001	21	315,011	6	90,003
17,001 to 21,000	19,001	6	114,003	7	133,004
Above 21,001	21,001	3	63,003	7	147,007
No response	0	3	0	6	0
<b>Total</b>		<b>96</b>	<b>975,042</b>	<b>96</b>	<b>889,542</b>
<b>Mean</b>		<b>-</b>	<b>10,484</b>	<b>-</b>	<b>9,884</b>


## APPENDIX 2. Income level and water expenditure

No	Area	Water (Ksh/month)	Income level (Ksh/month)	5% of Income (Ksh)	No	Area	Water (Ksh/month)	Income level (Ksh/month)	5% of Income (Ksh)
1	Simba cool	900	9,000-13,000	450-650	97	Bondeni	300	9,000-13,000	450-650
2	Simba cool	1000	5,000-9,000	250-450	98	Bondeni	2000	Above 21,000	Above 1,050
3	Simba cool	900	5,000-9,000	250-450	99	Bondeni	150	9,000-13,000	450-650
4	Simba cool	300	9,000-13,000	450-650	100	Bondeni	300	17,000-21,000	850-1,050
5	Simba cool	300	13,000-17,000	650-850	101	Bondeni	300	9,000-13,000	450-650
6	Simba cool	600	5,000-9,000	250-450	102	Bondeni	100	9,000-13,000	450-650
7	Simba cool	1500	17,000-21,000	850-1,050	103	Bondeni	300	-	-
8	Simba cool	800	13,000-17,000	650-850	104	Bondeni	250	9,000-13,000	450-650
9	Simba cool	600	9,000-13,000	450-650	105	Bondeni	600	9,000-13,000	450-650
10	Simba cool	400	13,000-17,000	650-850	106	Bondeni	900	5,000-9,000	250-450
11	Simba cool	400	9,000-13,000	450-650	107	Bondeni	150	Below 5,000	Below 250
12	Simba cool	600	13,000-17,000	650-850	108	Bondeni	400	9,000-13,000	450-650
13	Simba cool	300	9,000-13,000	450-650	109	Bondeni	400	9,000-13,000	450-650
14	Simba cool	400	5,000-9,000	250-450	110	Bondeni	200	5,000-9,000	250-450
15	Simba cool	700	5,000-9,000	250-450	111	Bondeni	200	5,000-9,000	250-450
16	Simba cool	400	9,000-13,000	450-650	112	Bondeni	250	5,000-9,000	250-450
17	Simba cool	450	Below 5,000	Below 250	113	Bondeni	200	Below 5,000	Below 250
18	Simba cool	200	9,000-13,000	450-650	114	Bondeni	200	5,000-9,000	250-450
19	Simba cool	100	9,000-13,000	450-650	115	Bondeni	200	Below 5,000	Below 250
20	Simba cool	260	13,000-17,000	650-850	116	Bondeni	300	5,000-9,000	250-450
21	Simba cool	364	17,000-21,000	850-1,050	117	Bondeni	300	5,000-9,000	250-450
22	Simba cool	400	13,000-17,000	650-850	118	Bondeni	200	5,000-9,000	250-450
23	Simba cool	600	17,000-21,000	850-1,050	119	Bondeni	200	5,000-9,000	250-450
24	Simba cool	300	9,000-13,000	450-650	120	Bondeni	720	5,000-9,000	250-450
25	Simba cool	400	13,000-17,000	650-850	121	Bondeni	180	17,000-21,000	850-1,050
26	Simba cool	600	-	-	122	Bondeni	2000	Below 5,000	Below 250
27	Simba cool	900	17,000-21,000	850-1,050	123	Bondeni	600	17,000-21,000	850-1,050
28	Simba cool	300	5,000-9,000	250-450	124	Bondeni	600	5,000-9,000	250-450
29	Simba cool	300	9,000-13,000	450-650	125	Bondeni	500	9,000-13,000	450-650
30	Simba cool	200	13,000-17,000	650-850	126	Bondeni	200	17,000-21,000	850-1,050
31	Simba cool	450	5,000-9,000	250-450	127	Bondeni	250	Below 5,000	Below 250
32	Simba cool	600	9,000-13,000	450-650	128	Bondeni	500	5,000-9,000	250-450
33	Ruriie	300	5,000-9,000	250-450	129	Ma-Kosovo	300	Below 5,000	Below 250
34	Ruriie	500	9,000-13,000	450-650	130	Ma-Kosovo	200	9,000-13,000	450-650
35	Ruriie	600	9,000-13,000	450-650	131	Ma-Kosovo	300	9,000-13,000	450-650
36	Ruriie	450	Below 5,000	Below 250	132	Ma-Kosovo	600	9,000-13,000	450-650
37	Ruriie	450	Below 5,000	Below 250	133	Ma-Kosovo	240	Above 21,000	Above 1,050
38	Ruriie	600	Below 5,000	Below 250	134	Ma-Kosovo	300	9,000-13,000	450-650
39	Ruriie	450	Below 5,000	Below 250	135	Ma-Kosovo	350	13,000-17,000	650-850
40	Ruriie	500	5,000-9,000	250-450	136	Ma-Kosovo	550	13,000-17,000	650-850
41	Ruriie	300	Below 5,000	Below 250	137	Ma-Kosovo	300	-	-
42	Ruriie	600	5,000-9,000	250-450	138	Ma-Kosovo	300	Above 21,000	Above 1,050
43	Ruriie	300	5,000-9,000	250-450	139	Ma-Kosovo	60	-	-
44	Ruriie	350	17,000-21,000	850-1,050	140	Ma-Kosovo	500	9,000-13,000	450-650
45	Ruriie	500	5,000-9,000	250-450	141	Ma-Kosovo	300	Below 5,000	Below 250
46	Ruriie	600	Below 5,000	Below 250	142	Ma-Kosovo	300	Above 21,000	Above 1,050
47	Ruriie	200	13,000-17,000	650-850	143	Ma-Kosovo	300	5,000-9,000	250-450
48	Ruriie	140	5,000-9,000	250-450	144	Ma-Kosovo	250	5,000-9,000	250-450
49	Ruriie	700	13,000-17,000	650-850	145	Ma-Kosovo	180	5,000-9,000	250-450
50	Ruriie	300	13,000-17,000	650-850	146	Ma-Kosovo	250	5,000-9,000	250-450
51	Ruriie	600	5,000-9,000	250-450	147	Ma-Kosovo	0	9,000-13,000	450-650
52	Ruriie	150	Above 21,000	Above 1,050	148	Ma-Kosovo	120	5,000-9,000	250-450



