ACCESS TO PIPE- BORNE WATER IN KADUNA SOUTH LOCAL GOVERNMENT AREA OF KADUNA STATE, NIGERIA

BY

Martin Nkanson DANIEL B.A GEOG. (A.B.U.) 1994
M.S.C/SCIENCE/10418/2008-2009
(M.Sc. Geography)

A THESIS SUBMITTED TO THE SCHOOL OF POSGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA-NIGERIA

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTERS DEGREE IN GEOGRAPHY.

DEPARTMENT OF GEOGRAPHY, FACULTY OF SCIENCE,
AHMADU BELLO UNIVERSITY,ZARIA,
NIGERIA

NOVEMBER, 2014

Declaration

I hereby declare that the thesis entitled "Access to Pipe- Borne Water in Kaduna South Local Government Area" was written by me under the Supervision of Professor J.A. Ariyo and Dr. I.J. Musa. It is a record of my own research work, except where reference is made to published literatures and duly acknowledged. It has not been presented for any degree or examination in any University.

_____ _____

SIGN **DATE**

Certification

This thesis titled "Access to Pipe- Borne Water in Kaduna South Local government of Kaduna State" by Martin Daniel, Nkanson, meets the regulations governing the award of the Degree of Masters of Science in Geography Department, Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literacy presentation.

Prof. J.A. Ariyo Chairman, Supervisory Committee	_____ Sign	_____ Date
Dr. I.J. Musa Member Supervisory Committee	_____ Sign	_____ Date
Dr. I.J. Musa Head of Department	_____ Sign	_____ Date
Prof. A. Z. Hassan Dean School Postgraduate studies	_____ Sign	_____ Date

Dedication

This thesis is dedicated to my late wife Agatha, my daughter Gladys Gusmen, my son Joel Yishieng, my dear parents Daniel (Father), Cecelia (Mother).

Acknowledgement

My special thanks go to the Lord Almighty who spared my life and made this work a success. My unending thanks to my supervisors' professor J.A. Ariyo who took the pains and sacrifice his time to modify the topic I worked upon and Dr. I.J. Musa whose constructive criticism and corrections from the beginning to the end of this work made it a reality. My profound gratitude to my external examiner Prof. B. Dogo, Dean,Post Graduate School Kaduna State University, and my internal examiners Dr. A. Binta, Science Education Department, Faculty of Education Ahmadu Bello University Zaria, Dr. R.O. Yusuf coordinator, Post Graduate School, Department of Geography. Their constructive critics and corrections from page to page made this work a perfect one.

My thanks also go to Mal. Abas who took the pains to go through my work and correct the grammar alongside with the supervisors. I must not forget Yunusa whose inspiration gave me courage in the work, also Engineer Abdulmumini of the Kaduna State Water Board is not left behind who from the initial stage gave me an insight on how to construct questionnaire to approach the topic of this nature, I must not forget Mr. Isitua, Mr. Istafanus, Mr. Bulus Baita for typing and print out copies of my proposals free of charge.

My thanks also go to the Departmental librarian who assisted me with related materials to the research topic, Mr. Tony who did the computer analyses. I must not forget my friends, especially Joseph Audu, Grace Habu,Patricia Ishaya, Martina Joseph and Adewale, my brothers and sisters(Agnes,Godfrey,Sylvanus,Andrew,Theresa and Monica)for their moral support.

Table of Contents

CHAPTER FOUR: METHOD OF RESEARCH

CHAPTER FIVE: PRESENTATION AND ANALYSES OF DATA

CHAPTER SIX: SUMMARY, RECOMMENDA AND CONCLUSION

List of Tables

List of Figures

Abstract

This study examined access to pipe-born water in Kaduna South Local Government Area, Kaduna State. The specific objectives were to identify the sources of household water supply and identify the presence of pipe lines facilities in each household, to establish the percentage of household with access to pipe-borne water and to determine if the quantity of pipe water supply meets demands, to assess the effects of quantity of water supply on the socioeconomic activity of householders. This study adopted a survey research. Data for this study was acquired by administration of a total of 300 questionnaires to households in five wards within the study area (60 questionnaires in each ward). Purposive sampling method was employed to select the respondents. The analysis was based on descriptive statistics and presentation. The study revealed that most of the pipe lines meant for the supply of potable water was old and inefficient despite a significant (84.4%) coverage of these pipe lines facilities. Pipe-borne water supply in the study area is not sufficient to meet the demands of the residents due to irregularity in the flow of water; 4.2% of these taps run every day, 8.8% of these taps run once a week, 11.7% of these taps run once in 3 days, 18.4% of these taps run once a year, 22.2% of these run once a month, while 37.7% water used for cooking, washing, drinking and sanitary purposes were mostly source from alternative sources that are energy and time consuming and costly to obtained. The average water consumed per person per day in the study area was 37.76 liters which is below the minimum absolute daily water needed 50 liters per person per day as stated by UNDP (2008). Consequently pipe- borne water supply in the study area do not have any significant impact on the socio-economic activities of residents as people still spent the better part of their time sourcing for water, this study therefore recommended that there should be constant monitoring of population growth rate and repairs of damage pipes and taps.

CHAPTER ONE:

BACKGROUND TO THE STUDY

1.1 Introduction

Water is a natural resource of fundamental importance. This is because it supports all forms of life and creates jobs and wealth in the water sector, tourism, recreation and fisheries (Ntengwe, 2005). Without water, life as it exists on our planet is impossible (Asthama and Asthama, 2001). About 97.5% of water on the earth is salt water, leaving only 2.5% of freshwater of which over two thirds is frozen in glaciers and polar ice caps. The remaining unfrozen fresh water is mainly found as groundwater; only a small fraction is present above the ground. Freshwater is a renewable resource, yet the world's supply of clean freshwater is steadily decreasing.

Water demand already exceeds supply in many parts of the world, and as world population continues to rise at an unpredicted rate, many more areas are expected to experience this imbalance in the near future (Wikipedia, 2008).

Potable water or drinking water is defined as having acceptable quality in terms of its physical, chemical and bacteriological parameters, so that it can be safely used for drinking and cooking (WHO, 2004). In addition, potable water should be colorless, tasteless and odorless. It should be free from fluorine, arsenic, nitrates, and nitrite and lead contents. Also, potable water should not be associated with water borne disease during and after use. However, human activities comprising of both domestic and industrial discharges has resulted in pollution of the common sources of water that are available to households. Water pollution occurs when unwanted materials with potentials to threaten human and other natural systems find their ways into rivers, lakes, wells,

streams, boreholes or even reserved freshwater in homes and industries (Galadima, Garba, Leke, Almustapha and Adam, 2011).

The pollutants are usually pathogens, silt and suspended solid particles such as soils, sewage materials, disposed foods, cosmetics, automobile emissions, construction debris and eroded banks from river and other water ways. Some of these pollutants are decomposed by the action of micro-organism through oxidation and other processes. The major problem is the reconcentrations of these harmful substances in natural food chain (Oshide, 1990). During the decomposition process, natural bacteria and protozoan in the water source utilize the oxygen dissolved in the water. This could significantly reduced the oxygen level to less than two parts per million, (Galadima, et al 2011). Therefore, in such situation, the respiratory conditions of aquatic species would be seriously affected. Consequently, fishes, bottom-dwelling animals and even marine plants can be contaminated and/or killed, creating significant disruption in the food chain. On the other hand, when this contaminated water is directly consumed without proper treatment can lead to water born diseases such as dysentery, cholera, hepatitis etc.

In Nigeria today, research indicates that majority of the common fresh water sources are polluted, resulting to series outbreak of these and other diseases. A study by Umeh, Amah, Omeh, (2004) showed that 48% of the people in Katsina-Ala Local Government area of Benue state were affected by urinary schitosomiasis, due to increase in water pollution. Some previous investigations indicate that 19% of the whole Nigerian population is affected, with some communities having up to 50% incidence of schitosomiasis.

Also, Olaoye and Onilude (2009) have documented varying levels of microbial

contaminations in drinking water from western parts of the country. In addition to microbial infections, heavy metals poisoning through drinking water have also been documented. Nriagu, Olem, Cudjo, Chino, (1997) reported blood lead levels greater than 30mg/dl in children from Kaduna state. Garba et al (2010) reported a mean arsemic concentration of 0.34mgll in drinking water from hand dug wells, boreholes and taps of Karaye local government area, Kano state.

The Nigerian government has long considered the provision of water supply and sanitation services to be the domain of the federal, state and local government. The federal government is in charge of water resources management; state government has the primary responsibility for urban water supply; and local governments together with communities are responsible for rural water supply (Wikipedia, 2012). However, the public sector has not been successful in meeting more than a small portion of the demand for water of residential and commercial users. This could be due to deterioration of the necessary infrastructure and poor management of the system. Many water supply systems show extensive deterioration and poor utilization of existing capacities, due to under maintenance and lack of funds for operation (FRN, 2000). This has resulted in the shortage of potable water supply. For example, out of the 85 million people living in urban and semi-urban areas, less than half have reasonable access to reliable water supply (FRN, 2000). Many households, often the poorest, end up purchasing water from private vendors that is very expensive when compared to the public supply.

1.2 Statement of Research Problem

The demand for fresh water is fast increasing at a rate greater than the world's population growth. Access to safe water supply is therefore a serious issue across the

globe. Recent statistics indicate that 1.2 and 2.4 billion people suffer from lack of safe water supply and sanitation respectively (WHO, 2004). In many developing countries, Nigeria in particular, more than half of the population is affected by lack of access to safe drinking water (Galadima, et al 2011). Water resources include the fresh and marine waters. The former comprise of water from lakes, hand dug wells, taps, boreholes, streams, rivers, wet lands and those available in underground reservoirs. Fresh waters represent the main source of safe water for household, agricultural and even industrial applications. They are required for drinking, cooking, recreational activities, farming, fishing etc, making them unavoidable for the evolution of society and civilization (Orubu, 2006). However, in Nigeria today the fresh water sources available to the local inhabitants are either unsafe or difficult to obtain due to poor management. According to the World Bank (2010), water production facilities in Nigeria are "rarely operated to full capacity due to broken down equipment, or lack of power to fuel the pumping". Equipment and pipes are poorly maintained, leading to intermittent supply of pipe borne water in Nigeria (World Bank, 2010).

For Over a decade, huge amount of public funds estimated at about 82.5billion Naira have been spent on the provision and management of water in Nigeria (Wikipedia, 2012). However, there is still no potable water and many lack access to adequate sanitation. More than half of the deaths recorded in the nation's health facilities are caused by complications arising from bad water and poor sanitation (Abaje, Ati, and Ishaya, 2009). This has made successive governments and other donor agencies to see that they could expand water supply infrastructures, but despite their efforts, the public is still disenchanted because access to safe water and sanitation is not improving (NEST,

1991; Emosbino and Alayande, 2007).

In Kaduna State, the per capita potable water supply in 1976 was 76.4 liters per day. While the average proportion for the whole state was 32.1%. In 1986, the per capita portable water supply rose from 76.4 litres to 101.9 litres a day. The average proportion for the whole state stood at 35.1%. In terms of the proportion of the population of the state having access to portable water, there was no significant change in 1986 from the situation in 1976 (Onokerhoraye, 1995). This situation of scarcity of potable water has thrown residents of Kaduna metropolis into a fix, as most people now spend the better part of a whole day sourcing for water (Thisday, 2010). In addition, the piped water supply is very poor (erratic, poor quality, low coverage), and as a result most residents are dependent on either boreholes or low quality wells in Kaduna metropolis. Kaduna south local government area is an urban area with an increasing population having a lot of domestic and industrial activities.

Kaduna State Water Board (KSWB), whose responsibility is to pump and distribute sufficient clean water to the residents in the study area, is seriously constrained due to its inability to meet the rising demand for domestic potable water. Water consumption and use has however been greatly hampered by the increasing population brought about by the influx of people into the area.

Many researches have been conducted on the subject matter. For instance, Addisie (2012) in a study in Ethiopia on the assessment of drinking water quality and consumption revealed that the people in Simba District were generally satisfied with the water services provided by the municipality because the quality was good and walking distances were short only that the cost was considered high, especially for the poor who

could not afford it and therefore used alternative unprotected sources.

Fortue (2012) in a study in Cameroon with the aim of identifying the determinants of the households' choice of drinking water source revealed that distances to the source of portable water and household characteristics (size and expenditure) had strong impact on access to portable water in the area.

Afolabi (2010) conducted his study on water supply and sanitation situation in Akure, Ondo State, with a view to determining the extent of deficiency and what was required to meet the Millennium Development Goals (MDG's) safe drinking water and sanitation target in 2015. The paper revealed that majority of residents of the city depended on other sources of water supply other than pipe borne water which were unsafe for public consumption due to poor existing pipe lines and outdated network.

The study by Saleh (2006), aimed at analyzing the nature of water supply and demand in Malumfashi, Katsina state. The result showed a spatial variation of water supply in the study area, some areas had the advantage of water supply over others.

In another work by Saleh and Musa (2012) on the nature of pipe borne water supply and demand in Katsina urban area, revealed a steady increase in population and water demand, consequently there was deficit in supply to meet the demand. Musa, Shehu, and Lukman (2009) conducted a study on Urban Zaria with the aim of identifying distribution methods and supply problems of tap water and the findings came up with four identified methods, namely coagulation, disinfection, filtration and post liming.

The above studies were outside Kaduna South Local Government area where this present research focuses on. Given the steady increase in population and complaints by residents that potable water is inadequate, there is a water supply problem which should

be investigated. This gave the researcher the impetus to carryout an in depth study on access to pipe borne water in Kaduna south local government.

In order to achieve the objectives of the study, the following research questions were answered and follow by hypothesis:

i. What are the sources of domestic water supply to the household in the study area?

ii. Are the pipe line facilities sufficient in the study area?

iii. What is the proportion of people with access to pipe – borne water in the study area?

iv. To what extent is access to pipe – borne water adequate for the people?

v. What is the effect of access to pipe – borne water on the socio – economic activities of people in the study area?

vi. What are the challenges of accessibility of pipe – borne water to households in the study area?

1.3 Hypothesis

1. There is no significant difference between households with accessible pipe-borne water and households without pipe-borne water on their socio-economic activities.

1.4 Aim and Objectives

The aim of this study is to analyze people's access to pipe borne water in Kaduna South Local Government Area of Kaduna state.

This aim shall be achieved through the following objectives which are to;

i. Identify the sources of domestic water supply to house holds in Kaduna

South LGA,

ii. Identify the households with pipe line facilities in Kaduna south LGA,

iii. Examine the proportion of people that have access to pipe – borne water in Kaduna South LGA,

iv. Analyze if the quantity of pipe water supply meets the people's demand in Kaduna South LGA,

v. Examine the effect of accessibility to pipe – borne water on the socio – economic activities of people in Kaduna South LGA,

vi. Examine the challenges of accessing pipe – borne water by household in Kaduna South LGA.

1.5 Justification of the Study

The importance of water to both urban and rural dwellers cannot be overemphasized. Access to pipe- borne water is a point of concern world wide. Kaduna South local government Area is an urban area full of socio-economic activities and needs economic transformation. The researcher therefore attempts to study access to pipe -borne water in the study area. The study would be of benefit to the Kaduna state water board management, as the findings would supply update information on access to pipe borne water. The community concerned would benefit because the result of the study would help facilitate the improvement on the quantity and quality of pipe borne water supply to the area and hence improve quality/standard of living in the area. The study would serve as reference to similar studies in future.

1.6 Scope of the Study

This study was conducted in Kaduna South Local Government Area. The study revolved around access to pipe- borne water. The population units for this study were the householders, to whom questionnaire was administered. Information about pipe borne water facilities were obtained from the management of water board in the two districts in Kaduna South Local Government. The research visited the National Population Commission to obtain information on the total population of Kaduna South L.G.A. of (2006).

