University of Nairobi
Department of Sociology

The Effects of Water Reforms on the Health of Maasai Community of Central Division Kajiado District.

By:
Samuel Obara
C50/P/8239/04

Supervisors:
1. Prof. Octavian Gakuru
2. Mr. Allan Korongo

Research Project Submitted to the Department of Sociology, University of Nairobi, in Partial Fulfilment of the Requirement of Mast Sociology

Project Paper
CSO698

October 2007

THE EFFECTS OF WATER REFORMS ON THE HEALTH OF MAASAI COMMUNITY OF CENTRAL DIVISION, KAJIADO DISTRICT

DECLARATION

I Samuel Obara Reg. No.C50/P/8239/04, hereby declare that this Research Project is my original work and has not been presented for a ward of degree in any other University or for any other a ward.

Signature _____ Date 19/11/2007
Samuel Obara

SUPERVISORS

This Research Project has not been submitted for the ward of Degree in any University under our approval as Supervisors

Signature _____ date 19/11/07
1. Prof. Octavian Gakuru
Dept. of Sociology, University of Nairobi

Signature _____ date 19/11/07
2. Mr. Allan Korongo
Dept. of Sociology, University of Nairobi

DEDICATION

This study is dedicated to mothers and children in Africa. Maternal Child Health remains a major challenge in Africa. Contributing factors include diarrhoea which is partly attributable to lack of safe water and poor hygiene and sanitation practices. To keep the child and mothers a live in Africa water quantity and water quality in households is essential. It is my hope that this study has contributed to this critical component.

ACKNOWLEDGMENT

I'm extremely grateful to a number of people who supported me in the course of this research project. To the people of Kajiado Central: community elders, local administration and household heads for allowing me and my research assistants to collect data in the area and their own willingness to volunteer information whenever called upon.

To the government of Kenya: Ministry of Education for issuing me a research permit within such a short time. The Ministry of Water and Irrigation for granting me permission to interview senior technical officers .The officers were vey cooperative and supportive and I'm very grateful. The ministry of Health: Kajiado district Hospital, KMQ and Mile 46 Health Centres staff for their support in making data on water related diseases available and creating time to be interviewed as Key Informants.

To my colleagues in AMREF, I'm forever grateful for inculcating in me a culture of research and interest in water, hygiene and sanitation issues that contributes a large percentage of the disease burden among the poor communities in Africa.

Many thanks to Tom Omurwa, along time friend for creating time to critique my sampling framework and guiding me how best to minimize errors in sampling. To Tom Oketcho and Mwakio, I'm grateful for your support in collecting of secondary data and helping in data cleaning process. I'm highly indebted to Jacob Ole Sampeke a friend and along time colleague for guiding me in dos and don'ts while in the field and for translating the questions in Maasai language for respondents who could not understand English or Kiswahili and at the same time mobilizing and educating the community on the importance of the study.

Many thanks to Dr. Benson Agaya, Department of Sociology University of Nairobi, for creating time and sharing on ideas of how to improve the quality of this study

Prof. Octavian Gakuru and Mr. Allan Korongo for their commitment and dedication in supervising me for the entire course of this study. Without their inputs, this study would not be what it is now.

To my wife Carol N. Namulumba for teaming up with me in raising resources required for this research and general technical and moral support.

To Several people and friends contacted in the course of this study and not mentioned my sincere and heartfelt gratitude to you all.

To God Almighty for the gift of life, security and provision of resources required for undertaking this kind of project.

Lastly, this is my original research work and where it is indebted to the work of others, they are duly acknowledged.

TABLE OF CONTENT

	CHAPTER ONE : INTRODUCTION	2
1.1	Background Information	2
1.2	Project Statement	5
1.3	Research questions	7
1.4	Objectives	7
1.5	Rationale of the Study	7
1.6	Scope and limitation of the Study	8
	CHAPTER TWO : LITERATURE REVIEW AND THEORETICAL FRAMEWORK	
2.1	Introduction	10
2.1.1	Community Structures And Participation in Water	10
2.1.2	Water Management: Professional & Local Knowledge	11
2.1.3	Leadership, Social Systems & Water Management	12
2.1.4	Gender Dimensions and Water	14
2.1.5	Equity, Poverty and Water	15
2.2.1	The Kenya Government & Devolution of Water Services	15
2.2.2	Water Diseases and the Local Structures	17
2.2.3	Water Reforms and Implications on Health	19
2.3.1	Theoretical Framework: Systems and HBC Theories	21
2.3.2	Water sector constraints	24
2.3.3	Summary of Literature Review	26
2.4	Operationalisation and Measurements Measurement of Variables	27
2.6	Definition of Key Terms	30
	CHAPTER THREE: METHODOLOGY	
3.0	Introduction	31
3.1	Research Site: Background Information	31
3.1.1	Cultural & Social Organization of the Maasai	32
3.1.2	The Maasai Home	33

3.1.3	Mode of Transportation	33
3.2	The Study Site	33
3.3	Unit of Analysis and Observation	34
3.4	Research Protocol	35
3.5	Study Design	35
3.6	Sources of Data and Methods	35
3.7	Sampling Design and Sample Size	36
3.8	Data Collection	38
3.9	Data Analysis	38

CHAPTER FOUR: DATA PRESENTATION AND ANALYSIS

4.0	Introduction	39
4.1	Socio Demographic Characteristics	39
4.2	Effects of water reforms on Households	
4.3	Reforms and effects on Health	48
4.4	Reforms And Changes in water management	56

CHAPTER FIVE:TER FIVE: SUMMARY,R ECOMMENDATIONS AND CONCLUSION

5.1	Summary	63
5.1.1	To investigate how reforms in the water sector has affected the Maasai	63
5.1.2	Trends in Water related diseases	64
5.1.3	Changes in water management	64
5.2	Conclusion	65
5.3	Recommendations	66
	Reference list	69-72
	Appendices : Research Instruments, Map of the Study Site, research permit	73-94

LIST OF TABLES

Table 1	Operationalisation of study Variables	27
Table 2	Education level of respondents	40
Table 3	Sources of Income	41

Table4	Main water sources for households	41
Table 5	Knowledge on water reforms	45
Table 6	Mile 46, Water related morbidity by gender	46
Table7	K.M.Q water related morbidity by Gender	47
Table 8	water related diseases Elangata Ewuas	48
Table 9	Water related diseases Toroka sub location	49

LIST OF GRAPHS

Graph1	Sex of respondents	39
Graph2	Household water consumptions patterns	42
Graph3	Average distance to water points	43
Graph 4	Methods of water transportation	44
Graph 5	Safe water use at household level	50

LIST OF FIGURES

Fig1	The Four F connection	18
Fig 2	Conceptual Framework	20
Fig 3	The Systems Theory Framework	23

ACRONYMS

AMREF	African Medical & Research Foundation
CDF	Constituency Development Fund
MDGs	Millennium Development Goals
SAPS	Structural Adjustment Programmes
IDWSSD	International Drinking Water Supply and Sanitation Decade
IMF	International Monetary Fund
KWAHO	Kenya Water & Health Organization
KMQ	Kenya Marble Quarries
HBM	Health Belief Model
UNDP	United Nations Development Programme
UNDP-HDR	United Nations Development Programme – Human Development Report
USA	United States Of America
UNICEF	United Nations Children's Fund
UNDP	United Nations Development Programme
WHO	World Health Organization
GOK	Government of Kenya
PLA	Participatory Learning for Action
PHAST	Participatory Hygiene And Sanitation Transformation
UN	United Nations
NGO	Non Governmental Organization
URTI	Upper Respiratory Tract Infections
VLOM	Village Level Operations Maintenance
WSRB	Water Services Regulatory Board
UNESCO	United Nations Educational Scientific & Cultural Organization
SPSS	Statistical Package For Social Scientist

ABSTRACT

The objectives of this study were: to investigate how the reforms in the water sector has affected the Maasai pastoral community (Loodokilani Location, Central Division, Kajiado District),to examine trends in water-related diseases (hygiene and dirty water-related diseases) and water reforms ,to find out changes in management of water as a result of water reforms? , to examine the community perceptions of the water reforms and to assess the objectives of the water reforms and emerging effects on the community.

The study site is Loodokilani Location, Central Division of Kajiado District. The area is mainly inhabited by the Maasai who practice semi-nomadic Pastoralism.

The study focus was an investigation on the effects of the water Reform process on the local structures .The main data collection tool was a household survey involving 62 households (31 from Elangata Ewuas and 31 from Toroka Sub-Locations, Loodokilani location) supplemented by twelve key informant interviews conducted at three levels: Community, District and Ministry of Water and Irrigation Headquarters Nairobi.

Study key findings: This study has established that the Reforms in water have manifest and latent outcomes, then Positive and negative outcomes. Latent and manifest outcomes are fully discussed in the last chapter of the study. The positive effects include: establishment of new structures that has realized the following: increased revenue collection in the urban places, clear guidelines on management of catchment areas, increased water availability especially in the urban areas, control of wastages through illegal connections and rehabilitation of broken down water points and construction of new water points. In the health sector, there is a general decline of water related diseases as reflected in the study site, which is also a general reflection in the entire district (Kajiado).

The creation of Constituency Development Fund (CDF) to support community projects and pretence of international and local organizations in the study site involved in water issues also contributed greatly to the above outcomes.

The negative effects include: The reforms in water are to large extent revenue focused. Consequently, transferring of the burden of water costs to Water Services Providers (WSP) in low income communities in the rural areas has been a challenge as tariffs that would ensure sustainability are beyond the reach of many water users in the rural areas. These schemes have not been attractive to investors and therefore dependent on the ministry of water and irrigation, which has both staff and resource shortages. In terms of changes at the grassroots level in water management, not much has changed. Water is still being managed by water committees as the licensed providers (Water Service Providers) are still forming. Similarly it was established that water provision in rural areas is not lucrative as in the urban areas. There is therefore lukewarm interest for investors. This remains a challenge to the government as it rolls out the Reform process.

This study identified the following as areas that require improvement: Financial management. The committees had not so far adopted basics of financial management, like separation of authority, conducting of annual audits. Similarly the committees do not enforce their own laws of holding elections; neither do they enforce guidelines to educate the members on processes for identifying good leaders. Gender issues and level of education though recognized as important, they are not strictly adhered to. Similarly in terms of capacity improvement and development of linkages to forge partnership to support rapid expansion of water points was limited. In addition, prioritization of key issues like health education and sanitation, search for existing opportunities like exploring ways of tapping into other funds (like the Ministry of Water and Irrigation budget for rural water programmes) other than the Constituency Development Fund was lacking.

Regarding water safety and quality assurance standards, the study established that, the Water Services Regulatory Board together with Kenya Bureau of

Standards (KEBS) has come up with minimum service level standards. All water service providers must have a testing unit kit. Chlorine residue must not be less than 0.2 and not more than 0.4. Have this has also not been fully operationalised.