## APPENDIX 2. Income level and water expenditure (continued)

No	Area	Water (Ksh/month)	Income level (Ksh/month)	5% of Income (Ksh)	No	Area	Water (Ksh/month)	Income level (Ksh/month)	5% of Income (Ksh)
53	Ruriie	600	5,000-9,000	250-450	149	Ma-Kosovo	100	5,000-9,000	250-450
54	Ruriie	200	13,000-17,000	650-850	150	Ma-Kosovo	200	Below 5,000	Below 250
55	Ruriie	500	Below 5,000	Below 250	151	Ma-Kosovo	700	Above 21,000	Above 1,050
56	Ruriie	600	5,000-9,000	250-450	152	Ma-Kosovo	600	Below 5,000	Below 250
57	Ruriie	1800	13,000-17,000	650-850	153	Ma-Kosovo	300	5,000-9,000	250-450
58	Ruriie	300	13,000-17,000	650-850	154	Ma-Kosovo	500	Below 5,000	Below 250
59	Ruriie	600	Below 5,000	Below 250	155	Ma-Kosovo	300	Above 21,000	Above 1,050
60	Ruriie	1500	5,000-9,000	250-450	156	Ma-Kosovo	300	5,000-9,000	250-450
61	Ruriie	1050	9,000-13,000	450-650	157	Ma-Kosovo	150	Below 5,000	Below 250
62	Ruriie	1200	13,000-17,000	650-850	158	Ma-Kosovo	300	9,000-13,000	450-650
63	Ruriie	500	5,000-9,000	250-450	159	Ma-Kosovo	240	5,000-9,000	250-450
64	Ruriie	300	5,000-9,000	250-450	160	Ma-Kosovo	0	-	-
65	Mu-Kosovo	300	9,000-13,000	450-650	161	Mabatini	400	5,000-9,000	250-450
66	Mu-Kosovo	350	13,000-17,000	650-850	162	Mabatini	600	Above 21,000	Above 1,050
67	Mu-Kosovo	250	Below 5,000	Below 250	163	Mabatini	500	5,000-9,000	250-450
68	Mu-Kosovo	900	-	-	164	Mabatini	700	5,000-9,000	250-450
69	Mu-Kosovo	300	17,000-21,000	850-1,050	165	Mabatini	450	5,000-9,000	250-450
70	Mu-Kosovo	600	9,000-13,000	450-650	166	Mabatini	300	13,000-17,000	650-850
71	Mu-Kosovo	750	9,000-13,000	450-650	167	Mabatini	600	13,000-17,000	650-850
72	Mu-Kosovo	750	9,000-13,000	450-650	168	Mabatini	300	17,000-21,000	850-1,050
73	Mu-Kosovo	800	Above 21,000	Above 1,050	169	Mabatini	600	Below 5,000	Below 250
74	Mu-Kosovo	1500	5,000-9,000	250-450	170	Mabatini	800	9,000-13,000	450-650
75	Mu-Kosovo	300	Below 5,000	Below 250	171	Mabatini	450	5,000-9,000	250-450
76	Mu-Kosovo	600	13,000-17,000	650-850	172	Mabatini	450	5,000-9,000	250-450
77	Mu-Kosovo	400	13,000-17,000	650-850	173	Mabatini	300	9,000-13,000	450-650
78	Mu-Kosovo	400	9,000-13,000	450-650	174	Mabatini	300	5,000-9,000	250-450
79	Mu-Kosovo	1500	Above 21,000	Above 1,050	175	Mabatini	600	5,000-9,000	250-450
80	Mu-Kosovo	600	9,000-13,000	450-650	176	Mabatini	250	9,000-13,000	450-650
81	Mu-Kosovo	150	5,000-9,000	250-450	177	Mabatini	350	5,000-9,000	250-450
82	Mu-Kosovo	300	5,000-9,000	250-450	178	Mabatini	1000	9,000-13,000	450-650
83	Mu-Kosovo	300	13,000-17,000	650-850	179	Mabatini	500	17,000-21,000	850-1,050
84	Mu-Kosovo	300	-	-	180	Mabatini	700	Above 21,000	Above 1,050
85	Mu-Kosovo	750	9,000-13,000	450-650	181	Mabatini	400	Above 21,000	Above 1,050
86	Mu-Kosovo	650	5,000-9,000	250-450	182	Mabatini	600	5,000-9,000	250-450
87	Mu-Kosovo	150	13,000-17,000	650-850	183	Mabatini	650	5,000-9,000	250-450
88	Mu-Kosovo	300	5,000-9,000	250-450	184	Mabatini	600	9,000-13,000	450-650
89	Mu-Kosovo	300	13,000-17,000	650-850	185	Mabatini	300	13,000-17,000	650-850
90	Mu-Kosovo	200	9,000-13,000	450-650	186	Mabatini	400	13,000-17,000	650-850
91	Mu-Kosovo	280	5,000-9,000	250-450	187	Mabatini	400	5,000-9,000	250-450
92	Mu-Kosovo	300	Below 5,000	Below 250	188	Mabatini	600	5,000-9,000	250-450
93	Mu-Kosovo	450	9,000-13,000	450-650	189	Mabatini	400	9,000-13,000	450-650
94	Mu-Kosovo	300	5,000-9,000	250-450	190	Mabatini	300	5,000-9,000	250-450
95	Mu-Kosovo	250	5,000-9,000	250-450	191	Mabatini	300	Below 5,000	Below 250
96	Mu-Kosovo	600	9,000-13,000	450-650	192	Mabatini	300	17,000-21,000	850-1,050