CHAPTERTWO:

CONCEPTUAL FRAME WORK AND LITERATUREREVIEW

2.1 Introduction

In this chapter, available literatures were reviewed in relation to the pertinent issues that concern this study. This is with a view to providing information, which could give foresight to the study. Thus, literature in respect of the following issues will be looked at water resources and management practices in Nigeria, Water Management Practices and Policies in Nigeria, The effect of poor management in Nigeria in Nigeria's Growing population on social services, municipal drinking water distribution system for socio-spatial equalities in access to pipe-borne, access to pipe-borne water for sustainable development, household water demand, household use of domestic water, average water consumed by household, water scarcity and its associated problems.

2.2 Water Resources of Nigeria

Nigeria is well drained with a close network of rivers and streams. Some of these, particularly the smaller once in the north are seasonal. There are four principal surface water basins in Nigeria.

i. The Niger Basin which has an area of 584,193Km² within the country, which is 63% of the total area of the country, and covers a large area in central and north-western Nigeria. And the most important rivers in the basin are the Niger and its tributaries Benue, Sokoto and Kaduna.

ii. The lake Chad Basin in the northeast with an area of 179,282Km² or 20% of the total area of the country is the only internal drainage basin in Nigeria. This is

because; it does not terminate in the Atlantic Ocean. Important rivers are the Komadougou-Yobe and its tributaries at Hadejia, Jama'are, and Komadougou-Gena.

iii. The south-eastern littoral basins, with the main water courses being the cross and Imo rivers, have an area of 584493Km², which is six percent of the total area of the country, and receive much of their runoff from the plateau and mountain areas along the Cameroon border.

iv. The south-western littoral basins, with an area of 101,802Km², which is 11percent of the total of the country. The rivers originates in the hilly areas to the south and west of the Niger river.

In addition to the surface water, Nigeria has extensive ground water resource, located in eight recognized hydrological areas together with local ground water in shallow alluvial (Fadama) aquifers adjacent to major rivers:

i. The Sokoto basin zone comprises sedimentary rocks in north-east Nigeria. Yields ranges from below 1.0 to 5.0 liters per second (l/s).

ii. The Chad basin zone comprises sedimentary rocks. It has three aquifers zones: upper, middle, and lower. Borehole yields are about 1.2 to 1.6 l/s from the upper unconfined aquifer and 1.5 to 2.1l/s from the middle aquifer.

iii. The middle Niger basin zone comprises sandstone aquifers yielding between 0.7 and 5.0 l/s and the alluvium in the Niger valley yielding between 7.5 and 37.0l/s.

iv. The Benue basin zone is the least exploited basin in Nigeria extending from the Cameroon border to the Niger –Benue confluence. The sandstone aquifers in the area yield between 1.0 and 8.0l/s

v. The south-western zone comprises sedimentary rocks bounded in the south by the coastal alluvium and in the north by the basement complex.

vi. The south-central zone is made up of cretaceous and tertiary sediments centered on the Niger-Delta. The yields are 3.0 to 7.0l/s

vii. The south-eastern zone comprises of cretaceous sediments in the Anambra and Cross River basins. Borehole numbers are low due to abundant surface water resource.

viii. The basement complex comprises over 60% of the country's area. It consists of low permeability rocks and ground water occurs in the weathered mantle and fracture zones with yields of between 1.0 to 2.0l/s

Coupled with the climatic characteristics, surface and ground water resource, Nigeria's total annual renewable water resource are estimated at 286.2Km³ (AQUASTAT FAO, 2010). Annual internally produced resources amount to 221Cubic Kilometer (Km³), made up of 214Km³ surface water and 87Km³ ground water, while 80Km³ of the latter is assumed to be overlap between surface water and groundwater. External water resources are estimated at 65.2Km³/year, being surface water coming from Niger, Cameroon, and Benin. Exploited surface water resources are estimated to be 80percent of the natural flow, which is about 96Km³/year. Annual extractable groundwater resource are about 59.51Km³, distributed as flows; 10.27Km³ in northern Nigeria; 25.48Km³ in the middle belt; 23.76Km³ in the south. Dam capacity is estimated to be 44.2Km³ (Akpabio and Iniubong, 2013).

2.3 Water Management Practice and Policy in Nigeria

Nigeria has estimated water resources of 286.2Km³/year amounting to 893m³/year per capita (AQUASTAT FAO, 2010). This is no doubt a great resources which when harnessed will produce maximum benefit to the nation. In an attempt to maximize this potential, a number of agencies have been put in place for the management of water resources and provision of water service infrastructure in the country.

Nigeria's water resource management is anchored dominantly on a federal framework consisting of three tiers namely federal government, states government and local government. Relevant laws and regulations on water resources use have been found in several documents and instruments (Table 2.1) as well as customary practices.

Table 2.1 List of Water Resources Act in Nigeria

S/N	Names of Statues	Key Provision
1	The water works Act of 1915	Colonial Nigeria (shortly after Amalgamation in 1914) passed the law specifically to keep water from being polluted. It prohibits the pollution of water in Nigeria by obnoxious or harmful matters.
2	The minerals Act of 1917	The laws vested the Head of States of Nigeria with power to make regulations for prevention of pollution of any water course.
3	The public Health Act of 1917	It prohibits the functioning of water and vitiation of the atmosphere.
4	The oil in navigable water Act,	It prohibits water pollution by oil spillage.

	1968	
5	The petroleum Act of	It covers prevention of pollution by inland waters, rivers, lakes and water courses.
6	The land use Act of 1978	Ownership of land linked to ownership of groundwater resources.
7	The Rivers Basin Development (RBDA) decree 25 of 1976 (Revealed by No. 87 of 1979 and also latter by the RBDA Act, decree 35 of 1987, i.e Cap 396	In its presence from Cap 396 spells out diverse functions and objectives for these authorities to ensure a Pan-Nigerian program for water resources development.
8	The Environmental Impact Assessment (EIA) Decree, No. 86 of 1992	The law seeks to protect the physical and aquatic environment.
9	Water Resource Decree, No. 101 of 1993.	It vested the right to use and control all surface waters and groundwater and of all water in any water course affecting more than one state in the Federal Government, with provisions that any person may take water without charge for his domestic or livestock watering purposes (in any water course to which the public has free access).
10	The 1999 constitution of the	The constitution puts the Exclusive Legislative

	Federal Republic of Nigeria	List (ELL) shipping and navigation on the river Niger and on any such other inland water way as many be designated by the National Assembly to be an international water way or to be an inter state water way. The ELL also includes water from such sources as may be declared by the National Assembly to be sources affecting more than one state.
11	National Guidelines and Standard for Environment pollution control of Nigeria (1991)	Pollution control in water course as part of the environment.
12	National Effluent Limitation Regulation 1991	Control of discharge of industrial waste and sewage into water courses.

Source: Federal Ministry of Water Resources, Legal and Regulatory Framework Theme Group (2001) (Adele, 2005)

Constitutionally, water resource is placed in the concurrent list of the 1999 constitution, involving all tiers of government and private sector. Matters bordering on international water rights and management come under the Exclusive Legislative List (eg, Nigeria is a signatory to many international regulations on water). This implies that issues bordering on international waters are strictly on the exclusive domain of the Federal Government. The basis for which Nigeria maintains' peaceful relationships with her riparian neighbors (eg, Chad and Niger Republics). Article 20 of the 1999 constitution

also grants power to states of the Federation as thus ″the state shall protect and improve the environment and safeguard the water, air and land, forest and wild life of Nigeria″. Prior to 1999, domestic water management had no position in the political decision making process. There were, however, selected but water related legislation at pre-independence colonial (eg, the water works Act of 1915; the minerals Act of 1917; and the public health Act of 1917), at post-colonial periods (eg, the oil in Navigable waters Act, 1968; the petroleum Act, 1969; land use Act, 1978; the National Effluent Limitation Regulation 1991; waste management regulation,1991, the ELA decree, No. 86 of 1992 water resources decree, No. 101 of 1993, among others).

Water management practices during these periods were more disjointed in approach (responding to agencies), with a number of vague and unrealistic assumptions (eg, Land use Act of 1978). More so, implementation mechanisms were stronger and reliance at pre-independent and colonial periods and very weak at post colonial period (Akpabio and Iniubong, 2013). This probably was so given the fact that the colonial masters were stronger and sensitive to water based and water-washed problems than the natives. Although the colonial masters attempted to put down some statutes to guide water management, the influence of customary laws were and are very strong among the natives both at pre-colonial and post-colonial periods. In northern Nigeria for instances, the strength of the customary laws in water resources management was, and is still very influential as most management modes were community centered through negotiation, consensus and customary right of access. This situation in the south is almost at the same angle of influential customary system, though at a lesser scale than the northern region because of contrasting hydrological extremes between the two regions (Akpabio and

Iniubong, 2013).

Generally and with regard to domestic water issues, statutory rights of management are embedded in the land use Act of 1978 and the water resources decree of 1993. While the water resources decree vested all the water within the territorial borders of Nigeria, the land use Acts give the right to groundwater exploitation within a given tenure boundary. The division between surface and groundwater has important implications with regard to the issue of ownership of water. Thus, in constitutional terms, surface water is primarily considered as river water. Here there is a partial riparian perspective to rights to water which is, essentially one of the rights to the waters of a flowing river inhering in, or as claimed by different users located along side (or in the vicinity) of that river. This can arise at the level of households, farms, communities, villagers or towns, but occurs in amore marked form at the level of politics or administrative units within a country (Lyer, 2003). Jurisdiction over dispute is vested in the government; explicitly, federal government in relation to inter-state disputes and implicitly, the states in the case of intra-state rivers.

In contrast, ownership of groundwater is linked to land ownership which, although subject to governmental; control and regulation is difficult to regulate legally, given obscure regulatory legislation and multiplicity of users. The linking of water and land rights, led to a situation of unmitigated tapping of ground water by individuals with means and capacities to do so, especially in the urban areas (Akpabio, 2006). And as such, has important implications bordering on the health aquifers and quality of water people drink.

The authority of the ministry for Waste Resources to control groundwater use

includes the power to define the time, places, and manner in which water may be taken or used; to fix the amount that may be taken in time of shortage; to prohibit the taking or use of water for health reasons; to regulate the construction and operation of boreholes; and finally to revoke a right to use or take water in the public interest. In the discharge of its statutory duties, the ministry is required to make proper provision for adequate supplies of suitable water for domestic, and domestic use; the watering of animals, irrigation, agricultural purposes as well as the generation of hydro-electric energy for navigation, fisheries and recreation. As defined in the Water Resources Decree (1993), the term ″domestic use″ means the use of water for drinking, washing, bathing, cooling, gardening, or for any other purposes

In any residential premises utilized for non profit motives; the term ″non-domestic use″ means the use of water from any water works for profit or gain; while the term ″public use″ refers to any domestic or agricultural use from any water works provided through any fountain, standpipe, valve tap or appliances used by the public.

The Federal Ministry of Water Resources (FMWR) is the main government agency responsible for management and control of water resources in Nigeria. An institutional framework comprising the River Basin Authorities and the National Water Resources Institute supports it. With the mission of harnessing underground and surface water resources for irrigation, and water supply for domestic and industrial use.

In year 2000, the Federal Government formulated a new National water supply and sanitation policy which was not subsumed under the National Policy on the Environment. This policy states inter alia that the “center-piece of Nigeria’s water supply and sanitation policy shall be the provision of sufficient potable water and adequate

sanitation to all Nigerians in an affordable and sustainable way through participatory investment by the three tiers of government, the private sector and the beneficiaries". The policy document goes further to set water supply improvement standard for urban, semi-urban and rural dwellers (Niyi and Felix, 2007).

With respect to the policy, separate water supply and sanitation considerations were made to match the three socio-economic profiles of the populations as follows:

a. Rural water supply guaranteed minimum level of service of 30liters per capita within 250meters of the community of 150 to 5000 people serving about 250-500 per water point.

b. Semi-urban (small towns) the water supply represent settlements with population of between 5000-20,000 with a fair measure of economic activity with minimum supply standard of 60liters per capita per day with reticulation and limited of full house connections as determined by the beneficiaries.

c. Urban water supply of 120liters per capita per day for urban areas with population greater than 20,000 inhabitants to be served by full reticulation and consumer premises connection.

2.4 Municipal Drinking Water Distribution System

The role of social infrastructure, such as safe drinking water in societal welfare and development, has long been recognized. According to Brown (2003), infrastructure is regarded as ″the systematic framework which under pins community's ability to fulfill its mission of providing a base for its citizen to be productive and to nurture social equity″. It is a kind of public trust of common wealth, upon which every citizen relies and draws for prospect and day to day socio economic opportunities. When it functions efficiently, the

whole society benefits and the resultant effect is manifested on the growth and development of the community. When it functions below expectations, everybody pays in kind and cash (Akinnla, 2000).

Access to adequate supplies of water is a universal component and indicator of human development in all territories and plays a fundamental role in resolving some of the manifold problems associated with poverty, disadvantage and exclusion. Thus, the second World Water Development Report (UNESCO, 2006) emphasizes that human development is inextricably linked with issues of water availability and management, in terms of proximity, quantity and quality. Therefore, there is need to increase globally the number of households connected to both water and sanitation networks.

Municipal drinking water distribution systems if properly managed are very efficient devices for delivering water to households. Under normal operating conditions, complex network of pumps, pipes and storage tanks provide high quality treated water to millions of households (Kenneth, Steven, and Robert, 2005).

In developing nations, disparities within metropolitan areas where access to water and sanitation services vary by geographical locations within the city and proximity to the pipe infrastructure, as well as household socioeconomic status is as a result of the rapid growth in urbanization. Urbanization growth can impede on pipe-borne water supply and as a result, diminishing access by households if the government is not giving sufficient attention as regards to funding for the expansion and maintenance of the existing piped network, nature of settlement (unplanned) record of consumers is inaccurate , and there are household being too poor to afford pipe-line extensions.

Several recent studies have affirmed that having a connection to the network is not

always synonymous with adequate access to water, in terms of quantity, quality and regularity. Good examples of this principle have been reported by Chikher (1995) in the context of Algiers, Allan-El Mansouri (1996) in Rabat-Sale, Zerah (1999) in Delhi and Darmame (2004) in Annman. These studies illustrate the impact that an intermittent supply of domestic water can have on households and the costs that are involved in strategies to cope with such problems centers on rapid urbanization growth. Thus, the lack of continuous supply, often serves to exacerbate socio-spatial inequalities in access to pipe-borne water.

2.5 Access to Pipe-Borne Water

It is important to recognize the significance of water and its fundamental contribution to sustainable development. Water has strong linkages to the three pillars of sustainable development, economic, social and environmental (Short, 2003).

The socio-economic significance of water at the household level is achieveable when there is proper and functioning pipe-borne water coverage. For instance, in most developing countries, women and young girls often spend hours collecting and carrying water, restricting their opportunities in productive activities due to poor pipe-borne water coverage (United Nations Development Programme, 2006). Water-borne diseases like gastrointestinal illness, vector-borne diseases and water-washed diseases are caused due to insufficient water for basic hygiene and unsafe water use (UNESCO Division of water Services, 2003). These water related diseases are among the most common causes of illness and death and these limit poverty reduction and economic growth in some of the developing countries such as India, Ethiopia and Indonesia(United Nations Development Programme, 2006).

Further, these put pressure on a country's economy due to cost productive labor time, increased health costs by the government and individuals and long run impacts of nutritional deficiencies. An expansion of pipe-borne water coverage, well regulated water supply and full sanitation would reduce the burden of water borne diseases (UNESCO Division of Water Services, 2003). Access to safe drinking water and improved water management practices has a great potential to reduce the vector borne diseases and gastrointestinal illness burden (World Health Organization, 1997). Further, it will reduce the time to secure water and leave more time for people to engage in productive activities.