On the issue of quality compliance and enforcement, it was established that a department on water solution quality control has been established. This study found out that, whereas, World Health Organization, has its own quality standards. This is not adhered to because some of the conditions are difficult to be met in Kenya due to the geological structure.

At the time of this study, the above procedure has not been rolled out in the rural areas. However in the urban areas, water companies are being obliged to observe this and residents confirmed improvement in treatment of tap water. This was validated by the study using random observation checks of taps with running water.

The study also established that the government has come up with a segmentation criterion which has identified pastoral issues as unique and requires special intervention. This is a good criterion; however its effects are not yet to be felt as it is not yet rolled out.

Going by the trends of data collected by this study, the government must deal with imagined and perceived fears by the community that water will cost high and that the government in the long run may withdraw from the water sector handing it over to the private sector (introduction of SAPs through the back door).

In conclusion, the study recognises that reforms are not one time event, but a continuous process that should be implemented in relation to the changing circumstances and in consultation with water users at all levels. The government should ensure this is maintained.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

The World Commission on Water estimates that water use will increase by about 50 percent in the next 30 years and an estimated 4billion people (one half of the World's population) will experience severe water shortage by 2025 if the current trend prevails. During the past century the world population tripled and the use of water increased six fold. Irrigation accounted for 70%, Industries 20% and domestic use 10%. Many developing countries therefore face daunting water resource challenges as the needs for water supply, irrigation and hydroelectricity increase (World Bank 2004:4).

The World Water Conference of 1977 adopted a declaration which initiated a new era in international co-operation for improved water supplies and sanitation in the developing world. According to this declaration, the 1980s was to become the "International Drinking Water Supply and Sanitation Decade (IDWSSD)". One of the major concerns was how to provide poor populations with safe water and how to reduce sanitation and hygiene related diseases (Maggie 1998).

As a follow up, the Commission on Environment and Development of 1987, popularly known as (the Bruntland Commission) published a landmark report entitled "Our Common Future" that led to the 1992 Earth Summit in Rio de Janeiro. The summit argued that the earth's natural resources; air, soil, minerals, fresh water, forests, have intrinsic values that must be safeguarded by everybody. All people even the poor were therefore to make some contributions at least for their maintenance. This formed a major historical shift in the management of water and other natural resources. Communities were to support in cash and in kind (Maggie 1998: 28).

The World Health Organization (WHO) in 1993 launched PHAST (Participatory Hygiene and Sanitation Transformation) model as an effort in involving communities in water and sanitation. PHAST has the proven principle of adult

learning and community participation. Communities possess a huge store of health-related experience and knowledge.

When people understand why improved sanitation and hygiene is to their advantage, then they will be motivated to meet the costs. PHAST model was therefore tried out in 1993 and 1994 in Botswana, Kenya and Zimbabwe. Key lessons learnt include:-Water development and management should be based on a participatory approach involving users, planners and policymakers at all levels, that Women play a central part in provision, management and safeguarding of water (WHO, UNICEF 2001: 15).

Building on the 1980s' water decade experiences and consolidating lessons learned, an international conference on community water supply and sanitation was held in USA – Washington in 1998. The conference resolved a shift in approach to water issues. The new approach was a shift from water service delivery (top – down approach) to demand responsiveness and community participation (bottom – up approach). This in essence required governments in Africa to redesign their programmes and policies in regard to water (Maggie1998).

At the turn of the millennium (2000), over one billion people lacked access to safe drinking water and two to three billion people lacked access to safe sanitation. Similarly about five million people die every year mostly children under the age of five from waterborne diseases caused by inadequate water, sanitation and hygiene (www.unicef.org).

Access to safe water is therefore a key focus in the world. In view of this scenario, In September 2000, 189 UN member states adopted Millennium Development Goals (MDGs) setting a clear time bound targets for making real progress on most pressing development issues. Goal Seven is on environment and water. The goal aims at reducing by half the proportion of people without sustainable access to safe drinking water by 2015. In order for this target to be

realized, 2.9 billion people will need to have an improvement in the water supplies .Several reforms are being initiated to ensure this goal is attained especially in developing countries (World Bank 2005).

Water has been a subject of concern by the Kenya Government since independence. Efforts towards the development of the water sector in the past had been based on the fact that water is a basic need and an important catalyst in accelerating development.

The Ministry of Water and Development (currently referred to as Ministry of Water and Irrigation) was created in 1974, with the key objective of supplying all Kenyans with clean water by the Year 2000. But these objectives, noble as they were, floundered against heavy fiscal burdens and inevitable budgetary cuts. Reforms in the water sector were initiated and cost sharing introduced. Local communities were asked to contribute in form of cash, labour and materials. These were part of the changes and conditions set by the World Bank under the Strategic Adjustment Programmes (SAPs) of the 1990s for African governments (GOK, Sessional Paper No.1). However despite all these endeavours, water still remains far inadequate to most communities in Kenya and by large Africa.

In Kenya, (2003 – 2005) period, water management has undergone a major policy shift aimed at improving services to Kenyans by separating policy formulation from service delivery. This in essence is devolution of water power structures. This began by the Act of Parliament that was passed to repeal the Water Act (Cap 372) and certain provisions of the Local Government. Consequently anew Water Act was enacted clearly outlining roles of different water authorities. This is commonly referred to as ***'The Water Act of 2002' (GOK, Kenya Gazette 2002).***

To support the operationalisation and ensure continuity of operations as roles are transferred to different institutions, staffs of the Ministry of Water and Irrigation and the National Water Conservation and Pipeline Corporation were in July 2005 seconded to the new institutions. Staffs with required skills, competencies and

experience were retained through a redeployment process while others were trenched. An Inter-ministerial Committee has been put in place to ensure the exercise is well coordinated. However the fears and concerns are how these changes will affect water costs and access in rural parts of Kenya. (www.water.go.ke)

The study therefore investigates the water reform process and how it is impacting on the health of the Maasai people.

1.2 Problem Statement

Water is an important natural source that sustains life. In addition, prospects for human development are threatened by a deepening global water crisis. For example, almost 2 million children die each year for want of a glass of clean water and adequate sanitation (UNDP-HDR 2006).More so; millions of women and young girls are forced to spend hours collecting and carrying water, restricting their opportunities and their choices. Worse still, water-borne infectious diseases are holding back poverty reduction and economic growth in some of the world's poorest countries (Ibid).

At community level (beyond the household), competition for water as productive resource is intensifying. Symptoms of that competition include the collapse of water-based ecological systems, declining river flows partly due to silting and large-scale groundwater depletion. Conflicts over water are intensifying within countries and communities (Ibid).

The Kenya Government water reforms aimed at decentralising water structures to increase efficiency, access, affordability and reliability of water sources in all parts of Kenya. The process has achieved the following: formation and establishment of seven Regional Water Service Boards, the Water Services Regulatory Board, Water Services Trust Fund and the Water Appeal Board. These institutions have been established to manage water resources, regulate water services provision and mobilize and promote efficient utilization of

resources. As a result of these measures, unaccounted for water (UFW) has been reduced on average by 12%.

In addition, 74 rural water supply schemes (community water projects), 89 dams and water pans and 82 boreholes were constructed or rehabilitated around the country in the period 2003 – 2005 (www.planning.go.ke).

To monitor water, quality, an analysis machine (Atomic-Absorption Spectrophotometer – AAS) has been procured and over 4,840 water sample collected and analyzed for quality in the last three years. Industrial effluent in major towns has been reduced by 60% due to regular surveillance (www.planning.go.ke).

Nevertheless, despite all these reforms and improvements, water shortages are common in most parts of Kenya and water-related diseases remain a threat and a concern to the health of most Kenyans. Furthermore, water is still a key issue that contributes to conflicts at community level. This is made worse by frequent droughts, river silting and interference with water catchments areas due to high pressure on land. For the Maasai who are Pastoralists and livelihood revolves around livestock, shortages in water and pasture present serious challenges and consequences.

Similarly water-related diseases such as diarrhoea, dysentery, skin diseases and eye diseases such as Trachoma are common affecting children and mothers in the study site. The World Health Organization (WHO) estimates that 80% of all sickness in the world is attributable to unsafe water and sanitation, WHO also estimates show that each year throughout the world children below five years - 1.5 billion suffer episodes of diarrhoea (www.water.org). In Kajiado District diarrhoea, eye infections and skin infections are among the common water-related health problems seen in the health facilities (GOK, Kajiado District, 2002)

The study therefore examines the effects of water reforms such as water costing, water management, water availability and reliability of water supplies. The study also investigates how the water reform process is addressing the issue of water safety and water-related diseases as cited above. Critically, an important question being asked by the study is how are water reforms different from the 1990s SAPs? . It should be noted that the 1990s, SAPs did not by and large achieve the intended objectives of improvement of services, generation of revenue and sustainability of water supplies. In addition, the study examines the health effects and implications of water reforms on rural communities, using the case of Maasai pastoral community of Kajiado. These issues therefore form the basis of investigation by the study.

1.3 Research Questions

This study was guided by the following research questions:-

a) What is the effect of water reforms on water-related diseases?
b) How have reforms in the water sector affected the Maasai of Loodokilani Location, Central Division, and Kajiado District?
c) Are perceptions of the community an impediment to the Water Reforms process?

1.4 Broad Objective

The broad objective of this study was to investigate the impact of water reforms on the health of the Maasai community of Loodokilani Location of Central Division, Kajiado District.

1.4.1 Specific Objectives of the Study

This study was guided by the following specific objectives:-

a) To investigate how the reforms in the water sector has affected the Maasai pastoral community (Loodokilani Location, Central Division, Kajiado District)
b) To examine trends in water-related diseases (hygiene and dirty water-related diseases) and water reforms

c) To find out changes in management of water as a result of water reforms?
d) To examine the community perceptions of the water reforms
e) To assess the objectives of the water reforms and emerging effects on the community

1.5 Rationale of the Study

Globalization and SAPs have negatively affected African social programmes. State budgetary cut backs have resulted in serious consequences on key sectors like water (Aina Akin et al 2004). In Africa, safe water is increasingly becoming expensive and unaffordable for the general public. Poor people also need access to water for productive use and to help provide a livelihood, such as for irrigation or animal husbandry. It is therefore important that reforms in water recognize needs and abilities of different members of society (Soussan 2004).

Kenya population is estimated at 28.6 million people, more than 50% live below one US dollar a day (GOK 1999 Census Report). Since independence, the water sector has undergone several changes, yet water availability remains a challenge.

The study focused on the Maasai of Kajiado, Central Division. The Maasai are dominantly pastoral people living in the Central Rift Valley in an area stretching from Southern Kenya to Central Tanzania. In Kenya, they are about 464,883 in number (GOK, Kajiado District Development Plan 2002- 2008). Over 75% of the population derives its livelihood from livestock production, which accounts for about 60% of the total labour force (Ibid).