 It is shown monthly water expenditure overspend 5% of household monthly income.

### APPENDIX 3. Summary of differences between Mukuru and Mathare slums

Contents	Mukuru	Mathare
<b>Household profiles</b>		
Gender distribution (Men : Women) (%)	57 : 43	53 : 47
Age distribution	24 years old	34 years old
Family size	3.5 people	4.1 people
Children	1.5 people	2.1 people
Over 3 children (%)	26	37
One room share (except single) (%)	60 (32)	60 (39)
Education-Primary (%)	55	46
Education-Secondary (%)	38	43
Average income	Ksh 10,484	Ksh 9,884
Less than 9,000 income (%)	41	51
House rent fee	Ksh 2,319	Ksh 2,595
Self employed + Labor (%)	73 44 (29)	74 53(21)
Power exist (%)	89	87
Power fee per month	Ksh 300~500	Ksh 300~500
<b>Water accessibility and quality of life</b>		
Types of main water source	Private vendor (82%)	Kiosk (58%)
Physical - daily consumption	24 L/person/day	24 L/person/day
Physical - daily jerry can	3.3/family/day	3.6/family/day
Economic - a 20 jerry can	Ksh 5	Ksh 2
Economic - cost	Ksh 522	Ksh 404
Over 5 of income (%)	35	21
Economic - Price fluctuation (%)	74	57
Economic - Price fluctuation experienced	Average 10 times per year	Average 3 times per year
Economic - Seasonal cost	Average Ksh 25	Average Ksh 13
Water collection per day	2 hours 35minutes	1 hour 52 minutes
Quality of Life (poor-normal-good) (%)	76 - 7 - 17	25 - 21 - 54
Quality of Life (mean)	3.6	5.6
Prioritized sectors	Income-water-toilet	Water-housing-sewage
<b>Perception of water accessibility to the slum residents</b>		
Satisfaction of water supply (fair and good) (%)	33	47
Satisfactions of water consumption (fair and good) (%)	40	44
Feel far distance from house to water sources (%)	28	77
Facilities hygiene conditions (%)	67	95
Water cost - expensive (%)	57	32
Improvement on water supply	Pipe>Cost>Hygiene>Continuity>Distance	Pipe>Distance>Cost>Hygiene>Continuity
Water accessibility affects QoL (%)	75	81