Thus, the significance of water to sustainable development can be viewed from its enhancement of human healthcare, which are linked to better quality water, access to sanitation and improved hygiene, thus reducing human suffering, increasing productive capacities, reducing health care costs, improving the quality of life and expectancy of the people (Short, 2003; Hull, 2003).

2.6 Household Water Demand

Demand for a good or service is an economic function because it is influenced by an individual's budget, the price of the good, the price of other goods, and individual preferences. In terms of water supply, demand is defined as the quantity and quality of water householders will chose to consume at a given price. Price, as used here, signifies all valued resources' including an individual's time or labor given in exchange for service.

Water, just like other commodities, is a normal commodity whose demand is complementary, that is, the demand is for the purpose of providing support services

necessary for productive activities (ADB, 1999; Reinikka and Svensson, 2000; World Bank, 1994).

The determinants of the demand for water can be viewed from both the macro and micro level. According to Seleth and Diner (1993) at the macro level, the most dominant factors that determine the demand for water in any society are the scarcity and the cost of purchase, large geographic coverage , large number of residential buildings, population growth and density and the level of commercial and industrial activities(Menard and Clark, 2000; Diner, 1997; Clark et al., 2000).

At the micro level, often referred to as the household level, the most dominant factors are the socio-economic and demographic characteristics of the households (which include the education of the family members, their occupation, the size and composition of the family), the income of the household members, the quality of water, the reliability of supply, the existence of water and the household attitude towards the government that provide the water which, to most of them, is supposed to be free or subsidized (World Bank, 1993). Empirical studies on factors that affect the demand for residential water of households are discussed as follows:

2.6.1 Price Water

Despite heterogeneity in places and time periods studied, authors seem to agree on the inelasticity of water demanded in developing countries, with most estimates for households with a private connection in the range of -0.3 to -0.6. Espey and Show, (1997) report an average own-price elasticity of -0.51 from industrialized countries, suggesting that own-price elasticity for households in developed countries and for those in developing countries is in the same range. Only two studies from developing countries

find evidence of an elastic water demand. David and Inocencio (1998) use data from Metro Manila, Philippines, to estimate price elasticity for vended water at -2.1, and Rietveld,Ronwendal,Zwart, (2000) use data from Jakarta, Indonesia, to estimate price elasticity for piped water at -1.2.

2.6.2 Costs of Water Collection

Collection time and distance to the source are found to be significant drivers of household choice of water source(s) (Mu,Whittington,Briscoe, 1990). Using data from Ukunda, Kenya; Persson (2002), using data from metropolitan Cebu, Philippines) and to have a significant negative effective on the quantity of water collected from non tap sources (Mu et al., 1990; Strand and Walker 2005; Larson et al., 2006; Nauges and Strand Ana, Sonsouate and San Miguel (El Salvador) and Tegucigalpa (Honduras), Nauges and Strand (2007) estimate elasticity to price and hauling cost to be in the range of -0.4 to -0.7.

2.6.3 Quality of Water Service

Choice of water source is found to be driven by piped water pressure level (Madanat and Humplick, 1993) and by opinions about taste and reliability of water (Nauges and Van den Berg, 2009). If service from a piped connection is available for longer hours, water use by connected households increases (Nauges and Van den Berg, 2009). However, the magnitude of the effect is found to be quite small: an extra hour of piped water availability would increase per capita consumption of households.

In response to deficiencies in the water supply system, households may invest in coping strategies. That may incur fixed costs in the form of investments in alternate supply sources or storage facilities (Pattanayak,Yang,Whittington,Kumar, 2005). For

example, a household may buy a storage tank in order to mitigate problems with reliability and pressure that may be associated with private house connections, or, if the households relies on well water, pumping equipment may be purchased.

A demand equation that controls for household use of water storage tank or for tank capacity is featured in analyses by Crane (1994), Cheesman,Benneth,Son, (2008), and Nanges and Van den Berg (2009). Crane (1994) notes that use of a storage tank and its capacity could be endogenously determined in the demand model, as the investment decision regarding the tank and its capacity was certainly codetermined with the expected need for water.

2.6.4 Household Socioeconomic Characteristics

Income (or expenditure) and education level (or the ability of head of household to read and write) have been found to be positively associated with household choice of improved water source (Madanat and Humplick, 1993; Hindman Persson 2002; Larson, Minten,Razafindralambo,2006; Nanges and Strand 2007; Basani,Ishan,Reitlty, 2008; Nanges and Van den Berg, 2009). Mu et al., (1990),using data from Ukunda, Kenya, and Dakar, Senegal, respectively, found evidence that household composition affects choice of water source. In Ukunda (Kenya), households with more women were less likely to purchase from vendors (and more likely to rely on water from wells and kiosks), presumably because more people are available in the household unit to carry water. In Dakar (Senegal), the probability that household used water from the piped system increased if head of household was a widow (Nauges and Whittington, 2010).

In studies estimating water demand, income elasticity (or expenditure elasticity) is found to be quite low, most often in the range 0.1 to 0.3. Household size is found to be

significant in most cases. When the dependent variable is total household consumption, larger households are found to have larger water use. When the dependent variable is per capita consumption decreases with the member in the household (Nauges and Whittington, 2010). Using data from Buon Ma Thuot, Vietnam, Cheesman et al., (2008) found that doubling the number of percent residents in the household increased household consumption from piped network by approximately 50%.

2.7 Household Use of Domestic Water

In its guidelines for drinking water quality, WHO defines domestic water as being ″water″ used for all usual domestic purposes including drinking, bathing, and food preparation (WHO, 1993; 2002).This implies that the requirements with regard to the adequacy of water apply across all these uses and not solely in relation to drinking of water. The guidelines exclude some specific uses (For dialysis and contact lens cleaning) and elevated requirements for some particularly sensitive sub-populations (For instance the several immune-compromised).

In the ″Drawers of Water″ study on water use pattern in Africa,White,Bradely,White, (1972) suggested that three types of use could be defined in relation to normal domestic supply:

i. Drinking and cooking

ii. Hygiene

iii. Amenity use (for instance car washing, lawn watering etc)

In addition the Drawers of water supply, Thompson *et al.* (2001) suggested a forth category can be included of ″productive use″ which was of particular relevance to poor households in developing countries. Productive use of water includes uses such as

brewing, animal watering, construction and small scale horticulture.

2.8 Average Water Consumed By Household

Access to water is measured by the number of people who have reasonable means of getting an adequate amount of water that is safe for drinking, washing and essential households activities expressed as a percentage of the total population. It reflects the health of a country's people and the country's capacity to collect, clean and distribute water to consumers. World Health Organization (WHO), defines basic access to potable water as the availability of drinking water at least 20liters per day per person, a distance of not more than 1Km from the source to the house and a maximum time taken to collect round trip of 30minutes. The UNDP (2008) says the minimum absolute daily water need per person per day is 50liter (13.2gallons) which include: 5liters for drinking, 20liters for sanitation and hygiene, 15 liters for bathing and 10liters for preparing food.

The total domestic water needs in homes with piped water and inside sanitation is at least 115liters per head per day. The actual amount used may be greater depending on the ease and convenience of supply (Ayoade and Oyebande, 1983). The international consumption figures released by the 4th World Water Forum (2006), indicates that a person living in an urban area, uses an average of 250liters per day; but individual consumption varies widely around the globe (THD, 2007).

Wide differences exist between water consumption levels in industrialized and developing countries. Average per capita daily water consumption (l /c /d) for Switzerland, the least among industrialized countries, is 110l / c/ d, USA(668l/ c/d) and Japan (342l/ c/ d) (World Bank, 1997 as cited by Rosen and Vincent, 2009).

A household with pipe connection varies across places in developing countries.

For instances, 72liters per capita per day (lpcd) in a group of seven provincial towns in Cambodia (Basani et al., 2008), 88lcpd in Fianarantsoa, Madagascar (Larson et al., 2006), 120lcpd in Buon Ma Thuot, Vietnam (Cheesman et al., 2008), 130lcpd in Salatiga city, Indonesia (Rietveld et al., 2000) and 135lcpd in urban areas of medium cities from three districts in southwest Sri Lanka, namely Gampaha, Kalutara and Galke (Nauges and Van Berg, 2009). A survey conducted by London Economics (1999) on behalf of the ministry of works and housing (MWH) in major urban areas of Ghana to justify the introduction of private sector participation in urban water sector, they report an average of 105.1l/ c/ d for households with tap connections, 68.5l/ c/ d for those with yard tap. Acharya and Barbier (2002) report an average of 232litres per day per household or 24l/ c/ d for two wet land community in northern Nigeria, 34l/ c/ d in the urban settlement of Kaduna (KSWB, 2006).

Households without a piped connection have lower water consumption in general, with important differences depending on the source on which they rely. Households with a private well usually have a higher consumption level than households relying on public sources (Nanges and Whittington, 2010). In South Ana, Sonsonate and San Miguel(El Salvador) and Tegucigalpa (Honduras), non connected households relying on public taps outside the home consume on average 25lpcd whereas households relying on a private well consume on average 110lpcd (Nauges and Strand, 2007). In Jakarta (Indonesia) non connected households that buy water from resellers purchase an average 27lpcd whereas households that buy water from vendors purchase 15lpcd on average (Crane, 1994).

2.9 Water Scarcity and its Associate Problems

Water scarcity is defined as the point at which the aggregate impact of all users

impinges on the supply of water under prevailing institutional arrangement to the extent that the demand by all sectors, including the environment cannot be satisfied fully. Water scarcity is a relative concept and can occur at any level of supply or demand. Scarcity may be a social construct (a product of affluence, expectations and customary behavior) or the consequence of altered supply patterns-steaming from climatic change for example (UN, 2011).

Water scarcity situation is severe in developing countries with an estimate of about 1.2billion people in developing countries without access to ″to safe water″ (WHO, 1998).The World Commission for Water (2000) estimates that more than 1billion people in developing countries do not have access to clean water whilst 2billion people lack adequate sanitation. In the case of Sub-Saharan Africa, Rosen and Vincent (1999) estimates that about 67% of the rural population (about 250million people) lack safe and accessible water supply whilst 81% do not have access to sanitation facilities. 20% of the urban population (322million people) do not have access to water supply whilst 37% lack access to sanitation facilities (WHO/ UNICEF and JMP, 2010).

In an attempt to enhance water security, houses devices coping strategies that could enable them cope with water scarcity. And in most situations, the coping strategies are normally associated with some sort of costs, costs that can be of detriment to their health, time and socioeconomic activities.

2.9.1 Time Costs of Collecting Water

The amount of time spent by householders collecting water in order to secure water for the household is an evidence of water scarcity. Mehretu and Mutambirwa (1992) observe that in Zimbabwe, women spend approximately 91% of total time

devoted for household chores to collect water. In Madagascar, Beven, Collier, and Gunning (1989) indicates that women aged 20-29 spend 56minutes daily fetching water; age 30-49 (69minutes); over 50years (77minutes). In a village in Mozambique, Cairncross and Cliff (1987) indicates that about 5hours is devoted to water collection (return trip) from a public standpipe located 4kilometrs (average of 131minutes per carrier per day) whilst a similar source located 300meters takes an average of 25minutes per carrier per day. Women in Oyo state, Nigeria spend about 58minutes daily collecting water at an average distance of 537meters (Sangodoyin, 1992).

When drinking water is readily available at some reasonable distance, households saves time. Such substantial amount of time save could improve the welfare through time and energy availability for education, high-status work and civic activities (WHO, 1995). Studies reviewed by Rosen and Vincent (1999) suggest that time saved by women is channeled into housework (for example, cooking and hygiene), rest, social and personal activities. Others allocated time saved to having quality time with the family and as well engaging themselves into income generating activities (Ariyabandu, 2001).

2.9.2 Health and Energy Costs of Collecting Water

Health problems and energy expenditure are costs identified with water collection. Dufaut (1998) mention vertebral column injuries among adults, scoliosis among children, and limitation of inflexion and arthritis (degenerative rhenumatism) as common injuries. Estimates put energy costs of water collection between 8-10% of daily calories intake in Sub-Saharan Africa (Rosen and Vincent, 1999). For example, Mehretu and Mutambirwa (1992) observe that in Chiduku Zimbabwe, an average of 217 calories per day is expanded by each water carrier, representing roughly 10% of the carriers' daily

intake of calories.

Makule (1997) noted that women and girls in Arusha, Tanzania expand about 260calories carrying a container of 20liter capacity 1kilometer away from home and this energy expenditure represents about 10% of their daily calorie intake. An earlier study conducted in 12 rural communities in Kenya, Tanzania and Uganda by White, Bradely and White (1972) show that on the average, water carriers utilize 240calories daily in water fetching. Given an average calorie intake of 2840 calories for Eastern Africa, this value amount to about 8.5% of the carrier's daily calorie intake.

2.10 Problems Associated With Water Scarcity

Scarcity of domestic water has resulted in high dependency on supplementary sources such as hand dug wells, boreholes, water vendors. Abaje, Ishaya, and Ati (2009), observed that residents of Jamaa, in Kaduna state resorted to hand dug wells, boreholes, water vendors, and even streams as a result of water scarcity. Those that bought water from water vendors complained of high costs of water especially in a large family that depend on water vendors.

Abaje, Ishaya, and Ati (2009) revealed that there is a significant relationship between the sources of water supply and incidences of water borne diseases. That is to say, inaccessibility to pipe borne water supply may be the major factor of the various water borne diseases arising from contaminated water and poor sanitation practices. The health consequences of water scarcity include diarrhea diseases such as cholera, typhoid fever, salmonellosis, other gastrointestinal viruses, and dysentery.

Generally and with regard to domestic water issues, statutory rights of management are embedded in the land use Act of 1978 and the water resources decree of

1993. While the water resources decree vested all the water within the territorial borders of Nigeria, the land use Acts give the right to groundwater exploitation within a given tenure boundary. The division between surface and groundwater has important implications with regard to the issue of ownership of water. Thus, in constitutional terms, surface water is primarily considered as river water. Here there is a partial riparian perspective to rights to water which is, essentially one of the rights to the waters of a flowing river inhering, or as claimed by different users located along side (or in the vicinity) of that river. This can arise at the level of households, farms, communities, villagers or towns, but occurs in amore marked form at the level of politics or administrative units within a country (Lyer, 2003). Jurisdiction over dispute is vested in the government; explicitly, federal government in relation to inter-state disputes and implicitly, the states in the case of intra-state rivers.

CHAPTER THREE

STUDY AREA

3.1 Location

Kaduna South Local Government area (LGA) is one of the 23 LGA'S of Kaduna state. It is surrounded by Kaduna North LGA to the north, Igabi LGA to the west and Chikun LGA to the south and east. It is located approximately between Latitude 9^0 54′ and 10^0 29′ N and between Longitude 6^0 59′ E and 8^0 09′ E as shown in fig.3. 2.