The study investigated implications of water reforms in relations to water accessibility to livestock which is the mainstay of the Maasai. How do water reforms address livestock issues? The study further investigated why despite several approaches and policy reforms; water still remains far inadequate in most communities in Kenya. Similarly the study was interested in knowing why

despite increased safe water use awareness campaigns, water washable diseases remain prevalent in many communities in Kenya.

Policymakers, researchers, development agencies and the general public will find results of this study and recommendations useful.

1.6 Scope and Limitation of the Study

This study mainly focused on how water reforms addresses issues of water, disease and health. The study looked at water availability, water affordability, water management and water utilization. The study compared the above variables on water washed diseases (Water and hygiene practices which address diarrhoea, dysentery, skin diseases and eye diseases). The study basically analysed the effect of water quantity or availability on the prevalence of the above diseases. Similarly, the study also investigated waterborne diseases (limited to Typhoid, skin and eyes infections, Dysentery and Amoebiasis). This line of investigation looked at hygiene practices and how dirty water containing disease organisms can be harmful to health and how the water reform process is addressing this. The study also looked at Water reforms in relation to devolution of power and decentralisation of structures and implications to the local structures.

The study does not address water-related diseases which comprises of; Malaria, Bilharzia (schistosomiasis), River Blindness, Guinea Warm and Trypanosomiasis (Sleeping Sickness).

The study focus was also not on water quality standards which encompasses microbiological: Viruses, protozoa, schistosomiasis and helminthes, water contaminants which may cause infectious diseases. This is because quality assurance in water is complex even where treatment is done, evidence have shown that in certain cases chemicals in water may be harmful like high concentration of fluoride or nitrate levels.

Similarly the study does not address health seeking behaviour with view of comparing water disease burden and effectiveness of the health facilities in the area. Neither does the study address issues of distance to health facilities in the study site. These falls outside the study parameters.

In addition, while this study addressed reform issues in Kenya, the focus was on a limited setting: Loodokilani Location, Central Division, and Kajiado District. The findings therefore cannot be generalized but provides insights for further research.

CHAPTER TWO

2.0 LITERATURE REVIEW AND THEORETICAL FRAMEWORK S

2.1 Introduction

In this section, reports, journals, books, websites and writings both published and unpublished by different scholars on water and health has been analyzed and duly recognized. Three theoretical frameworks guided this study .These were Functionalism theory, '*The Systems Theory'* (Abraham 2004) and Health Belief Model (HBM) (*http://oc.nci.nih.gov)*. Details of these models are discussed in the last part of the chapter.

2.1.1 Community Structures And Participation in Water

(Orieko 1991: 2) suggests that community participation is a process and requires empowerment of the community in participation skills. That the way to people's participation is achieved through:- going to the people, living among the people, learning from the people, planning with the people, working with the people, starting with what the people know and building on what the people have.

In Kenya, the District Focus Strategy launched in 1983, was an attempt by the Government 'to go to the people' (Oyugi in Chitere et al 1991:33). In the ongoing water Reforms in Kenya; the fundamental principle of community water management is identified as, communities owning the process and the support agency being a facilitator of processes to enhance the capacity of the community to manage its water system.

Similarly, the water reform process should also recognize that efforts to enhance community management are not starting from scratch and many communities have had local structures and managed their own water supplies for a long time. So it is important to tap this traditional knowledge of water management which already exists. Moreover, recognition of existing community structures cannot be

addressed in isolation from the institutional context. It is important therefore that reforms in water are tailored along the existing structures (PLA No. 35: 1999).

2.1.2 Water Management: Professional and Local Knowledge

Whereas, it is true that water is critical to life and an average person requires 25 litres of water per day for drinking, cooking and personal hygiene (Guy 2002). Water reforms in Kenya have been very much shaped by the International Community and mainly driven by professionals. For many engineers, water is a technical matter. Therefore believed that if you address technical problems, the system will work. However, arguments in this study show the contrary:

"Visiting the same village, a hydrologist enquires about the water table, a soil scientist examines soil fertility, an agronomist investigates yields, an economist asks about wages and prices, a sociologist looks into patron – client relations, a doctor investigates hygiene and health,".

Some of these visiting professionals may be sensitive to the culture and needs of the people, but none is likely to fit all the pieces together, nor to be aware of all the negative factors facilitating the occurrence of the problem. Chambers therefore emphasizes participatory approach between professionals and Indigenous knowledge/skills in finding lasting solution to water in rural communities. (Chambers 1983: 23).

In addition, (Manzungu 2004: 6) suggests that for reforms in water to be achieved and sustained, the following steps are necessary: - Transparency and accountability through participatory mechanisms appropriate to local realities needs and wishes. That participation should be made meaningful to the participants through setting of attainable targets and realization that participation involves high transaction costs in terms of financial, human and time resources. Acknowledging power differences between various stakeholders, which ultimately determine who effectively, participates in what. Factoring in social and cultural aspects, which may hinder participation of some stakeholders, say of women and the poor and recognizing that participation is a process and not an event. In view of the above, (Manzungu 2004) strongly recommends that water management and reforms therefore should be people driven and collectively owned for sustainability.

2.1.3 Leadership, Social Systems and Water Management

WHO (1994) developed a handbook, to guide in water supplies and administration. The handbook stipulates that before any water scheme is fully operational, its potentials should be analyzed and cash raising options suggested. These may include:- Community fundraising abilities, indirect taxes, regular user charges, water vending and contributions in kind.

Caincross et al (1980) on the other hand raised pertinent issues on effective water supplies. The author argues that operation and maintenance of rural – water systems have received much less attention than their design and construction. The following issues are the concerns of the author: what proportion of the installation are functioning as intended and delivering sufficient water of acceptable quality?, what are the recurring operation and maintenance problems presented by the different technologies used in water supplies?, what policy frameworks support implementation?, what are the most important cultural and administrative features of village life to be taken into account when working out a socially appropriate operation and maintenance plan?, to what extent can beneficiaries be expected to contribute towards the operation and maintenance of their water supply?. How are leaders elected and made accountable to their electorates on water-related issues? .What mechanisms are in place to facilitate local ownership of the water projects?, what mechanisms are in place for involving the local people and ensures water service delivery and sustainability. These remains critical issues in the water reform process.

On the other hand, it should be noted that communities are complex social realities, it is impossible therefore to separate out the management of the water supply from other concerns. Management capacities can only be built successfully when there is a clear understanding of the social, economic and cultural characteristics of the community. Leadership is an important factor. If the leadership of a community is committed and receptive to change, the process

is likely to proceed smoothly, but if the local leaders are too dominant and want to pull all the strings of community life, they can also be counterproductive (PLA No. 35: 1999: 24)

(Kandawire in Government of Malawi, 1981) suggests a sociopedagogical approach to rural water development. The model incorporates scientific and traditional explanations to disease and tries to influence behaviour change through active participation. The author argues that the involvement of the whole community in the development programme presupposes that people in the community are aware of their problems and that they will make an effort to solve the problems through self-help efforts.

World Bank Paper (November 215) observes that communities in developing countries usually spend a significant part of each day trying to provide enough water for cooking, cleaning and domestic animals. That scarce water supply also means that personal hygiene is often relegated as there are more competing water needs. But to overcome these constraints and achieve sustainability, it is not enough to provide wells, pumps and the technical support to install them. Project designers should focus on 'software' or social capital within the same intensity they give to technical details. '*It is easier to construct a water system than to leave in place a local organization capable of managing it technically and financially*'. This paper (Ibid) also argues that for rural water projects to succeed those involved must be fully committed to the project and prepared to overcome operation and maintenance (O&M) of the new and improved facilities. Time and efforts must be spent helping local groups until they can manage water systems on their own. A village with limited capacity for social organization may require additional support, often mobilization and other advisory services.

The sociological model lays emphasis in social capital rather than machines as the basis and steps towards ownership and sustainability of water points by the local people. It is envisaged that the water reform process will find this model useful in facilitating ownership and sustainability of the water process in Kenya.

2.1.4 Gender Dimensions and Water

In many parts of the world, women are traditional providers of water for the household use and other household utilities like fuel. They are also responsible for disposing of household wastes, including children's faeces. Thus any instrumental role in water and service delivery to be assigned to communities must recognize the essential involvement and participation of women (Noma – 2000).

For many women in the developing countries, water supply provision is a major pre-occupation especially in water short areas. The investment of time and energy especially where pressure on local resources increases and water sources are further away is a significant drain on the household economy. Where water from natural sources is supplemented by informal vending or exchange, women have to find the means to pay for it, 'only when serious engineering and property – pipes and pumps enter the picture do men normally become involved' (Maggie 1998: 30). Furthermore, at the household and community level, when water had economic benefits the man tended to lead in decision making and the woman was satisfied as long as household needs are met. These findings confirm with previous gender findings and writings on access and control of resources at household levels (Moser in Tina Wallace 1991). Women generally have access, while men have both access and control. This has implications on access to information and services.

Water resources are a basis for the health and welfare of the poor and especially vulnerable groups such as children, the elderly, and women in general. Both the quality and the quantity of water matter. Safe and adequate quantities of water are recognized as a precondition for an acceptable standard of development. In order for the community to sustain water points therefore, gender issues are critical in the overall design of water projects (Soussan.2004).

2.1.5 Equity, Poverty and Water Reforms

According to WHO, health is a state of complete well being physical, social and not the absence of disease or infirmity. The Ottawa Charter (1986) reinforced on this definition by bringing in and emphasizing the aspect of disease prevention as key in the enhancement and enjoyment of better health, thus the concept of health promotion. Health promotion therefore is the process of enabling people to increase control over and to improve their health (WHO, et al 1986). Pre-requisites for health encompass:- Peace, shelter, food, and income, stable – ecosystem, sustainable resources, social justice and equity. Development on the other hand is the process that expands the choices people have in order to lead lives that they value (UNDP 2001:9). Paradoxes are raised regarding access to water, fairness in costing, distribution and affordability. Whereas UNDP Development Report (2003) shows that more than 1.2 billion – one in every five on earth – survive on less than one United States dollar a day, majority being in Africa, international policies on fair trade, globalization and Structural Adjustment Programmes seems to worsen the situation, by advocating that Governments in Africa remove subsidies, increase taxes to service foreign debts and meet structural governance obligations. Water is commercialized and charged according to the prevailing market prices. This defeats the logic of community empowerment, because at the time, WHO estimates that over 1,800 million people around the world lacked safe drinking water, Africa being the hardest hit with 75% (Maggie 1988)!.

2.2.1 The Kenya Government and Devolution of Water Services

Sessional Paper No. 1 of 1999 transfers the task for water provision from the Government to the people as means of improving water services to the citizens. The stakeholders and beneficiary communities should participate in the implementation, financing, operation and maintenance of water resources and supply facilities. All the prevailing management responsibilities that were fragmented among different sectoral agencies were to be integrated and to be in tandem with the worldwide reforms in water.

The reforms therefore led to the creation of the following structures (and their roles):

a) **Water Resources Management Authority**

This is a corporate body that functions under the direction of a governing board. It develops principles, guidelines and procedures for the allocation of water resources, assess national water resources management strategy, receive and determine applications for permits for water use, monitors use of water as per the permits, regulate and protect water resources quality from adverse impacts, manage and protect water catchments, determine water charges as per the water strategy guidelines, regulate water sources.

It also establishes offices in the Catchment Areas called Catchment Area Advisory Committee whose membership consists of Government officials, Stakeholders and Communities. The present Catchment Areas include: Lake Victoria South, Lake Victoria North, Rift Valley, Athi, Tana and Ewaso Nyiro.

b) **Water Supply and Sewage**

The Water Supply and Sewage Development is under the Water Service Regulatory Board. The functions include: issuance of licensees for the provision of water, determination of standards for the provision of water services to consumers, establishment of procedures for handling complaints, develop guidelines for providing advice on cost-effective and efficient management and operation of water services, monitor and promote water conservation activities.

c) **Water Boards**

i) **Water Service Boards**: These Boards ensure that every part of the country is catered for. Each service board is responsible for the efficient and economic provision of water services within its jurisdiction.

ii) **Water Service Providers**: Is authorized by the board for purposes of providing water in specified areas.

iii) **Water Services Trust Fund**: The objective of the trust fund is to support in financing the provision of water services to areas without adequate water services. It receives money from the government, donations or grants in order to finance these activities.

iv) **The Water Appeal Board**: Parties/Individuals aggrieved by the decision of the Authority or Regulatory Board concerning permit or a license have a right to appeal to the Water Board whose judgment shall be final. (Kenya Gazette, 24th October 2002)

These reforms aim at improving water supplies in Kenya and also to develop systems of accountability.

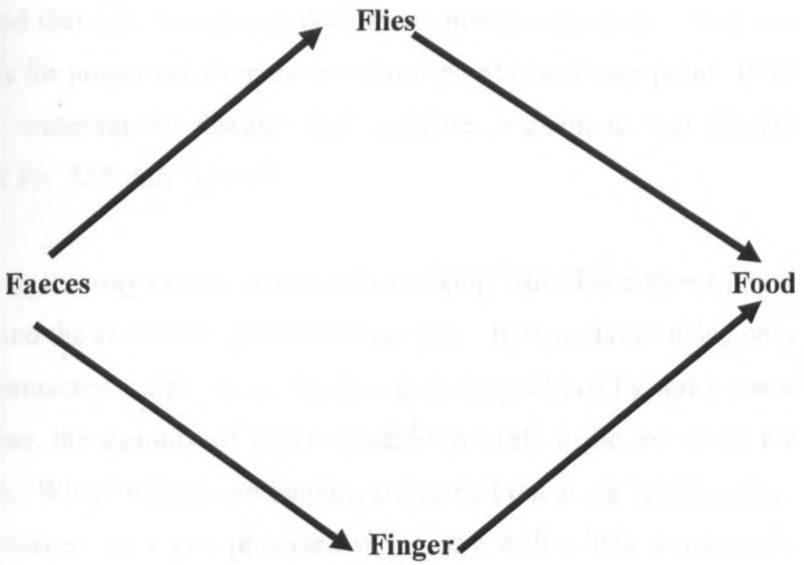
2.2.2 Water Diseases, Reforms and the Local Structures

Water reforms and governance refers to the various levels of political, social and administrative mechanisms that must be in place to develop and manage water resources including the delivery of services (www.unesco.org). Key tenets of governance include transparency and accountability, good policies, resource allocation, equity, participation, removal of social and cultural barriers that may hinder participation especially of women, the poor, youth and illiterate. Reforms in water therefore are a process and not an event and therefore require nurturing (Manzungu 2004:5).

(Wood et al 1997), on the other hand shows in details how water can affect health in a number of different ways. Lack of water for personal hygiene may result in the increased transmission of water-washed diseases. Water washed diseases include: diarrhoea and dysentery, skin diseases (including scabies), eye diseases (including trachoma). These can be prevented by the faecal oral route due to lack of washing hands, eating utensils and vegetable and by lack of personal hygiene – washing the face, eyes and body. To prevent the water washed diseases, water quantity is therefore important. The challenge is usually the unavailability of

water. Figure 1 below demonstrates this connection and interplay of Finger, Food, Flies and Faces on health.

Fig 1: The Four – F–Connection (Wood et al 1997: 184)



Water may also carry the organisms of specific diseases leading to waterborne diseases. These include: typhoid, cholera, poliomyelitis, amoebiasis and hepatitis (A). In contrast, these are due to dirty water containing the disease organisms themselves. To prevent waterborne diseases, it is necessary to improve the quality of the water.

Water-related disease on the other hand includes: malaria, schistosomiasis (Bilharzia) onchocerciasis (river blindness) drucunculosis (guinea worm), Trypanosomiasis (sleeping sickness). In general terms, more water leads to better health.

To prevent the above the wider aspects of the individual, environment and health should be addressed.

This study will be investigating how the water reform process is addressing these issues and the resultant effects on the beneficiaries.

2.2.3 Water Reforms and Implications on Health

During the Third World Water Forum at Kyoto Japan, a further argument was advanced that water provision alone is not health promotion unless accompanied by skills for proper use from the collection point to end user point. In the absence of this, water-related diseases will continue to claim its toll *(British Medical Journal Vo. 327, July 5, 2003).*

Similarly, the way people secure their drinking water has a direct impact on their health and the economic status of households. In households using only a remote and unprotected water source, health can be jeopardized by water contamination. Moreover, the quantity of water collected is likely to be too small for effective hygiene. When bathing and laundry are carried out at the source using improved water sources, such as a protected spring or a well within a reasonable walking distance, it does provide substantial health benefits. But hygiene may still be compromised and water may be contaminated during transport and storage (WHO: 2004:18). However once water is available, within home/community, then promotion of good hygiene behaviour becomes easier. An absence of adequate water and sanitation leads to disease on a massive scale. Improvements in water quantity, availability, reliability and quality are required to minimize the water-washed transmissions of faecal-oral diseases *(Journal of Public Health, 2003 Vol. 117, 452-456).*

Increased use of improved water and sanitation has many benefits: a significant reduction in disease, especially diarrhoea averted health related costs, and time savings associated with having water and sanitation facilities located closer to home. Time saved may translate into higher productivity and school attendance, more leisure time and other less tangible benefits, such as convenience and well being, all of which can have an economic impact. For example one of the recent successes in Africa has been steady progress in the eradication of guinea worm

disease through improved drinking water. The number of people suffering from this disease has been reduced by 99% from an estimated 3.5 million cases in 1986 to less than 35,000 reported cases in 2003 (WHO, UNICEF 2004: 10).

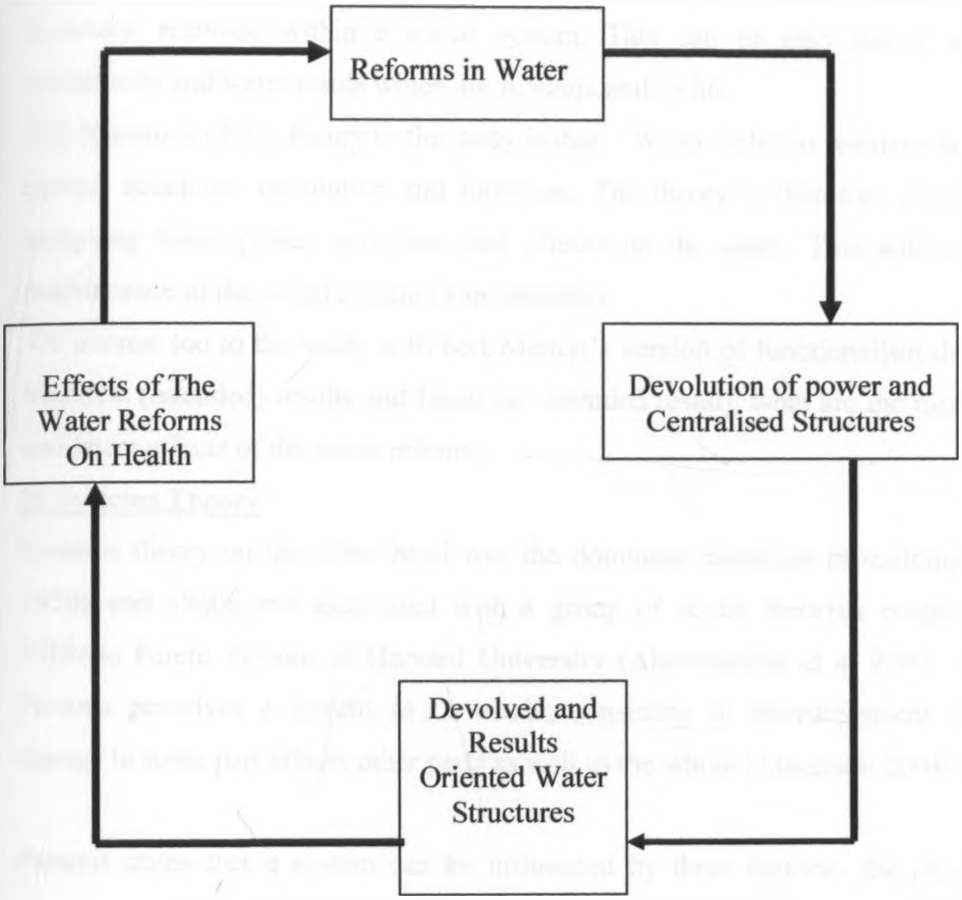
The major lesson learned from this guinea worm project is that water supply intervention accompanied by health education on safe water and disease prevention yields high dividends. To address water, sanitation and health issues a holistic approach, is therefore being suggested borrowing from the guinea worm scenario.

Similarly, where animals and human beings share the same water source, this may result into pollution by excrements of animals and the resultant may be waterborne diseases. This can have negative health implications on the people. This scenario is common practice in most rural regions in Kenya. It is envisaged that the water reform process will address this.

Studies and assessments have been done on water (WHO, 1998, Journal of Water and Health, 2005: Vol. 3). These studies observe that, while overall improvement in coverage remains far short of national and global targets, the sector has made significant progress for instance more than 2.4 billion people worldwide have access to better water services especially in Asia and Latin America. Nevertheless, access to water still remains a challenge to most communities in Africa. (Subra: 1997:3).

Arguments have been made that where user fees have been introduced, the poor has been denied access to essential services like health, education and water (Social Sciences, Medical Journal Vol. 36, No.11, and Vol. 34 No1). The study findings will validate this further.