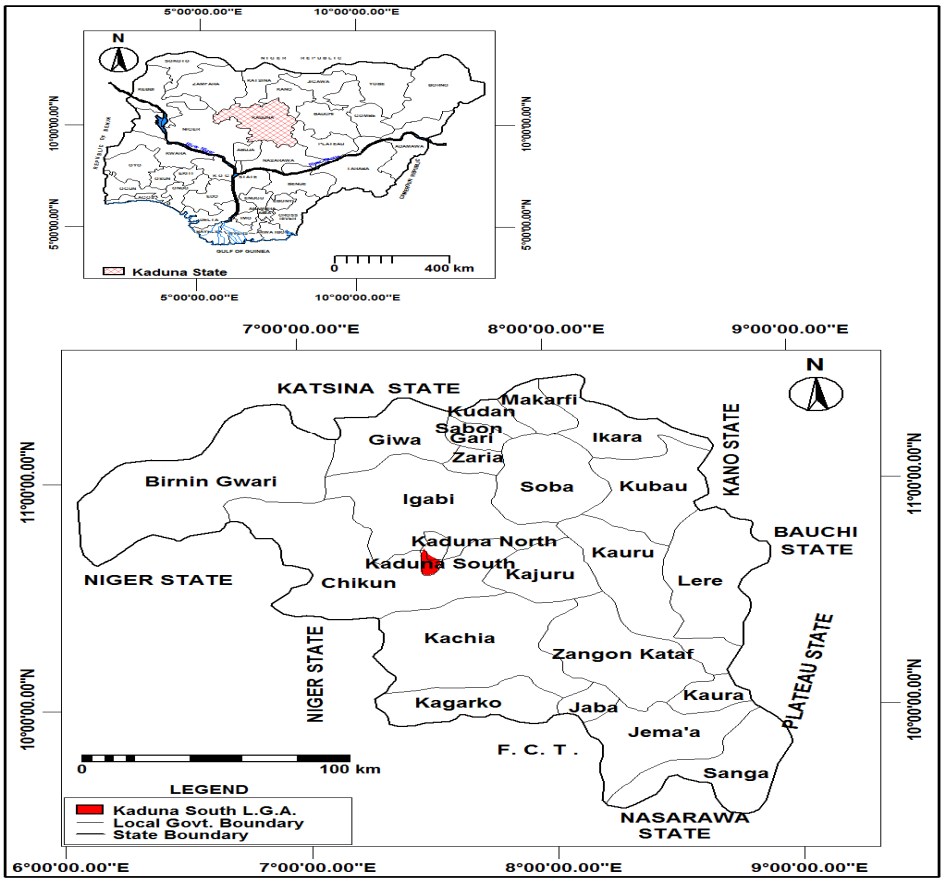

Fig. 3.1: Nigeria showing Kaduna state and Kaduna State showing study area
Source: Adapted from Administrative map of Nigeria

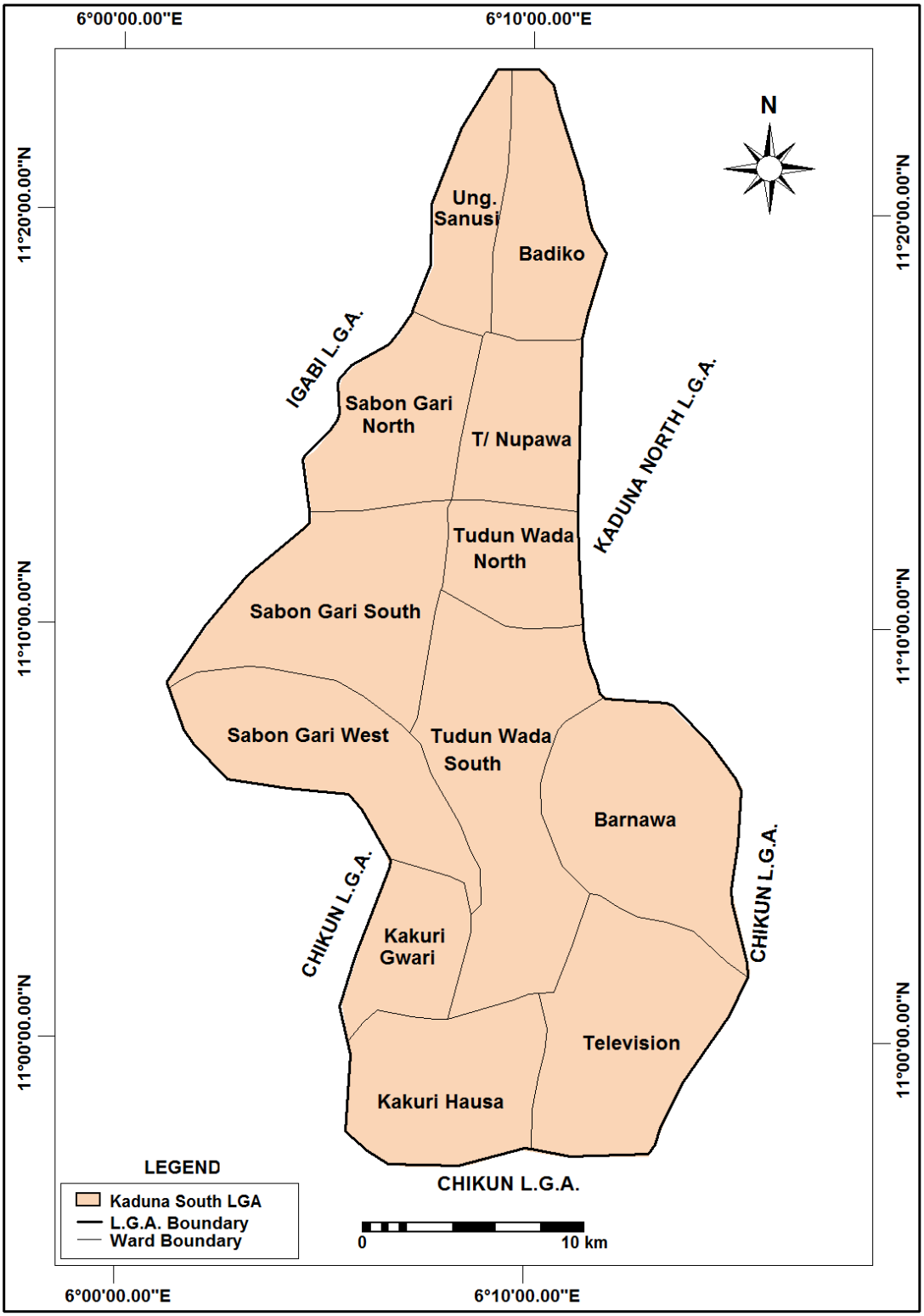

Fig. 3.2 : Kaduna South Local Govt. Area Showing Wards

Source : Adapted from Political Map of Kaduna South L.G.A.

3.2 Physical Setting

3.2.1 Climate

The climate of Kaduna metropolis is the same as obtained in the whole Kaduna state. The dry season last from November to March (5 Months). The cold-dry season accompany with dust laden harmattant wind blows from the north-east during this period. The rainy season lasts from April to October, (about 7 months) with the peak in July/August. The average annual rainfall is about 60.0mm. (NEST, 1991 in Ali 2004).

The rainy season is much longer in Kaduna as much longer in Kaduna as compared to the extreme northern states due to their nearnest to Saharan desert neighboring countries.

Temperatures are high throughout the year with the highest in March/April (about 38:6^{0}C). the lowest temperature is in January (about 20.2^{0}C). relative humidity in the dry season is below 10% in the afternoon and 30% at dawn. During the rainy season, the relative humidity can be over 70% in midday and 955 at dawn (NEST, 1991 in Ali 2004).

3.2.2 Vegetation

The vegetation is of the guinea savanna type with tall grass, scattered trees and gallery forests along river courses. Example of trees found in shea butter Butyrapenniu parkii, tamarind, tamarindus indica (Ali, 2004) activities of man have greatly affected the vegetation of Kaduna city. These activities include bush burning, cultivation, grazing, fuel, wood cutting, urbanization and industrial activities. Vegetation communities are associated with distinct ecological sites with particular regard to the nature of the soils.

3.2.3 Geology and Relief

Kaduna lies within the northern Nigeria Basement complex rocks which were 'emplaced' during the 'Erbuniun to Pan African Orogenic cycle about 1900 +250-550 years'. The rock is constituted of granite, gneiss, migmatite gneiss complex, schists are also sound (Geological survey, 1988, in Ali, 2004).

The Kaduna rocks are made up of granite referred to as older granites. Quartz and dolerite are further classified under igneous rocks while migmatite gneiss complex are grouped under metamorphic rocks. The quartz occurs as veins while dolerite occurs as dikes trending in a north-south fashion. (Geological survey, 1988 in Ali, 2004).

Sedimentary rocks occur as loose sediments or superficial deposits of clay, literate and alluvium restricted within flood plains or stream courses. These units of formation were deposited in recent times as a result the decomposition of the parent rock material. Furthermore, these units are widespread within Kaduna metropolis especially laterite and it forms the top soil useful for agricultural purposes (Federal Geological Survey, 1988 in Ali, 2004).

The structures sound associated with these rocks are faults, lineation, foliation and numerous structures left as relics of metamorphism. The faults were observed to follow a NE-SSW trend as well as lineation. These suggest that the fault plane may be ascribed to the weak failed arm of the 'RRR – triple junction rifting of the cretaceous times' (Federal Geological Survey, 1988 in Ali, 2004).

The southern parts of Kaduna metropolis is occupied by much of the ferruginous soils. These soils are deeply weathered and are usually reddish in color. They contain a lot of stones. The soil of southern parts of Kaduna metropolis falls into the following

categories for the USDA soils taxonomy classification system of Kaduna state:

i. Afisols

ii. Utisols

iii. Entisol

iv. Inceptols (Keay, 1959 in Ali, 2004)

3.2.4 Drainage

The entire Kaduna metropolis is drain by River Kaduna with its source from the highlands of Jos Plateau. The River Kaduna takes the form of the NNE-SSW trend of the major fault plan, while numerous subsequent streams takes the form of the basement fractures. It is thus believed that the river may be associated with one of the tectonic episodes (Federal Geological Survey, 1988, in Ali 2004). Other river that flows into River Kaduna in the study area are River Barnawa-Narayi, River Kakuri, River Makera and River Rafin Mallam. (Ali, 2004).

3.3 Human Setting

3.3.1 People and Culture

The Kaduna south local government area comprises of 12 wards. These include Tudun Nupawa, Tudun Wada North, Tudun Wada South, Sabon Gari North, Sabon Gari South, Sabon Gari West, Barnawa, Kakuri, Gwari, Kakuri Hausa, Television, Ungwan Sanusi, Badiko.

The Kaduna south Local government area with it's headquartering at Makera has the advantage of not being inhabited by any of the major ethnic groups. Available evidence shows that, the town is inhabited by over 200 different ethnic groups, the

inhabitants are a mix grill with Hausa, Yoruba, Igbo, Fulani, Gwari, Ikulu, Kadara, Bajju, Jaba, Iibio, Ijaw, Angas, Baron, Tiv, Idoma, Igala, and host other ethnic groups. All settled as a result of administrative, industrial and extensive trading activities. Virtually, all ethnic groups in Nigeria can be found here.

Christianity and Islam are the major religious groups in the town. The third important group is the traditional religion. This group has however, continued to suffer a major depletion in the number of its adherents since the advent of Christianity.

Hausa language is the dominant indigenous medium of communication after English which is official lingua franca of the country.

According to 2006 census, the Kaduna South local government area has a total population of about 402,390. This is attributable to a relatively high and stable birth rate combined with a steady decreasing death rate. In addition, rural-urban migration is, increasingly playing a significant part in the overlal growth of the population. There is a continuous influx of young school leavers into the town to look for jobs.

The concentration of federal and state institution in Kaduna has created government employment opportunities in Kaduna which act as magnets attracting people from far and near. As people move in many located near their next of kin giving leverage for its growth and continued prominence (Mamman, 1992 in Ali, 2004).

Trading in items such as leather products, wood carvings, kitchen utensils, household electronics hand woven cloths, ceramics, foodstuffs, vegetables and fruits to high quality textile materials became their occupation. Others who were professionals such as tailors, carpenters, bricklayers and barbers also came to offer their services to the people. They came from all tribes and tongues and they include the Ibos, Yoruba's,

Nupes and Hausas who took advantages of the market provided by the large government staff, railway workers, military men and commercial staff of the trading companies. In the early years, government also gave numerous incentives to encourage immigrants into Kaduna in attempt to secure enough labour to clear the surrounding bush and thereby free it from mosquitoes, tsetse fly and other dangerous creeping reptiles (Maman, 1992 in Ali 2004).

Two types of families can be distinguished in Kaduna south. These are the nuclear and the extended families. The nuclear family is based on the husband-wife or wives and their children. The extended family, in contrast, consists of two or more nuclear families joined through an extension of the parent-child relationship rather than the husband-wife relationship. An example of such married sons, their wives and the children of the later. These three generations live under the same roof or in a cluster of adjacent buildings.

Marriage is very prevalent among Nigerian adults of all ethnic groups. Thee types of marriages exists in the Southern part of Kaduna metropolis just as in other towns in Nigeria. The religious (Christian/Muslim) marriages which normally takes place in the church or mosques civil marriages and traditional marriages. In this society, marriage is generally universal (Ali, 2004).

3.3.2 Economy of Kaduna South LGA

The activities in the Kaduna South Local Government area reflect the commercial, service, administrative, industrial transport and professional needs of the state and northern Nigeria.

The 1956 capital territory law created the limits of the present day city of Kaduna and set in motion, the rapid and dynamic physical, economic and social transformation of

the town. This led to the establishment of modern infrastructural facilities such as electric power supply, pipe borne water, good roads, several banks telephone services and an international airport. These modern infrastructure were the backbone of the establishment of at least seven textiles mills, breweries, bottling companies, flour mills and a motor assembly plant just, to mention a few. Motor assembly plant just, to mention a few.

These are attracting many, especially the youth, to seek employment and share in the economic development of the town (Ali, 2004).

The Kaduna south local government area has achieve development; acquired more structures particularly manufacturing and industrial complexes that have today dominated the large industrial estates of Kakuri, Makera, nasarawa, Ungwan Romi, and more recently Kudenda. These actions has encourage the constant transformation of the existing levels of commerce and trade, social services, utilities and facilities and brought about the mixing that followed the choice of residential area. The combination of these gave some kind of initial impetus of status, class religion, ethnicity and development status of the town (Ali, 2004).

As a result of the its position (industrial) and fast rate of economic growth, Kaduna South local government area became attractive to both national and international business men and industrialists. The area witnessed a boom in population and commercial activities leading to the creation of new wards such as kakuri Kansa, Kakuri makera, Kakuri Gwari, Sabon gari north, sabon gari south, tudun wada north and tudun wada south.

The railway serves as a vehicle for economic and commercial tool. The railways lines from the East and west meet have. Hence, the name Kaduna function, the railway

became most important as the surrounding rural population could not produce the food required to sustain the increase influx. Therefore, the railway became an important mode of transporting food, industrial and agricultural products both into and out of Kaduna to the coast (Ali, 2004).

3.3.3 Land use Pattern in Kaduna South LGA

Residential land uses occupy the largest amount of space (4,036.6 hectares) of land. This consists of 1,392.4, 579.4 and 1353.0 of low, medium and high residential density neighborhoods respectively.

The residential areas in the Kaduna South Local Government Area have a unique and distinct spatial neighborhood pattern. The neighborhoods are broadly recognized as Sabon Gari, Government Residential Area (GRA). Tudun Nupawa, Tudun wada, Kabala, Barnawa, Narayi, Ungwan Sunday, television, Kakuri and Nasarawa neighborhoods. The GRA is a low 2-5 houses per hectare neighborhoods which was formerly exclusively reserved for the Europeans, the neighborhoods of Sabon Gari, Barnawa and Tudun Wada Manifest patterns of carefully planned and developed neighborhoods without any traditional village core. The other neighborhoods manifest a traditional village high density house structure.

The roads and agricultural land uses cut across all categories of slopes. However, agricultural use is least in the southern part of Kaduna metropolis because the area is designed for industries and its associated road linkages. Gulling pose the greatest threat to the survival of the building and currently, the most active in the areas where ground has been severely seared.

CHAPTER FOUR:

METHOD OF RESEARCH

4.1 Introduction

A survey research design was employed in this study. This is because the data collected was through questionnaire administration.

4.1.1 Types of Data Required

The type of data used for this study is primary data obtained via questionnaires and interviews. The questionnaire sought information about access to pipe borne water in terms of quantity, quality adequacy regularity and cost from the householders.

4.1.2 Sources of Data

The study was based on two sources of data: Primary and Secondary source

4.1.3 Sampling Techniques and Sample Size

Purposive sampling method was employed to select the respondents. Five wards were randomly selected out of the 15 wards and a total of 300 copies of questionnaire were administered to the five wards randomly selected (60 in each ward). The sampled wards include Sabon Gari North, Kakuri Gwari, Television, Kakuri Hausa and Tudun Wada South.