2.2.4 Fig 2: Conceptual Framework: Devolution of Water Services



2.3.1 Theoretical Framework: Functionalism, Systems and Health Belief Model Theories

This study was guided by three theoretical frameworks. This is discussed as below:

a) Functionalism Theory

Functionalism theory was developed by Sociological fathers involving Comte, Durheim, Pareto, and Parsons. Although each had different views of this theory, they all agreed on the common principles that society is a functionally organised system where every part contributes to the maintenance of the 'whole'. The theory recognises that society is a dynamic social system that keeps evolving and therefore not static. In the process of evolution, changes occur which may affect the stability of the social system. However the system's parts must re- integrate for the maintenance of the equilibrium and the general system. They termed this

process as ***the homeostasis***. Radcliffe Brown and Malinowski added an Anthropological dimension to this theory by looking at individual needs and structural relations within a social system. This can be also linked to the community and water needs which are fundamental to life.

The relevance of this theory to the study is that, Water Reforms revolves around power, structures, devolution and functions. The theory is therefore critical in analysing water power structures and effects on the users. This will ensure maintenance of the social system (**homeostasis).**

Of interest too to the study is Robert Merton's version of functionalism theory: Manifest (Intended) results and latent (an intended result), what are the manifest and latent effects of the water reforms.

b) Systems Theory

Systems theory on the other hand was the dominant paradigm in sociology in 1950s and 1960s and associated with a group of social theorists centred on Vilfredo Pareto Parsons at Harvard University (Abercrombie et al 2000: 354). Parsons perceives a system as 'a whole; consisting of interdependent parts, change in some part affects other parts as well as the whole (Abraham: 2004: 42).

Parsons states that a system can be influenced by three factors:- the physical environment, the human activities (culture) and the inner elements (internal components) of the system itself. The above factors can maintain the system's equilibrium or change the system. A system may be defined as a set of things so related as to form a unit with recognizable inputs and outputs.

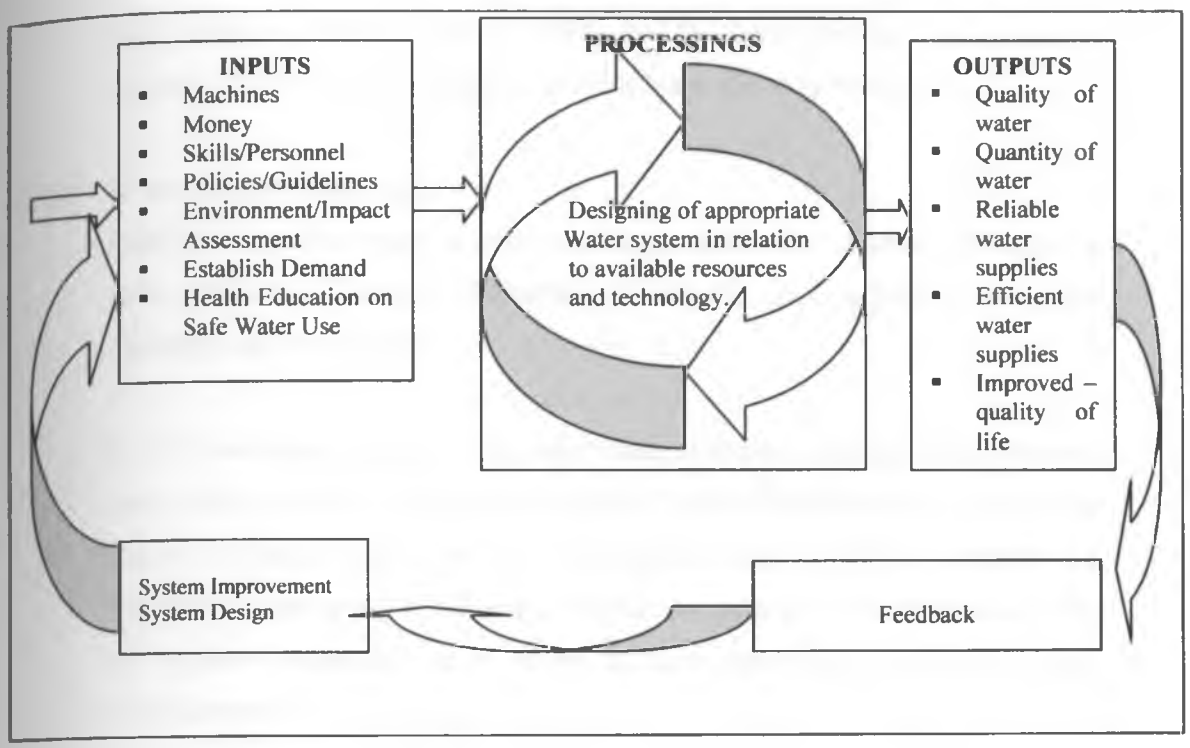
(Garret, 1973).

Gigch (1978) on the other hand states that systems are never perfect and requires constant monitoring. Gigch (1978) expounds on three elements that may translate into improvement of the system. These are:- the system does not meet its established goals, the system does not yield predicted results and the system does not operate as initially intended.

The above state justifies for a system's improvement (SI). However, if the results are not realized then Gigch suggests for a system's design (SD), which is a total overhaul of the system and designing of a new system. Designing the whole system means starting a fresh. In this study, systems approach will be instrumental in analyzing the water sector reforms in Kenya. Key concern of this study is whether the water supplies procedures in Kenya require an improvement or a re-designing!

Similarly, the system of water supplies will be compared with prevalence of waterborne diseases and water-related diseases in the study site with a view of coming up with findings whose implementation will impact positively on the health and wellbeing of people. The diagram in figure 3 shows how the system model works contextualized within the water reforms framework.

Fig 3: The Systems Theoretical Framework



c) Health Belief Model (HBM)

The third theoretical framework used in the study was: the Health Belief Model (HBM) which is useful in analyzing people's inaction or non-compliance. Originally introduced in 1950s, by psychologists working in the USA public Health Service *(http://oc.nci.nih.gov/services/theory)*. They assumed that people feared diseases and therefore health actions were motivated by perceived threats and benefits. That behaviour undertaken by individuals in relation to health is influenced to a large extent by self perceptions. Thus if an individual perceives himself/herself as being susceptible to certain illness/disease, they are likely to take some positive action. However, factors that enhance this course of action include: demographic variables such as age, sex, ethnicity and race, social psychological variables such as knowledge about the disease, peer pressure and access to mass media (Ndetei M. et al 2006).

This theory is used in the study as a means of seeking to explain water and hygiene practices, which has a relation in water-related diseases reduction. Of

interest in the study will be inaction or non compliance to ways of making water safe, adoption of good hygiene practices and the corresponding effect on related diseases like Dysentery, Diarrhoeaa, and Trachoma and skin infections.

2.3.2 Water Sector Constraints

Despite the strides made in water, challenges still exist. Global challenges in water include: - funding limitations, Inadequate cost recovery, inadequate operation and maintenance.

In the developing countries, varying challenges from countries, towns, districts and villages include:- financial difficulties, institutional problems, inadequate human resources, lack of sector co-ordination, lack of political commitment, insufficient community involvement, inadequate operation and maintenance, lack of hygiene education, poor water quality, insufficient information and communication.

Observations made from the field (Mzee 1980), reveal that most of the water projects that are commissioned become partially or fully in operative with time, where do things go wrong? Could it be finances, equipment, systems or the people themselves? (Mzee 1980), argues that the key obstacle are the technical personnel. That improper training translates into poor operation, inadequate skills, poor performance and poor maintenance.

Mzee (Ibid) argues that administrative bottlenecks are also a contributor as discussed below. The chain of technical information flow, instructions, date and records requires streamlining and co-ordination from the top to the bottom. For example the village mechanic or operator should pass information in the event of any abnormality or breakdown to the next level (district or provincial). (Mzee 1980) suggest that because maintenance problems are highly technical and unpredictable no one isolated functional unit can solve all the problems. The success of a rural water project depends on the existence of a systematic and comprehensive working principles built on past history and experiences. It is

therefore important, that the choice of the technology is correct and appropriate in the first place.

This needs to be supported by timely and routine maintenance. As illustrated in (figure2), this model will guide the study. (Noma 2000) however, argues that maintenance and sustainability revolves around two concepts: Sustainable Service and Demand-Responsive Approaches. According to Noma (Ibid), sustainable service entails: capacity of the community to maintain water supply system at an acceptable level through out design life span of the system without direct external support. This applies to both the physical infrastructure and the management of the system. Survey done by the author in designated water points established that most of the water facilities in rural Africa (Eastern and Southern) were found functioning and that communities collected funds for system operation and maintenance although often financial management was poor. Technical training and back up such as ability to get spare parts were found essential. All communities had water management committees with duties and responsibilities that varied from community to community. The more a community had an actual voice in such matters as selecting committee members, the more it felt it owned the scheme and the more effectively it managed the service. "The bigger the role of the user, the greater the chance of effective financing, functioning and management" (Ibid).

The second component of community sustainability of water supplies is Demand-response (Ibid). According to (Noma 2000), this allows the user to guide the key investment decisions. They establish clear links between what users want and what they are willing to pay for in cash, kind, labour and time. 'The more a community decides what it wants for itself, the more it sees the system as its own and is willing and able to sustain it.'

However, Noma (Ibid) contends that demand alone, does not create sustainability. Community involvement at all stages is essential. That community involvement at:- initiation, implementation, operation, maintenance, monitoring and

evaluation, training and technical back-up and extension services backed by appropriate and low-cost is vital in sustainability of rural water projects. Findings and recommendations of Noma (Ibid) forms a critical base in the study.

2.3.4 Summary of Literature Review

The literature review has looked at global, Regional, country and the study site water issues. Outstanding issues identified are that water reforms have been on going process characterized by debates and controversies. The International Agencies play a key role in water sector reforms. Equity, power and water costing remains emotive issues in the reform process in Africa and Kenya in particular. Water safety and availability remains a challenge especially in rural and slums settlements in Africa. Water washed diseases like diarrhoea and waterborne diseases like Bilharzia is an increasing challenge due to poor hygiene practices and water pollution. The literature review has also identified the issue of policy direction as fundamental in any reform process. The entrenchment of the reform process in the constitution (Kenya Gazette 2002) demonstrated the Government of Kenya commitment on water reforms. The literature review identified gaps and recommendations that provide a basis for further investigations.

2.4 Operationalisation and Measurement of Variables

A variable is a characteristic of a unit or an attribute for different observation (Singleton 1988:72). In an explanatory study, there are two types of variables. Dependent variable is the one which the researcher is interested in explaining and predicting. The independent variable is the variable that explains or predicts changes in the dependent variable(s). The independent variable is presumed cause while the dependent variable is the presumed effect (Ibid). In this study, the following variables are defined as:-

2.4.1 Water reforms

Ongoing changes in the water sector as outlined in the Kenya Gazette Supplement – 24th October 2002.

2.4.2 Local water committees

Designated groups for providing guidelines and implementation of Government water policies at specific water points and units.

2.4.3 Water safety

Process of ensuring that water is free from micro-organisms that can be harmful to the human body.