The population size for this study was 300.This was derived by 0.07% of the total population of 402,390.This was sizeable enough to provide the required information needed in the study area.

An open and closed questionnaire was structured to obtained information concerning access to pipe-borne water in the study area. In most cases questions were administered

in direct face to face interaction or interview by the researcher or the field assistants. Those who could read and write were allowed to fill and returned the questionnaire

4.3.4 Secondary Source

The existing official and unofficial statistics from both national and international publications, including articles, journals, book, conference papers, Thesis, Dissertations, were used. Downloaded online articles and reports of conferences of national and international agencies from several web sites were used. Data from National Population Commission (NPC) (2006) were obtained concerning the population of the study area. Some of these information provided answers to the several questions in this research.

4.1.5 Method of Data Analysis

The responses from the answered questionnaire were coded. Descriptive statistics were used. This involved the use of frequency, percentages and charts. Pattern that exists between two or more categorical variables was revealed by cross tabulation.

CHAPTER FIVE:

PRESENTATION AND ANALYSES OF DATA

5.1 Introduction

This chapter presents the analysis of data and interpretation of findings based on the research questions as indicated in chapter one of this study. The analysis is divided into five sections: the first section deals with the respondents' background, while section two, three, four, and five, covers the research questions respectively.

Three hundred (300) questionnaires were originally distributed to household heads, out of which 282 household heads filled correctly and returned the copies of questionnaire given to them. Seven (7) copies were wrongly filled and unusable, eleven (11) were not returned. Therefore, the analysis was based on the 282 correctly filled and returned questionnaire.

5.2 Background of Respondents

This section provides a general overview of the respondents' background of the study area. The key issues analyzed are: Age, gender, marital status, education, occupation, income level and household size.

Table 5.1: Description of the Respondents' Background

Respondent Background	Frequencies	Percentage
Age range(yrs)		
18-23	10	3.5
24-29	35	12.4
30-35	77	27.3
36-41	101	35.8
42 and above	59	20.9
TOTAL	**282**	**100**
Gender		
male	189	67.0
female	93	33.0
TOTAL	**282**	**100**
Marital Status		
Single	68	24.1
Married	158	56.0
Divorce	31	11.0
Widow/widower	25	8.9
TOTAL	**282**	**100**
Education		
Primary	79	28.0
Secondary	125	44.3
Tertiary	61	21.6
No formal education	17	6.0
TOTAL	**282**	**100**
Occupation		
Civil servant	39	13.8
Teacher	57	20.2
Trader	97	34.4
Bus/taxi/okada driver	84	29.8
Farmer	5	1.8
Unemployed	0	0.0
TOTAL	**282**	**100**
Income level		
High	15 50	5.3
Average	217	17.7
Low **TOTAL**	**282**	77.0
		100
Household size		
1-3	49	17.4
4-6	106	37.6
7-9	80	28.4
10-12	28	9.9
13-15	19	6.7
TOTAL	**282**	**100**

Source: Field survey (2013)

From Table 5.1, there is an uneven distribution of ages across the age groups with a majority 101(35.8%) of the respondents within the age range of 36-41years; 77(27.3%) of the respondents were within the age range of 30-35years; 59(20.9%) of the respondents were 42years and above, 35(12.4%) of the respondents were within the age range of 24-29years; while only 10(3.5%) of the respondents were within 18-23years.

On the distribution of respondents based on gender, majority 189(67.0%) of the respondents were male, while 93(33.0%) of the respondents were female. This revealed that majority of the bread winners were male.

With respect to the marital status of the respondents, majority 158(56.0%) of the respondents were married, 68(24.1%) of the respondents were single, 31(11.0%) of the respondents were divorced, while 25(8.9%) of the respondents were either widows or widowers. With respect to the educational level attained by the respondents, majority 125(44.3%) of the respondents had only secondary education, 79(28.0%) of the respondents had only primary secondary education, 61(21.6%) of the respondents had up to tertiary education, while only 17(6.0%) of the respondents had no formal education. This revealed that majority of the household heads had formal education and as such, perception of water quality and use would not be much a problem in the study area.

On the distribution of respondents based on occupation, none of the respondents were unemployed that is all of the respondents had something doing for a living. With majority 97(34.4%) of the respondents were traders, 84(29.8%) of the respondents were either a bus or taxi or an Okadar operators, 57(20.2%) of the respondents were teachers, while 39(13.8%) of the respondents were civil servants.

On the distribution of the respondents based on income level, majority 217(77.0%) of the respondents were low income earners, 50(17.7%) of the respondents were average income earners, while only 15(5.3%) were high income earners. This revealed that the household heads in the study area were generally low income earners.

On the distribution of respondents based on household sizes, majority 106(37.6%) of the households comprises of 4-6persons, 80(28.4%) of the households comprises of 7-9persons, 49(17.4%) of the households comprises of 1-3persons, 28(9.9%) of the households comprises of 10-12persons, while 19(6.7%) of the households comprises of 13-15persons. This revealed that a greater percentage of households in the study area are large.

Findings on Table 5.1 revealed that majority of the households head were male, and the socioeconomic status of the households head were low. This could be attributed to the fact that a greater percentage of the households head were primary and secondary school certificate holders. With which one can barely get a job that could attract good salary when considering the situation of the Nigerian economy. This fact is supported with the high level of low income earners in the study area.

5.3 Presence of pipe lines facilities for water supply

Issues discussed under this section includes the presence of taps in every house, the frequent flow of water from these taps, costs incurred by households source for water through an alternative source, and the management practices on pipe lines facilities by water board officials in the study area.

5.3.1 Presence of Taps in Every Household

This diagram shows the presence of pipe-borne facilities in every household of Kaduna South LGA

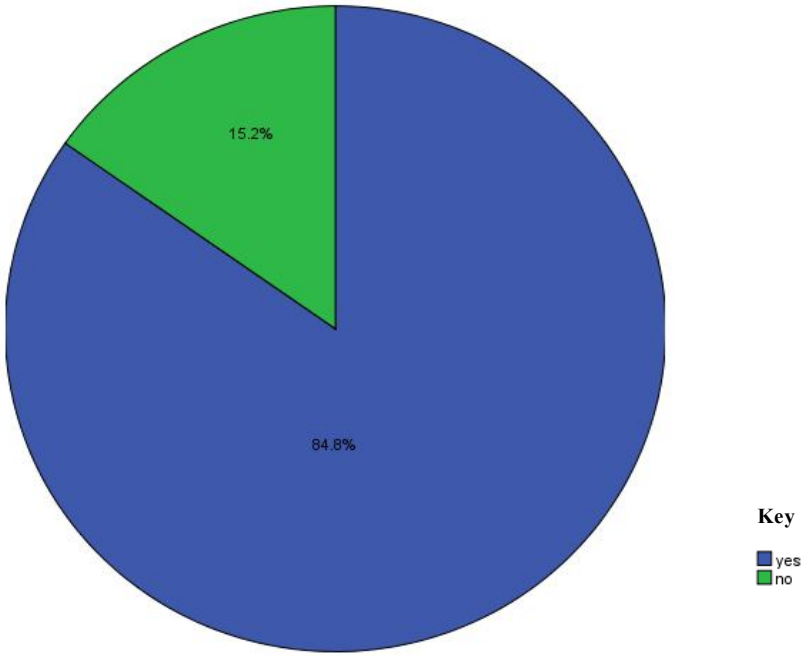

Figure 5.1: **Presence of pipe lines in household in Kaduna South** L.G.A.

Source: field survey

As seen in Figure 5.1, 84.8% of the households have taps, while 15.2% of the households do not have taps. This therefore, revealed that there is a significant coverage of pipe borne facilities in the study area.

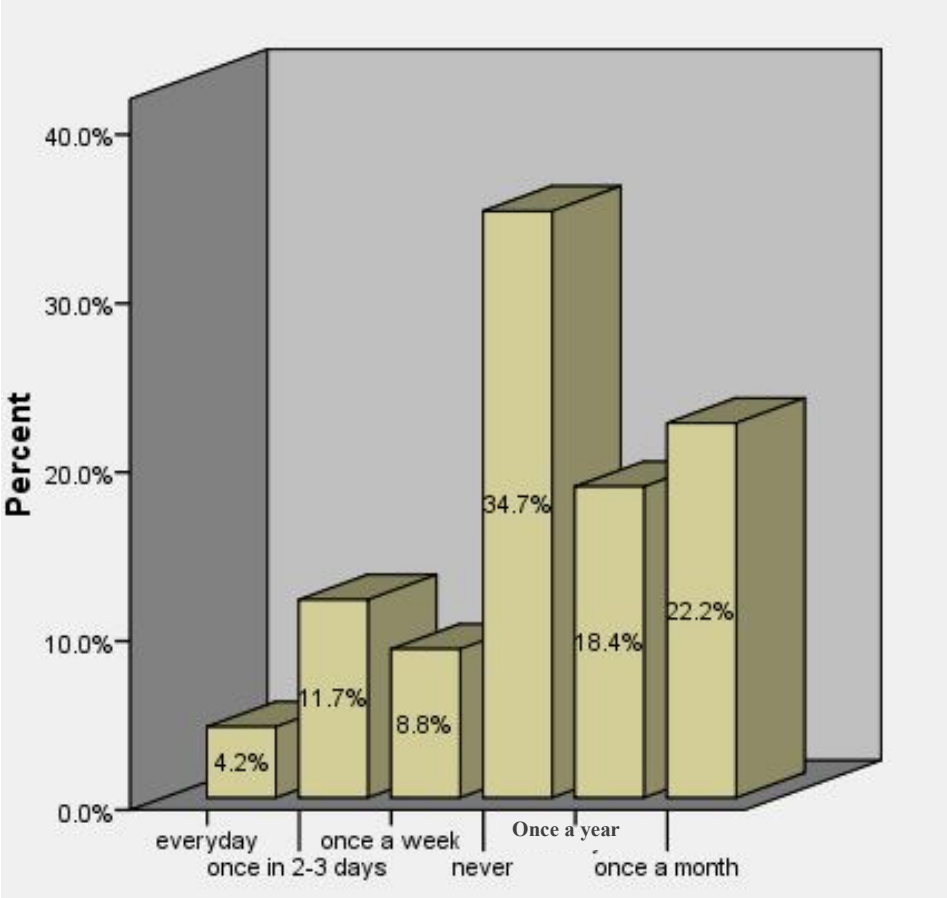

Figure 5.2: Frequency of flow of Taps in households in Kaduna South L.G.A.
Source: Field survey (2013)

From Figure 5.2, it can be seen that there is a downward trend in the flow of water from the taps: 4.2% of them run every day, 8.8% run once a week, 11.7% run once in 2-3days, 18.4% run once a year, 22.2% of these taps run once a month, while 34.7% of these taps has never run as attested by the respondents.

5.3.2 Costs Incurred by Households as a Result of Irregular Pipe Borne Water Supply

Householders had resorted to either buying of water from water vendors, open well, borehole or trekking to distant neighborhoods to fetch, as a result of irregular pipe borne water supply. In the course of sourcing for alternative water supply, majority 80.8% of the households had to trek, which of course involved household members of which women and children were the majority 261(92.6%), while only 21(7.4%) were men. The information can be seen summarized Figure 5.3 and 5.4.

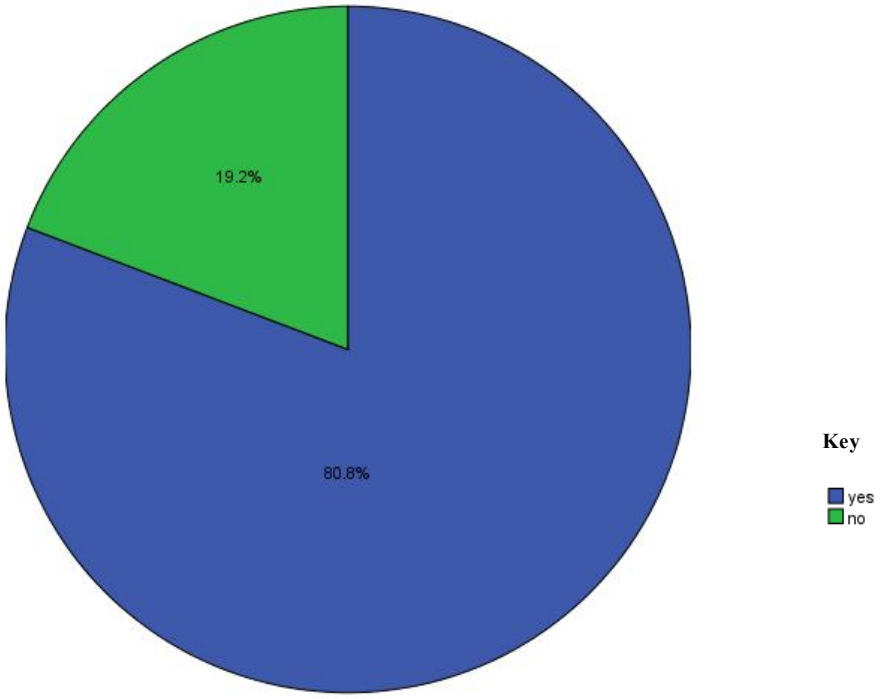

Figure 5.3: Householders that trekked sourcing for water in Kaduna South L.G.A.
Source: Field survey (2013)

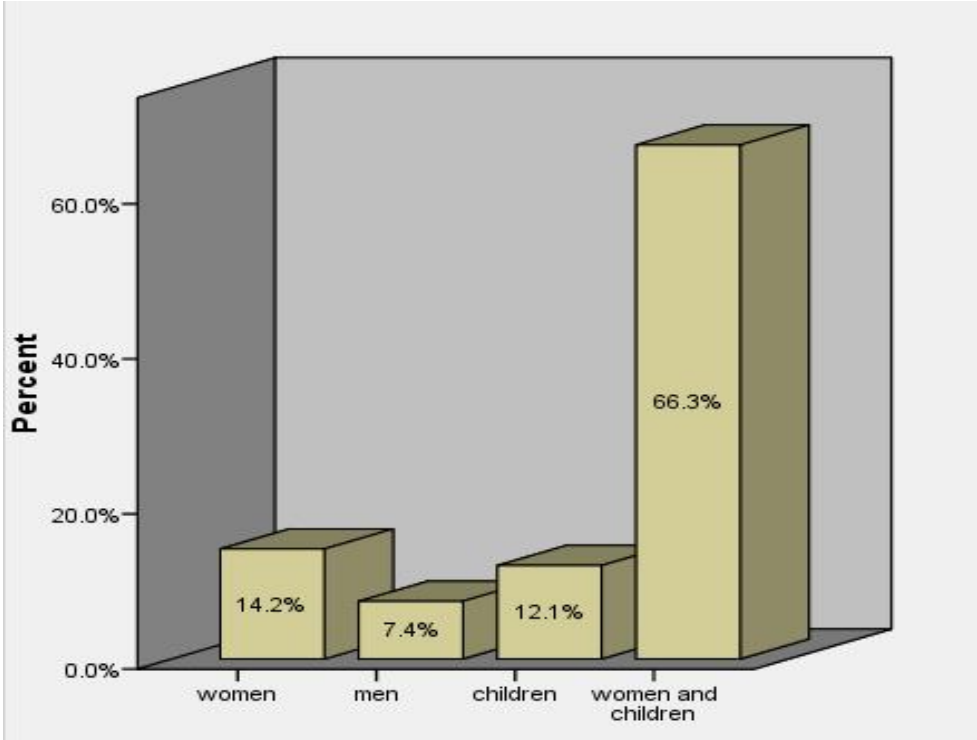

Figure 5.4: Household Involved in Collecting Water in Kaduna South L.G.A.
Source: Field survey (2013)

As household members trekked to alternative water source in collecting water and certain distance were found trekked by the household members.

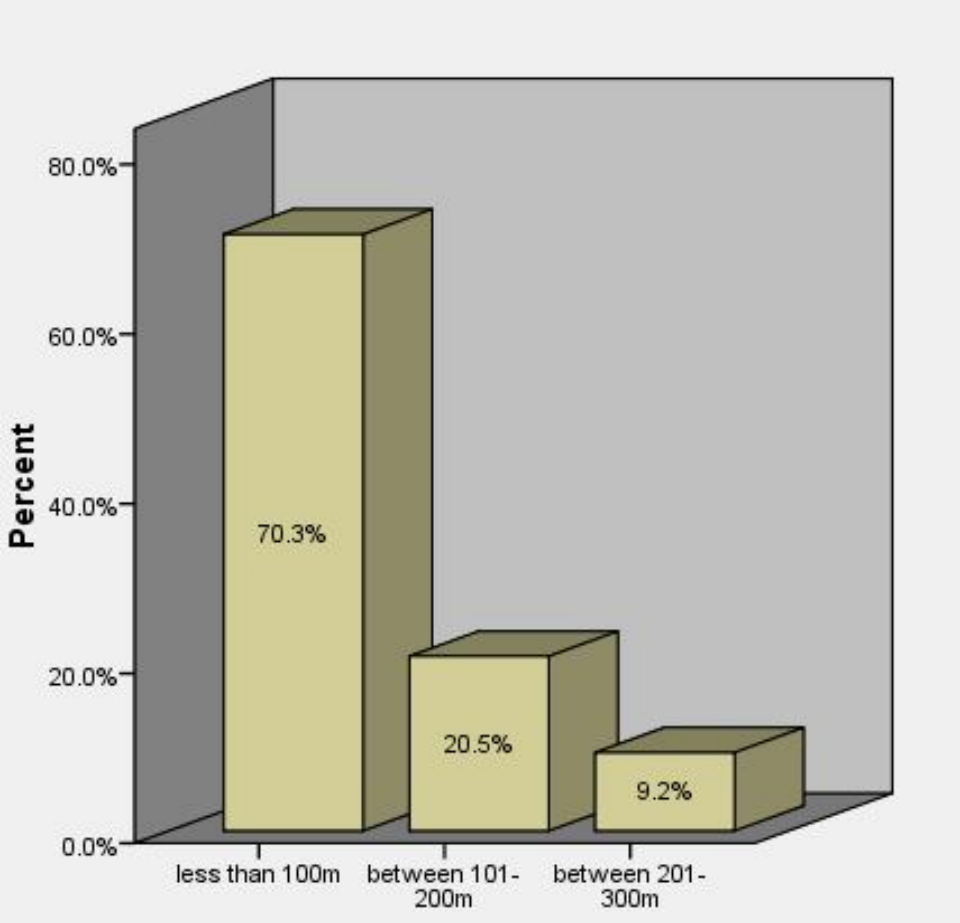

Figure 5.5: Range of Distance to Alternative Water Sources in Kaduna South L.G.A.
Source: Field survey (2013)

As shown in Figure 5.5, majority 182(70.3%) of the household members trekked a distance less than 100m, 83(20.5%) of the household members trekked a distance between 101-200m, while only 17(9.2%) of the household members trekked a distance between 201-300m.

5.3.3 Management Practices on pipe borne water distribution system by Water Board Officials

Issues as regards to maintenance culture of pipe borne water distribution system and the state of pipe lines were discussed.

Table 5.2: State of pipe borne water distribution system.

Variable		**Frequency**	**Percentage**
Water s Board officials come to Replace old pipelines With new ones	Always	17	6.0
	Not always	58	20.6
	Never	207	73.4
TOTAL		**282**	**100**
Most of the piping Systems distributing of Water are old	Strongly agreed	145	51.4
	Agreed	98	34.8
	Disagreed	29	10.3
	Strongly disagreed	10	3.5
TOTAL		**282**	**100**

Source: Field survey (2013)

From Table 5.2, there was a downward trend on how frequent water board officials come to replace old pipe lines with new ones. The table reveals that majority 207(73.4%) of the respondents indicated that water board officials never came to replace old pipelines with new once, 58(20.6%) of the respondents indicated that water board officials hardly came to replace old pipe lines with new once, while 17(6.0%) of the respondents indicated that water board officials always come to replace old pipe lines

with new ones. This information was strongly supported by the response mode with respect to how old pipe line distributions were. The table shows that 243(86.2%) of the respondents agreed that most of the pipelines systems distributing water were old, while 39(13.8%) of the respondents disagreed that most of the piping systems distributing water were old.

5.4 Average Quantity of Water Required in the Area

Water use by households ranges from drinking, cooking, washing of cloths, and for sanitary purposes. The per capita daily water consumption was obtained by adding the total daily water consumed and dividing it by the number of persons currently living in the family. This yielded an average quantity of 39.76liters of water per day. Therefore, the daily average quantity of water demanded in the study area will be 39.76 × 455755 liters per day, which is equal to 18,120,818.8 liters per day.

5.5 Quality of Water Consumed in the Area

Under this section, water security, and source of water that was readily available to the households was look into so as to ascertain whether pipe borne water supply in the study area was readily available and satisfied household consumption.

From Figure 5.6, majority 89.7% of the households' drinking water in the study area were from sources a number of sources, thus: borehole 48.9%, sachet/bottle water 32.6%, and open well 8.2% other than pipe borne 10.3%.

5.5.1 Source of Water Readily Available For Domestic Use in Kaduna South LGA

The pie chart below shows the alternative sources of water use by the household in Kaduna South LGA.

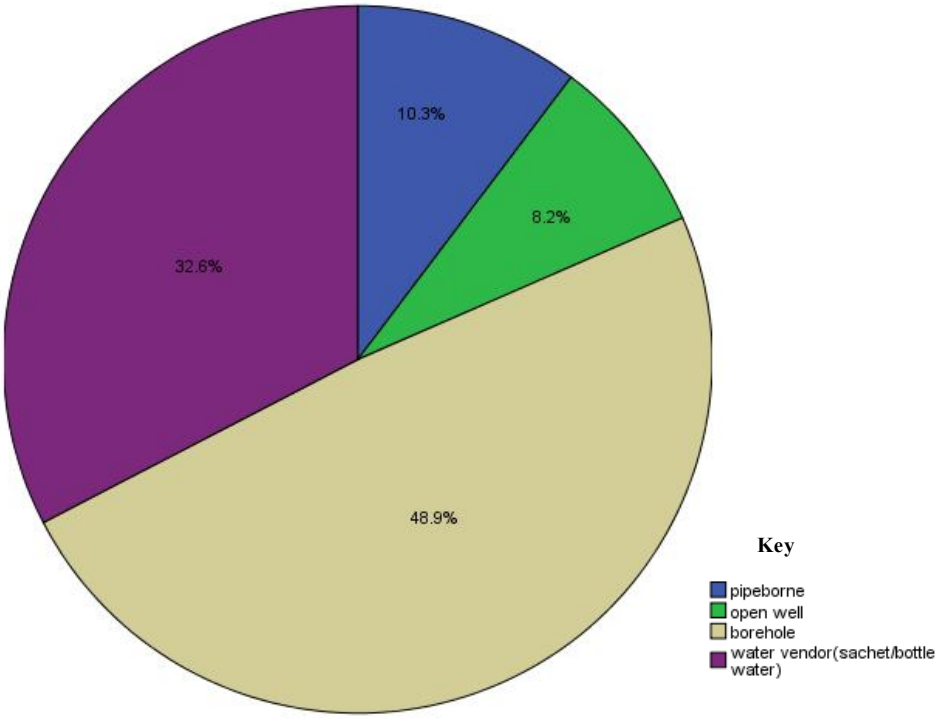

Figure 5.6: Source of Drinking Water in Kaduna South LGA
Source: field survey (2013)

From Figure 5.7, majority (96.5%) of the household water for washing clothes in the study area were from the following sources open well 54.6%, borehole 35.5%, and water vendor 6.4% other than pipe borne water 3.5%.

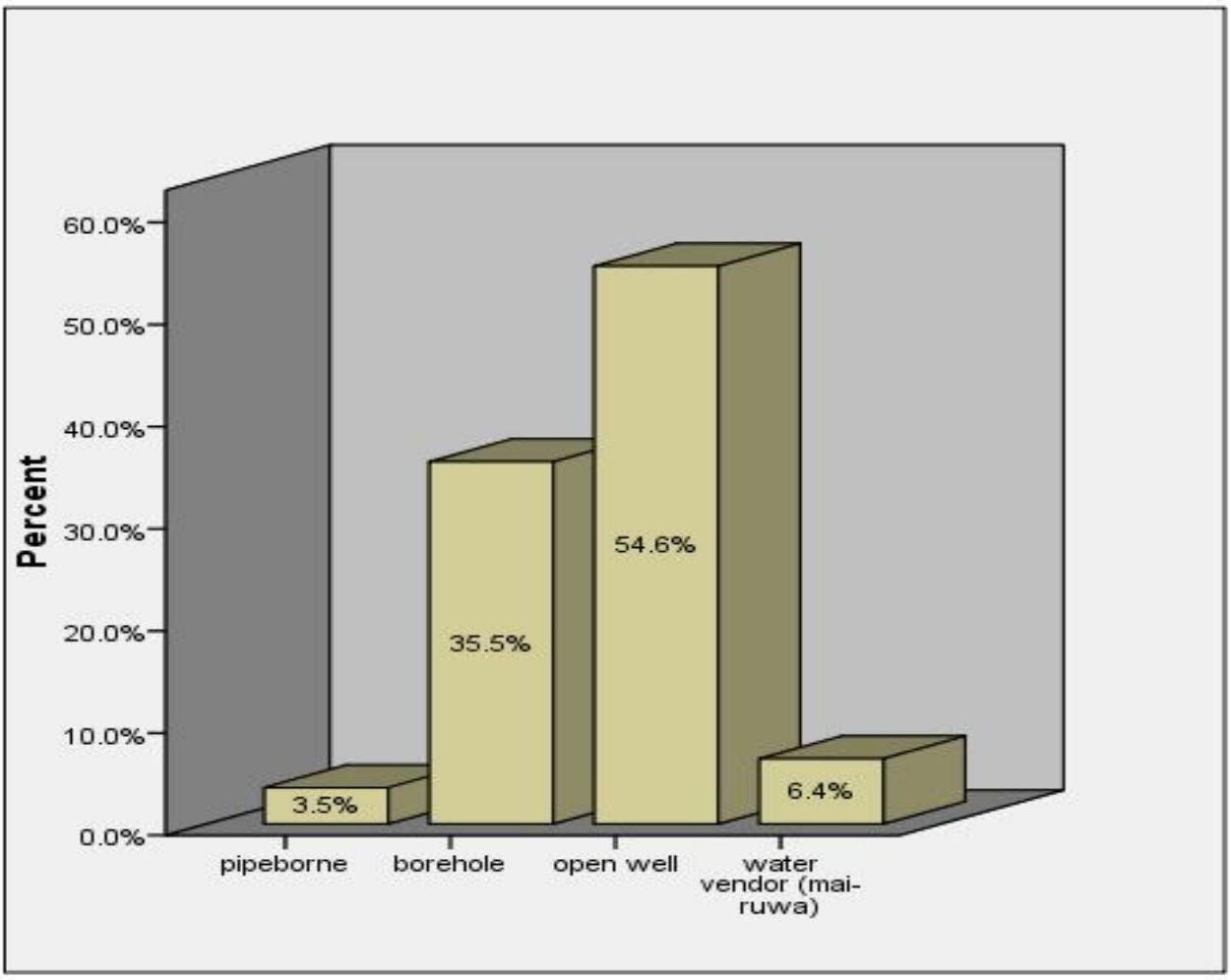

Figure 5.7: Source of Water for Washing Cloths in Kaduna South L. G. A.
Source: Field survey (2013)

From Figure 5.8, majority (89.8%) of the households cooking water in the study area were from the following sources borehole 54.3%, open well 27.7%, and Mai-ruwa 7.8% other than pipe borne 10.3%.

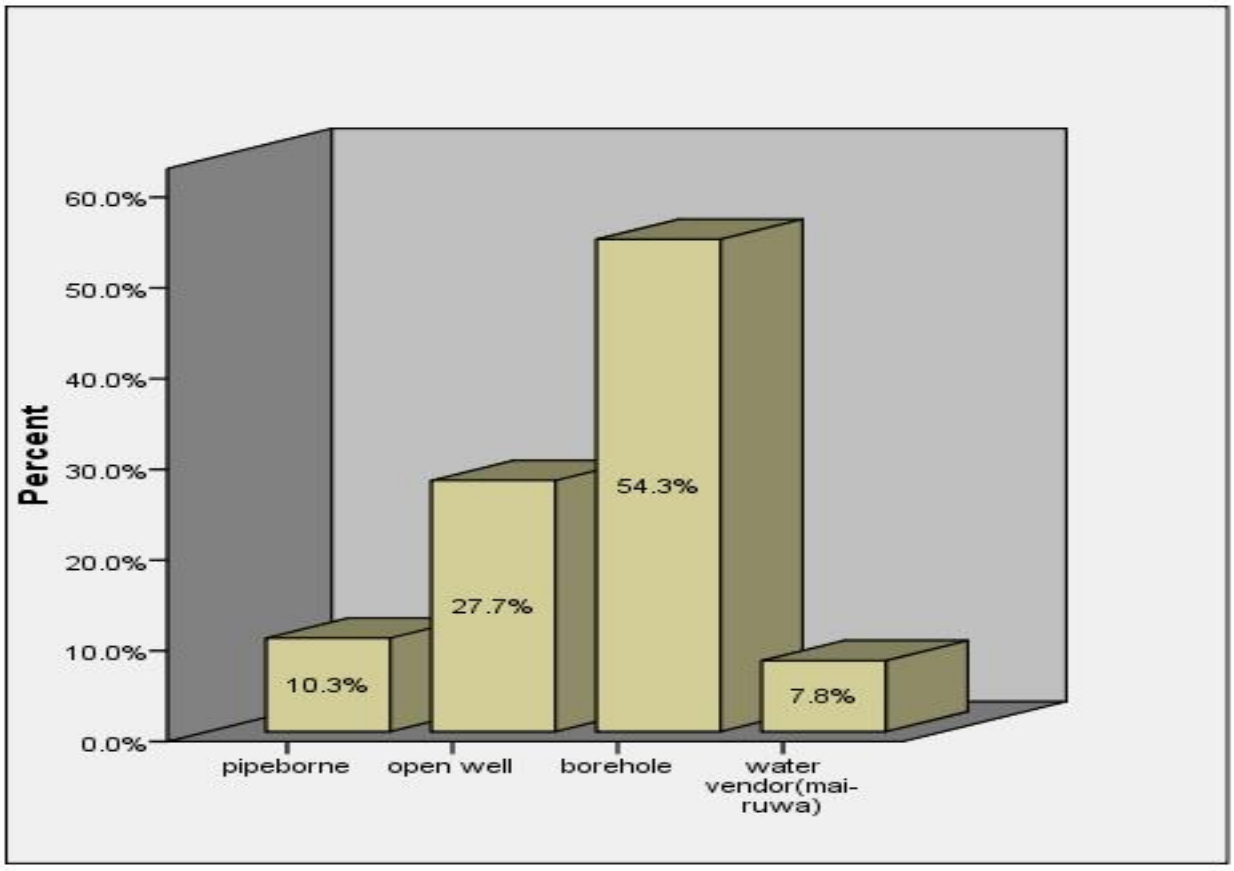

Figure 5.8: Source of Water for Cooking in Kaduna South L.G.A
Source: Field survey (2013)

From figure 5.9, majority 96.5% of the households water for sanitary purposes in the study area were from sources bore hole 54.6%, open well 34.8%, and water vendor 7.1% other than pipe borne water 3.5%.