2.4.4 Water Management

Development and implementation of guidelines for effective use and conservation of water.

Table 1 – Operationalisation of Study Variables by Objectives

Objectives	Types of Variable	Study Variables	Variable Indicators
1. To investigate how reforms in the water sector is affecting the Maasai Pastoral community (Loodokilani Location, Central division Kajiado)	(a) Independent Variable: Water reforms	Water quantity	- Reliable water supply from various Sources. - Improved water services. - Good monitoring and tracking system of water sources in the community.
	(b)Dependent Variable: Devolution of power and water structures	Functions of Water Boards, Authorities and Committees clearly outlined and rolled out	- Water Regulatory bodies in place and supporting water committees at community level. - Clear guidelines for setting water charges and waivers. - Linkages/ collaboration structure involving water users, donors, private sector and the general public in the reform process.

Objectives	Types of Variable	Study Variables	Variable Indicators
			- Number of water points rehabilitated, constructed - Water user charges acceptable and affordable - Proper procedures for electing leaders in place - Leaders elected and using management Guidelines as outlined in the Water Act 2002.
2.To examine trends in water-related diseases (hygiene and dirty water-related diseases) and water reforms	(a) Independent variable: water reforms.	Types of reforms	- Policy changes in water. - Decentralization of the water sector. - Rolling out of the new decentralized structure up to the grass root.
	(b)Dependent variable: water-related disease prevalence	Water, Hygiene and Sanitation	- Diseases related to water (Trachoma, Skin Infection, and Typhoid). - Methods of making water safe for human use and consumption. - Prevalence of water washed diseases (Diarrhoea Dysentery, Skin.

Objectives	Types of Variable	Study Variables	Variable Indicators
			Diseases/Scabies, Eye diseases especially among Children). - Trends of water borne diseases (Typhoid, Cholera and Amoebiasis) - Hygiene and sanitation practices in the community.
3. To find out changes in water management as results of the on going reforms in water?	(a)Independent Variable : Water reforms	Types of changes in water management at the grassroots	- Guidelines for governing of water points in place
	(b)Dependent Variable: Water Management	Structures established to run water points in Kajiado	- Number and types of water providers licensed
4. To examine the community perceptions of the water Reforms	(a)Independent variable : Water reforms	Objectives of water reforms	- water costs - water availability - water quality/safety
	(b)Dependent variable: Community perceptions	Knowledge of water Reforms	- Understanding of water reforms - Fears related to water reforms

5. To assess the objectives of the water reforms and emerging effects on the community	(a)Independent variable: Water reforms	-Devolution of water structures	- Types and number of structures devolved
	(b)Dependent variable: Effects of water reforms	-Distance to water points	-Types of water supplies - New water points developed /Rehabilitated

2.6 Definition of Key Terms

1. Reforms : Government driven process that facilitates specific policy changes in water access, costing and utilization.

2. Household : Consist of a person or a group of persons who live together in the same homestead/compound but not necessarily in the same dwelling unit, have common housekeeping arrangements and are answerable to the same household head (GOK Population Census definition).

3. Sanitation: Science of the environment: water, toilets and housing.

4. Water-washed Diseases: Diseases caused by lack of water, leading to poor personal hygiene and general hygiene like lack of washing the body, eating utensils, vegetables leading to diseases like Diarrhoea, Dysentery and Trachoma

5. Water Borne diseases Diseases caused by dirty water containing disease organisms like Amoeba, Cholera and Typhoid

6. Water-related Diseases Diseases related to water like malaria, Schistosomiasis (Bilharzia), River Blindness, Guinea Worm and Sleeping Sickness

CHAPTER THREE

3.0 STUDY METHODOLOGY

3.1 Introduction

The purpose of this unit is to outline approaches that were used in obtaining data and how data was analyzed. The chapter similarly describes in details the study site, reasons for choosing this site, research instruments and criteria for determining the sample size.

3.1.1 Research Site: Background Information

The study site was Loodokilani Location, Central Division of Kajiado District. The area is mainly inhabited by the Maasai who practice semi-nomadic Pastoralism on land that was initially communally owned. However, this is undergoing changes from group ranches to individual land tenure system (GOK – Kajiado District Development Plan 2002).

Kajiado District Population is 464,883 (males being 236,249 and females being 228,634). From the above total, the youth are 111,580 which is 24% of the population. The total fertility rate is 6.3 per woman and the average household size is 4.2.

The district has seven administrative divisions with forty seven locations. Central Division which is the focus of this study has ten locations with a population of 69,402 (35,813 – males, 33,589 – females) and 16,630 households
(GOK, Census 1999: Vol. 1).

The average distance to the nearest health facility is 10 kilometres and the doctor patient ratio is 1: 66,412. Kajiado has two district level hospitals, 19 health centres, 40 dispensaries and 26 private health institutions (GOK: Kajiado District Development Plan 2002). Common or main diseases are malaria, upper respiratory tract infections (URTI), diarrhoea, eye infections, skin infections and intestinal worms (GOK, Kajiado District Development Plan 2002).

The area has a bimodal rainfall pattern. The short rains fall between October and December, while the long rains fall between March and May, with an average of 500 mm – 1250 mm per year. The highest temperatures of about 34°C are recorded around Lake Magadi while the lowest minimum temperatures of 10°C are experienced at Loitokitok on the eastern slopes of Mount Kilimanjaro. Moreover, Noorlturesh water project supplies water to communities along the pipeline to Machakos without supplying the local community.

The district does not have adequate surface water resources for livestock and human consumption. To a greater part, therefore, the district depends on ground water, a resource which is influenced by climate, topography and the underlying parent rock. The other alternative source of water for domestic and livestock are sub-surface resources such as water pans, dams and shallow wells.

The district has three permanent rivers 259 wells, 24 protected springs, 105 earth dams, 400 operational boreholes and 200 non-operational boreholes and 860 households with roof catchments. The average distance to the nearest potable water point is 10 kilometres. The district has average total households of 96,621. Number of households with access to piped water is 26,354, number of households with access to portable water is 27,000 (GOK: Kajiado District Development Plan 2002).

3.1.2 Cultural and Social Organization of Maasai

The Maasai are the dominant group in the study site.

The Maasai are sometimes called Nilo Hamitic, who migrated from North Africa. All Maasai tribes share the Maa language hence the name Maasai. They share the Maa Language with the Samburu from whom the split sometimes ago. The Maasai are semi-nomadic pastoralists, who derive their livelihood mainly from livestock. The Maasai believe that their god Ngai (rain) granted all cattle to them

for safekeeping when the earth and sky split. They, therefore feel justified when raiding cattle from other ethnic groups, though this is changing with time.

The cattle serve many purposes: their milk is used for food, their hides are use for mattresses, shoes and accessories, their during is used for plastering hut walls, their urine (sterile) has some medicinal and cleansing qualities, their meat is rarely taken for food (but may be used during ceremonies and in times of famine or sell to meet pressing fundamental needs).Cattle are a major sign of wealth though other animals including goats, sheep and donkeys are also kept. The Maasai are turning towards some cultivation (usually maize and some vegetables) to supplement on their dietary needs as grazing pasture land is getting scarce.

3.1.3 The Maasai Home

Maasai families lives in an 'Ekang Manyatta', a form of thick fence of sharp thorn bushes containing about 10 – 20 small squats huts made from branches pasted with cow dung by the women. Huts are small, with two room separation) they are dark with a small doorway and tiny hole/holes on the sidewalls. Purposes of the hole (window) are to let some smoke to escape from smouldering (cow dung) fire which is kept burning for warmth and cooking and to let off unwanted insects like flies. The Maasai traditional houses (Manyatta) are designed in such way that they cannot collect any water during the rainy season.

3.1.4 Mode of Transportation

The road network is poor in all divisions of Kajiado District. In Central Division (study site), the area is dusty during dry season and muddy and impassable during the wet season. Mode of transportation is mainly by donkeys, bicycles and old modified Land rovers, which are used as 'Matatus' (public transport vehicles).

3.2 The Study Site

The study site was Loodokilani Location, Central Division, Kajiado District. The site was purposively selected because of the following factors:-

It has six public and one private boreholes that are operational, four boreholes that are non-operational (broken down). The area has over one hundred water pans and several traditional water wells, three seasonal lakes (Noon Kujit, Kaponko and Kwenia) and three seasonal rivers (Toroka, Indidupa and Suree). These variables made the site unique and quite relevant for the study and therefore influenced selection.

In terms of convenience and centrality of the ten locations that form Central Administrative Division, Loodokilani Location is one of the largest locations with both features of modernity and tradition. The location also exhibits aspects of modern homes and traditional 'Manyattas', modern water points and traditional water collection points (See Map in appendix section).

Similarly, the location host major water based NGOs like AMREF and in terms of population; this is one of the densely populated rural locations in Kajiado District. The location also has most aspects of the Maasai Community in terms of shelter, livestock and social organization. These factors therefore influenced site selection.

3.3 Unit of Analysis and Observation

According to Singleton (1998:69): Entities (objects/events) under study are referred to in social research as unit of analysis.

Nachmias and Nachmias (1996: 53) define the unit of analysis as the most elementary part of the phenomenon to be studied. In this study, the unit of analysis was water points (reforms and implications local structures and the user's health).

On the other hand, unit of observation is the subject, object, item or entity from which measurement and characteristics or data is obtained from. This can be an individual person, a house, pupils in a class, animals (Mugenda and Mugenda 1999: 15). In this study, the unit of observation was water users (people at collection and end point – households and animals).

3.4 Research Protocol

Letter requesting permission from authorities (Government, Community Leader) was written and permission granted at the local level. At national level, a letter from the University was forwarded to the Ministry of Education, requesting for a research permit. The Ministry of Education issued a six months research permit (appendix section). Rights to confidentiality of the respondents were upheld. Similarly, research findings have been confined for use of the intended purposes (academic knowledge and contribution to the ongoing reform process). Similarly respondents (household questionnaires and key informant interviews) were adults as defined by the Kenyan Laws that is above 18 years.

3.5 Study Design

The study design was to obtain data from household survey, conduct in-depth interviews from key leaders and resource persons. This is explained in details in subsequent sections.

3.6 Sources of Data And Methods

This study used primary and secondary data. Primary data was obtained from the field, using data collection instruments which are both quantitative and qualitative (a house hold questionnaire, observations and Key informant interviews). Details of the data instruments are explained in section 3.6.1. Secondary data was obtained from reports, journals, and records from Government Offices, water points/ Committees, health facilities and relevant websites. These were either published or unpublished documents.