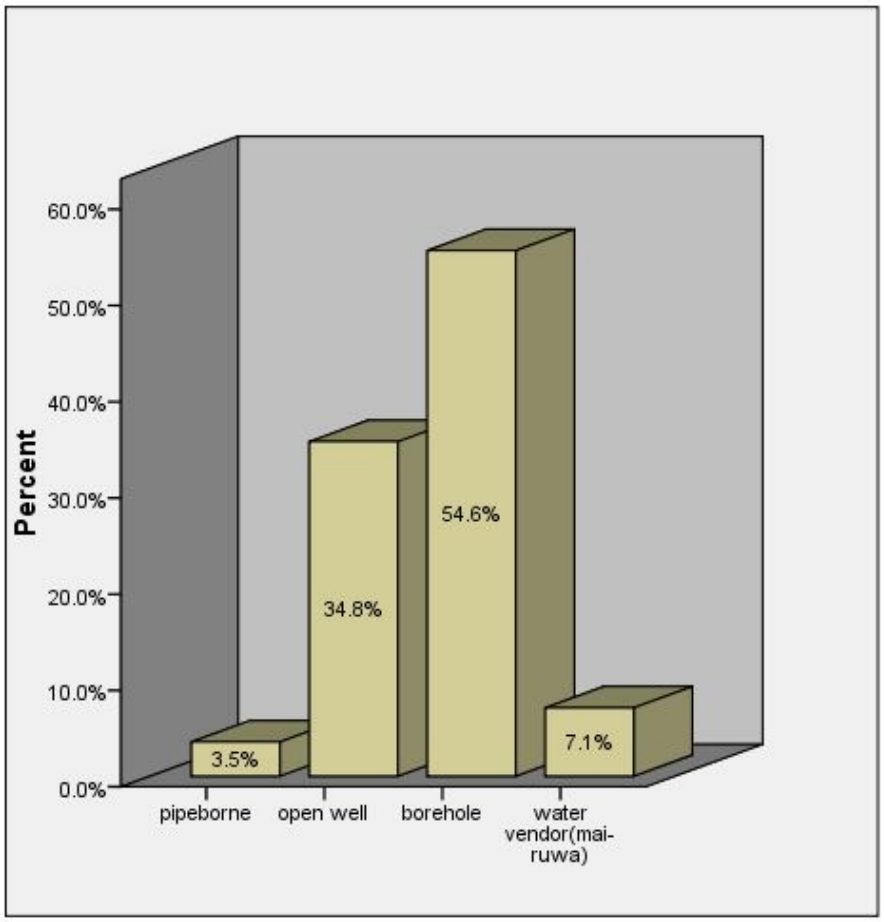

Figure 5.9: Source of Water for Sanitary Purpose in Kaduna South L.G.A.
Source: Field survey (2013)

5.5.2 Water Storage Employed By Households

The table below shows various ways employed to store water and the reasons for water Storage in Kaduna South LGA

Table 5.3: Water storage employed by households in Kaduna South L.G.A.

Variables		Frequency	Percentage
No. of people have to Store water	Yes	269	95.4
	No	13	4.6
TOTAL		269	100
Reasons for Storing water	To sustain us when there is scarcity of Water.	65	24.2
	To save us from Trekking every day.	87	32.3
	So that I will not have to buy from Vendors.	57	21.2
	To make water Available when ever I want to use it.	60	23.3
TOTAL		**269**	**100**
Method of storing Water	Inside drum	88	32.7
	Jerry can	93	34.6
	Buckets	49	18.2
	Plastic bowl	35	13.0
	Overhead tank	4	1.5
TOTAL		**282**	**100**

Source: Field Survey (2013)

From Table 5.3, majority 269(95.4%) of the respondents store water, while only 13(4.6%) of the respondents do not store water. In addition, reasons for storing water by the respondents were as follows: for sustainability of the households when there is scarcity of water, to save them from trekking everyday in search of water, to save them from buying from water vendors and to make water available whenever they want to use it.

5.6 Effects of Quantity of water supply on the Socioeconomic Activities

At the household level, socioeconomic significance of water is achievable when there is proper and functioning pipe borne water coverage and how it has impacted on the time spent collecting water and as well reported cases of water borne diseases in the study area. Under the null hypothesis that pipe borne water supply has not impacted on the socioeconomic activities of the area.

Variables were therefore cross-tabulated so as to determine whether water supply significantly affect socio economic activities. Variables such as the frequent flow of taps was cross-tabulated with costs associated as a result of the uneven coverage of functioning taps.

Table 5.4: Cross Tabulation of Pipe Borne Water Flow against Distance Trekked to Alternatively Water Supply in the study area.

			Do you trek to source for water.		
			yes	no	Total
Frequency of run water from taps	once in 2-3 days	Count	27	1	28
		Expected Count	22.6	5.4	28.0
	once a week	Count	16	5	21
		Expected Count	17.0	4.0	21.0
	never	Count	67	16	83
		Expected Count	67.1	15.9	83.0
	once a year	Count	32	12	44
		Expected Count	35.5	8.5	44.0
	once a month	Count	43	10	53
		Expected Count	42.8	10.2	53.0
Total		Count	185	44	229
		Expected Count	185.0	44.0	229.0

This Table shows Chi Square test on whether or not pipe-borne water supply has impacted on the socio-economic activities of residents in Kaduna South L.G.A.

Chi-Square Tests of significance level

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.545[a]	4	.162
Likelihood Ratio	8.148	4	.086
Linear-by-Linear Association	2.112	1	.146
N of Valid Cases	229		

a. 1 cells (10.0%) have expected count less than 5. The minimum expected count is 4.03.

Findings from chi-square revealed that at 5 degrees of freedom, the 95th percentile is 11.1 is greater than the calculated value (6.544). Therefore, the observed chi-square is not significant at 0.05 levels. So the null hypothesis is not rejected and we conclude that pipe borne water supply has not impacted on the socioeconomic activities of people in the study area. Implying that householders in the study area spent greater amount of time sourcing for water by trekking some distances.

Table 5.5: Cross Tabulation of Pipe Borne- Water Flow against Reported Cases of Water Borne Diseases.

			diseases		
			yes	no	Total
Frequency of flow of water from taps.	Everyday	Count	2	8	10
		Expected Count	6.4	3.6	10.0
	once in 2-3 days	Count	21	7	28
		Expected Count	18.0	10.0	28.0
	once a week	Count	12	9	21
		Expected Count	13.5	7.5	21.0
	Never	Count	51	32	83
		Expected Count	53.5	29.5	83.0
	noce a year	Count	36	8	44
		Expected Count	28.4	15.6	44.0
	once a month	Count	32	21	53
		Expected Count	34.2	18.8	53.0
Total		Count	154	85	239
		Expected Count	154.0	85.0	239.0

This Table shows Chi-Square test on whether or not there is relationship between water supply and occurrence of pipe-borne water disease in the study area

Chi-Square Test of significance level

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.973[a]	5	.005
Likelihood Ratio	17.364	5	.004
Linear-by-Linear Association	1.393	1	.238
N of Valid Cases	239		

a. 1 cells (8.3%) have expected count less than 5. The minimum expected count is 3.56.

Similarly, findings from chi-square revealed that at 5 degrees of freedom, the 95th percentile is 11.1 is less than the calculated value (16.973). Therefore, the observed chi-square is significant at $P \leq 0.05$ level so the null hypothesis is rejected. The study concludes that accessibility of pipe borne water supply has not impacted on the socioeconomic activities of the households in the study area. This therefore implies that reported case of water borne diseases is not on the high side.

5.7 Discussion of Findings

Findings from the study showed that there is a significant coverage of pipe- borne water distribution systems in the study area. However, most of them were old, thus making most of the taps inefficient and inadequate for water supply. This finding is therefore in agreement with the studies of Chikher (1995) in the context of Algiers, Allan- El Mansouri (1996) in Rabat-Sale, Zerah (1999) in Delhi, and Darmame (2004) in Amman, which in their studies, affirmed that having a connection to network is not always synonymous with adequate access to water in terms of quantity, quality and

regularity. As a result of the irregular water supply, householders resorted to buying of water from water vendors and trekking to some distance source of water supply such as open well and bore hole. This finding is supported by Akinola (2000) who affirmed that when social infrastructure like municipal drinking water distribution system functions below expectations, could make one pays in kind and cash.

The study also revealed that daily average water consumed for domestic purpose per person was 39.76liters of water which is still below minimum absolute daily water needed per person per day as set by UNDP (2008). Findings from the study also showed that the quantity of pipe borne water supply in the study area did not meet demand, implying that pipe borne water is a scarce commodity in the study area.

Another finding from the study showed that pipe- borne water supplied in the study area has not impacted on the socioeconomic activities since household members spent a better part of their time collecting water. This finding is supported by UNDP (2006) that affirmed that in most developing countries, women and young girls often spend hours collecting and carrying water, restricting their opportunities in productive activities due to low pipe borne water coverage.

Findings based on the study showed that the level of education played a major role on people perception on the use of water for a healthy living

5.8 Major Findings

1. There is significant coverage of pipe lines facilities in the study area,
2. Most of the pipe lines in the study area were old and inefficient,
3. The water supply in the study area is inadequate tomeet peoples' demand,

4. The domestic water consumed in the study area was 39.76liters per person per day which is below UNDP (2008) standard of 50 liters per person per day,
5. The pipe-borne water supply has not impacted on the socio-economic activities of the people in the study area.

CHAPTER SIX:

SUMMARY, RECOMMENDA AND CONCLUSION

6.1 Introduction

This chapter deals with the summary recommendation and conclusion

6.2 Summary

This study was carried out to examine the access to pipe borne water in Kaduna South Local Government Area, Kaduna State. The specific objectives were to identify various sources of water; identify households with pipe-borne water facilities; determine the proportion of people that have access to pipe borne water; determine if the quantity of pipe- borne water supply meets the people's demand; examine the effect of accessibility to pipe-borne water on the socioeconomic activity of householders and examine the challenges of accessing pipe-borne water by households.

In order to achieve the objectives of this study, a survey research design was employed. Data for this study was acquired by the administration of a total of 300 questionnaires to households in five wards within the study area (60 questionnaires in each ward). These wards include Makera, Kakuri Gwari, Television, Kakuri Hausa and Nasarawa. The administration of questionnaire was used to get the residents' views on the access of potable water in the area. To ensure that people from all social strata and income levels and group were adequately and equally represented in the study, purposive sampling method was employed to select the respondents. The analysis was based on descriptive statistics and presentation.

Findings from the study showed that the study area is significantly covered by of pipe borne water distribution systems. However, most of the distribution systems were

old, thus making most of the taps inefficient and inadequate for water supply. As a result of the irregular water supply, householders resorted to buying of water from water vendors and trekking to some distance source of water supply such as open well and bore hole.

The study also revealed that daily average water consumed for domestic purpose per person was 39.76liters of water, which is still below minimum absolute daily water needed per person per day as set by UNDP (2008). Findings from the study also showed that the quantity of pipe borne water supply in the study area did not meet demand, implying that pipe borne water is a scarce commodity in the study area.

Another finding from the study showed that pipe borne water supplied in the study area has impacted on the socioeconomic activities, since household members spent a better part of their time collecting water. This finding is not in line by UNDP (2006) which affirmed that in most developing countries, women and young girls often spend hours collecting and carrying water, restricting their opportunities in productive activities due to low pipe borne water coverage.

Findings based on the study showed that the level of education played a major role on people perception on the use of water for a healthy living.

6.3 Recommendations

Based on the findings, the following recommendations were made;

Based on the findings, the following recommendations were made;

- There should be constant repairs of damaged pipes and taps in order to reduce leakage.

- Proper maintenance of equipments at the water works should always be carried out.
- More funds should be allocated to water resources development.
- There should be public enlightenment campaign in mass media against the reckless over consumption and misuse of water.
- There should be constant monitoring of the rate of population growth so as to enable the government to be able to plan ahead in order not to face problems resulting from rapid urbanization.
- More funds should be allocated to water resources development.
- There should be public enlightenment campaign in mass media against the reckless over consumption and misuse of water

6.4 Suggestion for Further Research

- Based on the major findings from this study, therefore, future research should focus on:
- Effects of pipe-borne water supply on the socio-economic activities,
- Comparative study on access to pipe-borne water,
- Examine factors affecting pipe-borne water supply.

6.5 Conclusion

From the study, most of the pipelines meant for the supply of potable water to these households are old and inefficient despites a significant coverage of the area. The inefficiency and poor functioning of these pipe lines were as a result of poor or no maintenance by the water board officials.

Pipe- borne water supply in the study area is not sufficient to meet the demands of the residents due to irregularity in the flow of water. Water used for cooking, washing, drinking and sanitary purposes were mostly sourced from alternative sources which consume energy and time that could have been used in other productive aspect of economic. Thus, the average water consumed by persons in study area was 37.76liters of water, which is below the minimum absolute daily water needed per person per day.

References

Abaje I. B, Ati O. F, and Ishaya I. (2009) Nature of Potable Water supply and Demand in Jema'a Local Government Area of Kaduna state, Nigeria. *Journal of Environmental and Earth Science I* (1). 16 - 21

Acharya, G. and Barber, E. (2002). Using domestic water analysis to value grounwater recharge in Hadejia –Jama'are floodplain, North Nigeria. *American journal of Agricultural Economies, 84*(2) 415-426.

Addisie, M. B. (2012). *Assessment of drinking water quality and consumption in Simada District Ethiopia*. Cornel University Press.

Afolabi, A. (2010). Meeting the Millennium Development Goal (MDGs) targets of water and sanitation in Urban Area of Africa: The example of Akure, Ondo State, Nigeria. *Journal of Sustainable Development in Africa Vol.* (12) No. 3

Akinola, S. R. (2000). *Urban Infrastructural facilities.* (Unpublished Master's thesis) Department of Public Administration Obafemi Awolowo University,Ile-Ife, Nigeria.

Akpabio,E.M. and Iniobon,E.A.(2013).Water for cities in Nigeria: The Governance Dimension. *Mediterranean journal of social sciences vol*.40 No.4.Published by MCSR-Sapienza University of Rome.

Akpabio,E.M.(2006). *Institutional Arrangement For International Water Resources Management in the Cross River Basin, Nigeria.* (Unpublished dotoral thesis) Department of Geography and Regional Planning, University of Uyo.

Ali, I.A (2004). *Effects of Industrial Waste Pollution of River Kaduna on Economic Lives of the People in the Southern Part of Kaduna Metropolis.* (Unpublished master's thesis) Geography Department, A.B.U Zaria, Nigeria.

Allain- EL Mansouri, B. (1996). *L'eau et al Ville, le cas de la Wilaya de Rabat- Sale'* (Marcoc), The'se de doctorat Universite' de Poitiers

American Heritage Dictionary (AHD) (2009). *Description of water.* Rerived from http://education.yahoo.com/reference/dictionary/entry/water.

AQUASTAT-
FAO.(2010).*CoutryFactSheet,Nigeria*.Retrivedfromhttp://www.foa.org/no/aquas-tat

Ariyabandu, R. (2001) Household Water Security Using Rainwater Harvesting. Domestic Roof Water Harvesting Workshop IIT. Delhi,India.

Asthama, D.K. and Asthama, W. (2001) *Environment: Problems and Solutions.* Second Revised Edition S. Chand and Company Ltd. New Delhi.

Ayoade,J.O.andOyebande,B.L.(1983):"*WaterResourcesIn Eds " Oguntoyinbo,J.S.,Areola O.O,and Filani,m.Geography of Nigerian Development*, Heinemann Educational Books (Nigeria) Limited, Ibadan.

Basani, M., Ishan, J. and Reitly, B. (2008). "The Development of Water Connection and Water Consumption. *Emperical Evidence from a Cambodian Household Survey." World Development, 36*(5): 953-968

Bevan, D., Collier, P. and Gunning, J.W. (1989). *Peasants and Governments: An Economic Analysis.* Oxfort: Clarendon Press.

Braner, S. (2012). *"Chemical Nomenclature"* (Master's thesis, Department of Chemistry Widener University). Retrieved from http://hdl.handle.net/2123/7128

Brown, M. M. (2003). "clean water-An Agent of change". *Choices 12*(1), 3-4

Cairncross, S. and Cliff, J.L. (1987)."Water use and health in Mueda, Mozambique." *Transactions of the Royal society of Tropical Medicine and hygiene 81*:51-54.

Cheesman, J., Benneth, J. and Son, T.V.H. (2008): " Estimating Household Demand Using Revealed And Contigent Behaviour: Evidence from Viet Nam." *Water Resources Research 44*, 11-428, doi: 10.1029/2007WR006265.

Chikher F.(1995):L'eau a' Alger :Resources,Distribution,Commission,These de doctorate Universite' d Tolonse Le Mirail, U.F.R,de Geographie-Ame'nagement.

Crane, R. (1994): "Water Market Reform and the Urban Poor: Results from Jakarta Indonesia." *World Development 22*(1) 71-83

Darmame, K. (2004): Gestion de (a rarete':le service d'ean potable a'Amman entre laGestionpublique et prive'e-68p, available at http://www.iwmi.cgiar.org/Assessment/FILES/Work//

David, C.C. and Inocencio, A.B. (1998). *Understanding Household Demand for Water: The Metro Manila Case.*

Dufant, A (1998). " Women carrying water: how it affect their health." *Water line 6*(3). 23-25

Emoabino, I. U. and Alayande, A.W. (2007). Water Demand Management, problems and prospect of Implementations in Nigeria. Practices on River Basin management.154 -159.

Espey, M.J., Espey,J.and Shaw W.D. (1997). "Price elasticity of residential demand for water:A meta analysis".*Water Resources Research,vol.*33 No.6.

Fotue, L. A. T. (2012). Determination of the household choice drinking water source in Cameroon. *Journal of sustainable Developments in Africa Vol*. 14 No. 3.

Federal Republic of Nigeria (FRN) (2000). *Water Supply and Sanitation Interm Strategy*

note, Retrieved March 29, 2008 from http://siteresources.worldbank.org/NIGERIAEXTN/Resources/was110 0.pdf

Galadima, A., Garba Z. N., Leke I., Almustapha M. N., and Adam (2011). Communities in Nigeria - causes and consequences. *Vol. 52* No. 4, 592 - 603.

Henniker, J .C.(1949) " the depth of the surface Zone of a liquid". *Reviews of modern physics 21* (2) :322-341 doi:10.1103/Revmodphys. 21.322.

Hindman, A. and Persson, T.H (2002) "Household Choice Of Drinking Water Source in the Philippines. *Asian Economic Journal 16*(4):303-316. Available at http://www.d isgov.tr/congress2O77/cha pter3/84. pdf

Kenneth A.N., Steven G.B. and Robert M.C.(2005).Simulative Exposures to Deliberate Instruction into water Distribution Systems. *Journal of Water Resources Planning and Management, vol*. 131, No 3.

Larson B., Minten, B., and Razafindralambo, R. (2006). Unravelling the Linkages between the Millenium Development Gaols for Poverty, Education, Access to water and Household Water Use in Developing Countries: Evidence from Madagascar. *Journal of Development Studies,42*(1),22-40.

London Economics (1999). Ghana Urban water sector-willingness and ability to pay, demand assessment and tariff structure study, final report, July 1999.

Lyer, R.R. (2003).*Water prospectives,issues,concerns*.Sage Publications New Delhi India;Sage publications.

Madanat, S. And Humplick, F., (1993). "A Model of Household Choice of Water Supply System I Developing Countries," *Water Research 29*: 1353-1358.

Mamman, M.(1992).Analysis of fertility differential in Kaduna metropolis. Unpublished P.hd Thesis ABU Zaria in Ali,I.A.(2004).Effects of industrial waste pollution of River Kaduna on Economic lives of the people in the Southern part of Kaduna Metropolis.Unpublished.M.sc.Thesis,Geography Department A.B.U. Zaria.

Makule, D.E. (1997). "*Water and Sanitation-gender perspective: proceedings of the 23rd WEDC Conference*. Available at http.//www.iboro.ac.uk/departments/cv/wedc/23conts.htm.

Maude Barlow (c. 2007). *Blue covenant : the global water crisis and the coming battle for the right to water*. New York : New Press

Mehretu, A. and Mutambirra, C. (1992). "Time and energy cost of distance in rural life space of Zimbabwe:Case study of Chuduku Communal Area." *Social Science and medicine 34*(1).17-24.

Mu, X., Whittington. D, and Briscoe, J. (1990):Modelling village water demand behaviour:a discrete choice-choice approach.Water Resources. *Research,26,*521-529

Musa I.J., Shehu A., and Lukman, S. (2009). The Distribution Methods and Supply Problems of Tap Water in Urban Zaria Area, Kaduna State. EJEAFCHE (*Electronic Journal of Environmental, Agricultural and Food Chemistry*) Vol. 8 (4)

Nanges, C. and Stand, J.(2007):Estimation of Non-Tap Water Demand in Central America Cities. *Resource and Energy Economic,29,* 165-182

Nanges, C., and Van Den Berg (2009). Demand for piped and non piped water supply services: Evidence from South-West Sri Lanka. *Enviromental and Resource Economic, 42* (4), 535-549.

National Bureau of statistics, Available at www.nigeriansta.gov.ng. Accessed on 12/10/2009

National Population Commission (NPC) (Nigeria), and ORC/Macro, (2009S).Nigeria Demographic and Health Survey 2008. Calverton, Maryland: National Population Commission and ORC Macro.

NEST (1991). Nigerian threatened environment. A national profile. In Ali I.A (2004): Effect of Industrial Waste Pollution of River Kaduna on economic lives of the people in the southern part of Kaduna metropolis. Unpublished M.Sc Thesis, Geography Department, ABU Zaria.

Nigeria Environmental Study Action Team, NEST, (1991). *Nigeria's Threatened Environment: A National Profile. Nigerian Environmental Study/Action Team (NEST).* A NEST Publication, Ibadan, Nigeria.

Niyi G.and Felix,O.(2007).Assessment of Rural Water Supply Management in selected Rural Areas of Oyo State Nigeria.

Nriaga, J., Olem N.T., Cudjo C. and Chino A. (1997). This Science of the total Environment, 197, 13- 19.

Ntengwe, F. W. (2005) Designing a Domestic Water Supply system The Engineer's perspective and considerations as a challenge to consumers. *Physics chem. Earth, 30*, 11-16. http://ewbuiuc.org/system/files/sdarticle.pdf

Oguntoyibo, J.S., O.O. Areola and M. Filani, Heinemann Educational Books (Nigeria) Limited, Ibadan-ISBN: 978 129 525 2 (limp), 978 526 0 (cased).

Olaoe, O. A. and Onilude, A. (2009). Assessment of Microbial Quality of Sachet - Packaged Drinking Water in Western Nigeria and its Public Health Significance. *Public Health, 123,* 729 - 734.

Omba, C. O. (2006). Water Resources, Environmental and Sustainable Development in Nigeria. *J. Hum - Ecol. M, 19* (3): 169 - 181

Onokerhoraye A. G. (1995). Population Growth and Provision on Social Services in Nigeria. The Benin Social Science series for Africa. University of Benin, Benin city, Nigeria

Orubu, C.O (2006) Water Resources, Environment and Sustainable Development in Nigeria. *J. Hum. Ecol., 19*(3): 169-181 (2006).

Oshide (1990). Environmental Pollution in Nigeria. *Habitat International, 1411*(5-15).Oyo State, Nigeria. ATPS working paper series No.49.

Pattanayak, S.,Yang, J. C., Whittington, D.,and Kumar, B. (2005): "Coping with unreliable public water supplies; Averting Expenditures by Households in Kathmandu,Nepal,"*Water Resources Research 4*(2), o2012,doi:10.1029/2003WR002443

Rieveld, P., Ronwendal, J. and Zwart, B.(2000). Block Rate Pricing of water in Indonesia:An analysis of welfare effects. *Bulletin of Indonesian Economic Studies,36*(3),73-92.

Rosen, S. and Vincent, J.R.(1999). "Household water resources and rural productivity in Sub- Saharan Africa: a review of the evidence." *Development Discussion Paper No.673, Harvert Institute for International Development,* Cambridge, MA

Sale, H.(2006) and Musa, I. (2012). Water Supply and Demand Analysis for Katsina Urban Area Katsina in Katsina State as a sustainable Natural Resources Utilization and Development in Nigeria. A Paper Presented at the 54thAnnual Conference for the Association of Nigerian a Geographers (NGA) at University of Science and Technology Wudil, Kano State from 19th-23rd November, 2012.

Saleh, H (2006). *Water supply and demand analysis for Malumfashi,* Katsina State, (Unpublished M.Sc. Thesis), Geography Department A.B.U. Zaria.

Saleth,.R.M.and Dinar,A.(2000):Institutional changes in global water sector:trends,patterns and implications.*Water policy 2*:175-199.

Sangodoyin, A.Y. (1992). "Women's role in water supply and development: trends and expectation in Nigeria." *The Enviromentalist 13*(4): 255-261.

The Cross River Basin, Nigeria. Unpublished PhD Dissertation.Department of Geography and Regional Planning, University of Uyo, Nigeria.

This Day (2010): *"Water Scarcity hits Kaduna Metropolis"* News Report 7 April 2010. http://washafrica.wordpress.com/2010/04/08/Nigeria waterscarcity-hits-kaduna-metropolis.

Thompson, J., Porras, I. T., Tumwine, T. K., Muiwahuzi, M.B., Katui-Katua,M. Johnstoe, N., and Wood, L.(2001). *Drawers of water II: 30 years of change in domestic water use and enveromental health in East Africa.* IIED, London, UK.

Tongaat Hulett Dvelopments THD (2007) *Sustainable Water*. Retrieved February 5, 2009 from http/www.thdev.co.za/content/view/56/2.

Umeh, I. C., Amali O. and Omeh E.U (2004). The Socio - economic Effects of Tropical Diseases in Nigeria. *Economics and Human Biology, 2,* 245 - 265.

UNESCO (2006): *The United Nations World Water Development Report: Water, a shared Responsibility,* Second Report, UNESCO Publishing, Paris.

United Nations(2012). UN News Center-2012 World Water Day: target 7.C of the MDG' S met before the 2015 deadline; Ensuring access to water for agriculture vital for sustainable future. Un web services section/department of public information, United Nation. Available at http://www.un.org/apps/news/story.asp? News10=416 05&cr1=sanitation

United Nations(1998). *world population prospects. The 1998 Revision. Vol.III: Analytical Report,* New York, United Nations.United Nations, Available at www.gazeteer.com accessed on 12/10/2009

UNSN (2002), United Nations Development Assistance Framework: Nigeria 2002-2007, Abuja, United Water Distribution Systems. *Journal of Water Resources Planning Management, vol.*

White, G.F., Bradely, D.J.,and White, A.U.(1972).Drawers of water: domestic water use in East Africa, University of Chicago Press Chicago.WHO(1993). *Guidelines for drinking water quality, vol*.1 RECOMMENDATIONS 2nd edition.s.

WHO (2010) for Water Supply and Sanitation,

Wikipedia (2012). *Water Supply and Sanitation in Nigeria*. Retrieved October 28, 2012 from http://em.wikipedia.org/wiki. water supply and sanitation nigeria

Wikipedia, (2008) *Water Resource.*Retrieved April 12, 2008 from http://en.wikipedia.org/wiki.waterResources.

World Bank (1993) Water Demand Research Team,The demand for water in rural areas:Determinants and policy implications,*The World Bank Research Observer,vol.*8,No.1,47-70.

World Bank (2012). New Project to bring clean water to 50, 000 households.

World Health Organisation & United Nations Children□s Fund, 'Estimates for the use of Improved Drinking-Water Sources', in *Joint Monitoring Programme for Water Supply and Sanitation (JMP) Report 2010*, UNICEF, 2010.

World Health Organisation (1995). "Why women cannot be healthy without water and sanitation." Rural Enviromental Health Unit, Genava.

World Health Organization (1993). Guidelines for drinking water quality, Volume 1. Recommendations 2nd edition.

World Health Organization (2004). *Guidelines for Drinking Water Quality,* Geneva World Health Organisation.

Yusuf K. A. (2007). Evaluation of Ground Water Quantity Characteristics in Lagos city. *Journal of Applied Sciences 7* (13) p 1780 - 1784.

Ze'rah, M.H.(1999):L'acce's a' l,ea dans les villes Indiennes.pans, *Anthroppos,192*.(coll.villes).

Appendix

QUESTIONAIRE SCHEDULE

Dear Respondent

This questionnaire is designed to assist in a research on "Access to Pipe Borne Water in Kaduna South Local Government Area"

The information sought is purely for academic exercise and consumptions. You are hereby guaranteed that all information supplied will be treated with utmost confidence.

Thank you for your cooperation as I anticipated your response.

Questionnaire (For Household)
1.Age (years)

a.18-23 [ ] b. 24-29 [ ] c. 30-35 [ ] d. 36-41 [ ] e. 42 and above [ ]

2.Gender a. Male [ ]b. Female [ ]

3.Marital Status:

a. Single [ ] b. Married [ ] c. Divorce [ ] d. Widow/widower [ ]

4.Educational Status:

a.Primary [ ] b. Secondary [ ] c. Tertiary [ ] d. No formal education [ ]

5.Occupation:

a.Civil servant [ ] b. Teacher [ ] c. Trader [ ] d. Farmer [ ]

d. bus/taxi/okada driver [ ] e. unemployed [ ]

6.Household size ……

7.Household level of income

a. high b. average c. low

SECTION B

8.Do you have pipe borne water facility in your household?

a. Yes b. No

9.If yes in question 8, do water board officials come to collect water bills?

a. Yes b. No

10.How often does water run from your tap(s)?

a.Everyday [ ] b. Once in 2-3days [ ] c. Once a week [ ] d. Never [ ]

e. Once a month [ ] f. Once a year [ ]

11. If not every day in question 10, what is your alternative source of water?

a. Buying [ ] b. Trekking some distance neighborhood to fetch [ ]

c. Open well [ ] d. Borehole [ ] d. Others please specify [ ]

12. If you answered 11, do you trek some distance for your alternative source of water?

a. Yes [ ] b. No [ ]

13. If yes in question 11, how far do you trek?

a. less than 100m b. between 101-200m c. between 201-300m d. above 300m

14.Most of the piping systems distributing water in your vicinity are old

a. strongly agree b. agree c. disagree d. strongly disagree

15.How often do water board officials come to replace old pipes with new ones?

a. Always b. Not always c. Never

16. Which of your household member are involved in the fetching of water?

a. Women b. Men c. Children d. women and children e. Others

17. How many liters of water do you use in a day? _____

18. Do you have to store water?a. Yes b. No

19. If yes in question 18, what are your reasons _____

_____

_____

20. What method do you employ in storing water?

a. Inside drum b. Jerry can c. Buckets d. Plastic bowl e. Over head tank

21. Which of the sources of water do you use for sanitary purposes?

a. Pipe borne b. Open well c. Borehole d. Water vendors (mai-ruwa)

22. What is your source of drinking water?

a. Pipe borne b. Borehole c. Well d. Water vendor

23.What is your source of cloth washing?

a. Pipe born b. Borehole c. Open well d. Water vendors (mai-ruwa)

24.Which of the sources of water do you use for cooking?

a. pipe borne b. Open well c. bore hole d. Water vendor(mai-ruwa)

25.Has there been improvement in the supply of pipe borne water in your area?

a. to a great extent b. somewhat c. very little d. not at all

26. Has there been a reported case of water borne diseases in your area?

a. Yes b. No

27.Please, suggest possible solutions for the improvement of potable water supply by water board?