3.6.1 Research Instruments and Respondents/ Inclusion Criteria

This study obtained data from household survey using a questionnaire .This was supplemented by key informant interviews and secondary data. The process and tools were as follows:

(a) Quantitative Instrument 1: Household Questionnaire

A questionnaire was developed containing both closed and open ended questions. This was the main instrument of collecting data in this study. The respondents were household heads responsible for water collection and management at household level. One Research Assistant was recruited from the community to support in household data collection and translation of issues in Maasai language where necessary. The actual process of identifying households for inclusion in the study is explained in details in *section 3.7.*

(b) Qualitative Instrument 2: In depth Interview Guide

In-depth interview was used to obtain information from key informants. Open-ended questions guided the discussions on a one to one interview. Respondents were chosen purposively by virtue of the positions they hold on water committees or the role they play in the water reform process in ministry of Water and Irrigation at National, District and local levels.

(c) Qualitative Instrument 3: Observation Guide

Observation through a check list was carried out by the researcher and his assistant. This involved the researchers observing different aspects of the community in relation to water at the following levels, water points, water committee meetings, animal watering and water fetching modalities. This enhanced understanding of cultural and power issues, especially the devolution process and creation of structures for management of water.

The choice of the above tools was also influenced by the research objectives and research questions.

3.7 Sampling Design and Sample Size

Singleton (1988:137) defines sampling design as 'that part of the research plan that indicates how cases are to be selected for observation.

This is explained in details as below: The sample size was calculated based on random sampling design assuming a normal distribution of the characteristic

under study in this case access and availability of water in Central Division. The following formula by Kish, Leslie *(1965)* was used in determining the sample size.

The first step involved computing a sample size, S, based on an infinite population;

$$S = z^2p\ (1\text{-}p)/d^2$$

Where z is a percentile of the standard normal distribution which in this case was 1.96; p was an estimated of one of the characteristics under study and in this case is the proportion of the population with access to water (estimated at 27%) and d is the margin of error tolerated and in this case is 0.01.

The second and last step was to adjust the calculated sample size (S) by a finite population correction factor to obtain the final estimated sample size. This was done as follows;

$$n = S/1+(S/N),$$

Where n is the final estimated sample size, S is the calculated sample size based on an infinite population and N is the population of Central division.

Therefore in a population of 8856 (Loodokilani location), with 1810 households (Central Bureau of Statistics, 1999) with an estimated 27% of household with piped water (estimated from district proportions), a sample size of 60 households will ensure 99.99% confidence and the true proportions of households with water in the sample will lie between 22 and 32% (confidence interval).

Random sampling was used to select the first household in order to avoid bias, then systematic sampling was applied in selection of the 59 the households, making a total of 60 households. The systematic sampling involved listing of all elements in the designated population, and then selecting of every Nth (example) household from the list for inclusion in the study.

The random sampling method involved giving a number of every subject or members of the accessible population, placing the numbers in a container and

then picking at random. The subjects corresponding to the number picked were included in the sample (Mugenda and Mugenda (1999:45). Key informant interviews were purposive as already explained.

3.8 Data Collection

Data collection was done by the researcher, assisted by one Research Assistant, recruited from the community and trained on basic research skills. Quality controls were ensured by the constant feedback and experience. The arrangement in place was that all the two of us accomplished one area before moving to the next. This ensured consistency.

3.9 Data Analysis

Once data collected was brought from the field, the closed ended questions were coded and entered in a code sheet from which they were entered into a computer using Statistical Package for Social Scientists (SPSS). It is from this that interpretation was derived from. Qualitative data was summarized, classified into themes and analyzed.

CHAPTER FOUR

4.0 DATA PRESENTATION AND ANALYSIS

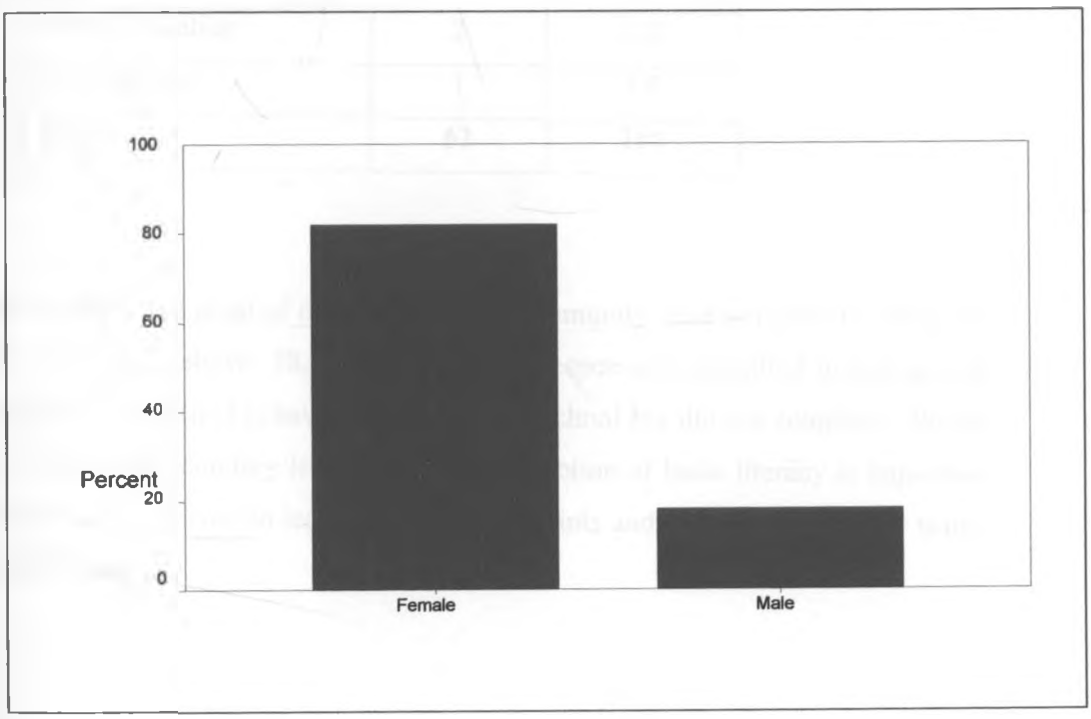
4.1 Introduction

This chapter presents study findings and analysis, derived from a household questionnaire and key informant interviews. 62 households responded to the questionnaire (31 from Elangata Wuas and 31 from Toroka sub locations, Loodokilani location). This was supplemented by twelve key informant interviews conducted at three levels: Community, District and Ministry of Water and Irrigation Headquarters Nairobi.

4.1.1 Socio Demographic Characteristics of Respondents

4.1.2. Sex of the Respondents

Graph 1: Sex of the Respondents



The bar graph above (graph 1) shows that of the 62 respondents, 80.6% (n=50) were female while 17.7% (n=11) were male. Contributing factors for this scenario include: this was a household survey, pastoral Maasai men prefer water issues at household level to be addressed by women. Similarly, most of day hours, the men are outside the homestead either addressing livestock or community issues.

4.1.3 Level of Education

Table 2: Education Levels of Respondents

Level of Education	Frequency	Percentage
None	36	58.2
Complete Primary school	9	*14.5*
Never completed Primary	11	17.7
Secondary education	2	3.2
Higher Education/College	1	1.6
Adult Education	2	3.2
No Response	1	1.6
Total	**62**	**100**

The study revealed that most of the people in the community have not gone to school as reflected in (Table 2) above. 58.2% (n=36) of the respondents admitted to having not gone to school, 17.7% (n=11) have gone to primary school but did not complete. While 3.2% (n=2) went up secondary level education. Promotion of basic literacy is important especially to those involved in leadership of water points and women who handle water safety issues at home.

4.1.4 Sources of Income

Table 3: Sources of Income

Types	Number	Percent
Livestock	22	36.7
Informal (Jua Kali)	11	18.3
Casual Workers	9	15
Pension	6	10
Missing	12	20

Regarding the question on main sources of income for the respondents, majority (Table 3) 36.7% (n=22), of the respondents are livestock-keepers, 18.3% (n=11) are informal (Jua Kali) workers, 15% (n=9) are casual workers and 10% (n=6) depend on pension. These are the retired civil servants. The low number of pensioners may be linked to level of education as shown in Table 2.

4.2 The first objective of the study was to investigate how Water Reforms are affecting the Maasai Community of Loodokilani Location Central division, Kajiado district.

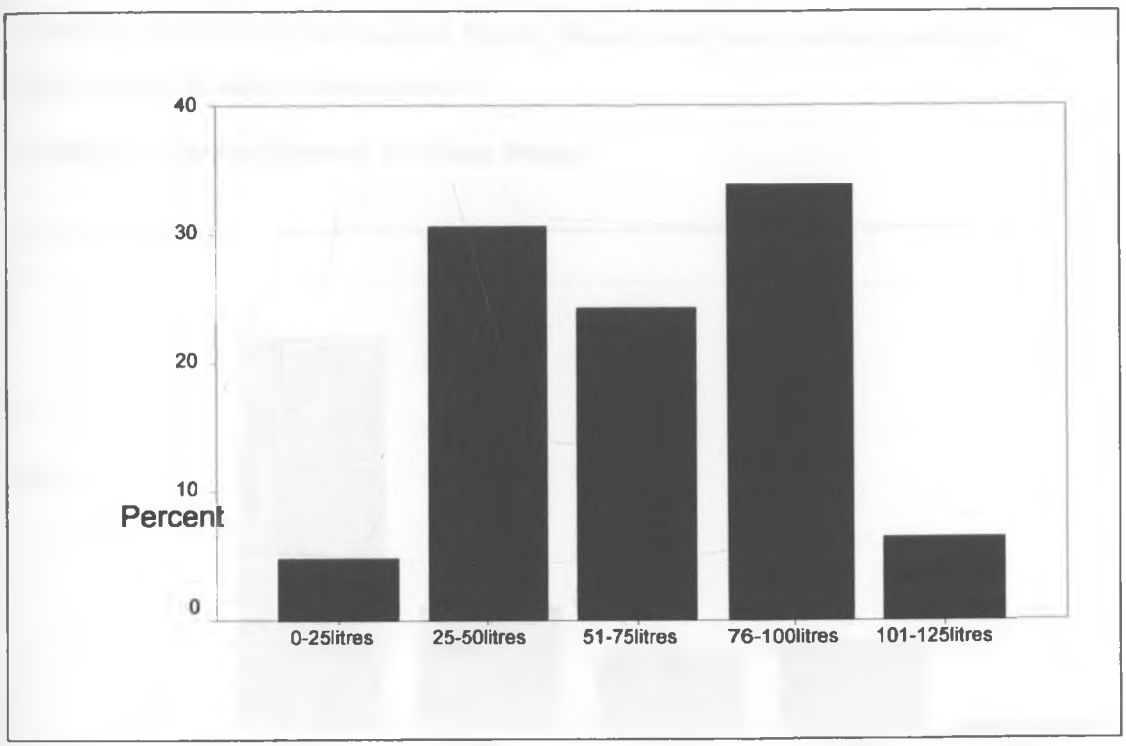
The findings are discussed as follows:

4.2.1 Table 4: Main Water Sources for the Households

Item	Frequency	Percentage
Borehole	30	48.4
Open Public well	20	32.3
Dam	5	8.1
River/Stream	3	4.8
Public Tap	1	1.6
Open well in compound	1	1.6
Rain water	1	1.6
Other	1	1.6
Total	**62**	**100**

Table 4, above reveals that majority of respondents 48.4% (n=30) and 32.3 % (n=20), respectively get their water from boreholes and open public wells for their household and livestock needs respectively. Followed by dams 8.1% (n=5) and river/stream 4.8 %(n=3). Very few residents use public tapped water and open wells in the compound. This is because there is limited standing water taps in the two locations and also due to unreliability of the rainfall, wells dry up very fast. Relating this to Reforms in water, the government should create incentives for people to explore alternative sources for harvesting and tapping water. Especially open wells technology should be improved and supported as away of increasing accessibility to reliable water at short distance.

4.2.2 Graph 2: Household Water Consumption Pattern

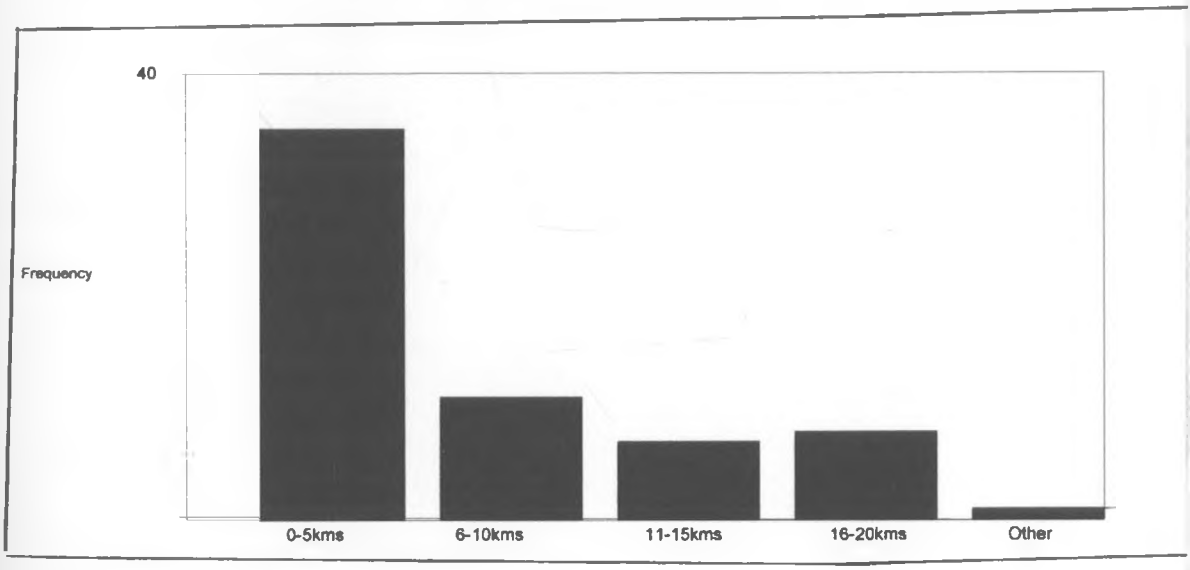


33.9% (n=21) of the 62 respondents said that they consume between 76-100 litres of water per day, 30.6% (n=19) consume 25-50 litres of water per day, 24.2 (n=15) consumes 51-75 litres of water per day. Only 4.8% (n=3) consumes between 0-25 litres per day.

Generally, 80.6% (n=50) of the total respondents admitted that the water fetched in their house is not sufficient for their daily needs.

This was compared with WHO minimum water ratio of 25litres of water per person per day for cooking and washing (Guy 2002:19) and the population in the household established by this study as 5 people per household. Comparing to the population per household therefore, none of the household therefore meets the WHO minimum ratio. This was confirmed by the Athi Water Services Board estimates of Kajiado District water supply coverage which is estimated at 3% (www.awsboard.com), which far inadequate. The purpose of the Reforms in water is to improve water accessibility and water safety. The Water Reforms therefore are far from the required targets, though most respondents confirmed improvement in water is being noticed.

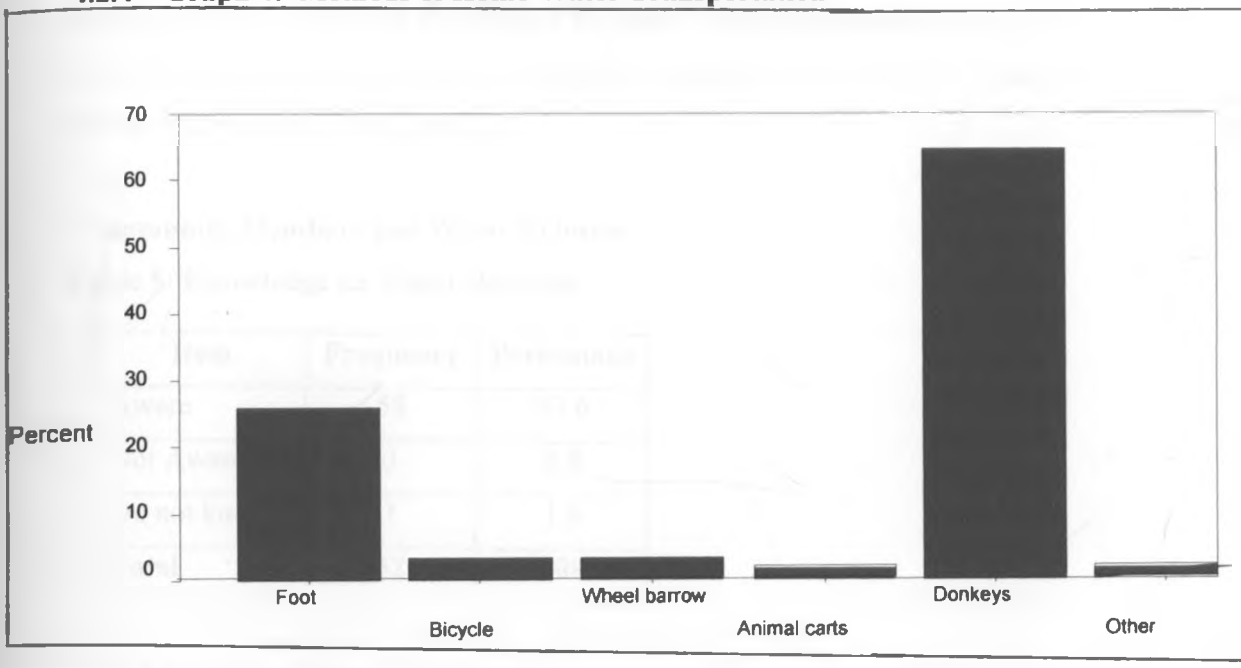
4.2.3 Graph 3: Average Distance to Water Points



Regarding distance to the water points, (Mainly a borehole), majority of respondents have access to water, as 56.5% (n=35) are between 0-5 kilometres from their residences, 17.7% (n=11) are 6-10 kilometres from the water source. Key informant interviews attributed this factor to works of development agencies (UNICEF, CCF, AMREF and KMQ) that have

sunk boreholes and rehabilitated and supported mentainance of boreholes. However it was also established that during the dry season, boreholes frequently breakdown due to increased demand for water beyond coping capacity of the boreholes and therefore distance to the nearest borehole generally increases. It is envisaged that when reforms are fully implemented, this will no longer be a problem.

4.2.4 Graph 4: Methods of Home Water Transportation



Donkeys are the most common way of transporting water to the houses as 64.5% (n=40) confirmed this, followed by foot 25.8% (n=16). Bicycles and wheel barrow are the least common methods as responded to by 3.2% (n=2), details in graph 4 above. The reforms in water should aim at reducing distance to reliable water point to about two kilometre radius. This will ease pressure on animals used in water collection and women, whose main mandate among others is water fetching.

4.2.5 Maintenance of Water Points

Maintenance of the water points is critical for the sustainability of clean and safe water. The study established that 66.1% (n=41) of the respondents attributed water maintenance to fees obtained from charges levied from water users, 14.5% (n=9) attributed to Government support and 19.3% (n=12) attributed to NGOs and donor support. Key informant interviews, however established that that routine mentainance is generally done by the water committee using water levy money. However, all committees interviewed confessed that the user levy money alone cannot undertake a major breakdown due to the high cost in spares. In the past the government, NGOs, companies like KMQ, Magadi Soda and Olkejuodo

County Council are approached for support. It is therefore difficult for the water committees alone and the community to service major breakdowns with the current levies, unless the costs are adjusted upwards. This will deny many households accessibility to safe water.

4.2.6 Community Members and Water Reforms

Table 5: Knowledge on Water Reforms

Item	Frequency	Percentage
Aware	58	93.6
Not Aware	3	4.8
Do not know	1	1.6
Total	**62**	**100**

On the issue of whether the community is aware of the ongoing reforms in the water sector initiated in 2003, majority of the respondents 93.6% (n=58), said they are aware while 4.8% (n=3) said that they are not aware and 1.6% (n=1) said that they do not know (as indicated in table 7 above). Further probing through informant interviews revealed that a lot of sensitizations have been done by the Government through the local administration, water committees and group ranches.

The study also wanted to ascertain whether Water Reforms and changes in Water are being properly addressed by the Government, 61 % (n= 38) said no, while 39% (n=24) said yes. Further probing through key informant interviews identified underlying fears by the community and suspicions that the Government is abandoning a key responsibility and passing the buck to the people, so that it is no longer held responsible on issues of water shortages and scarcity.

A key respondent paused,: '*how can you liberalize water without addressing the issue of poverty at household levels, this is one way of the government passing the buck and refusing to take responsibility on a key issue like water'* (Water committee Chairman) . This was also supported by a community elder who said:

'For us water means everything, if the Government transfers this task to water committees alone and the private sector, the burden will be heavy in terms of costs , maintenance and future expansions.' Community Elder.

Some of the Key respondents attributed water reforms to SAPs of 1990s, where the government introduced cost sharing in key services with the re3sultant effect of sharp increases in key services like health, water, education. However interviews with senior staff at the Ministry of Water and Irrigation revealed that the government is looking at modalities of liberalising the water sector and at the same time cushioning the poor and needy areas like Arid and semi arid areas. Details are being worked out as the reform process rolls out.

4.2.7 Reforms and Water Availability

On the question, as to whether they think water provision in the community is improving, 77.4% (n=48) felt so, while 22.9 %(n=14) said no.

Interviews with Ministry of Water and Irrigation senior officials at the headquarters established that the focus of water reforms is water availability, affordability and safety in relation to regions' differences. Strategies being developed therefore are to address uniqueness of each region.

However, this segmentation process has not been rolled out at the grassroots as this study established. Instead most of the achievements are attributed to NGOs, private companies (KMQ) and International Agencies like UNICEF and AMREF.

4.2.8 Water Reforms: Costing and Access

According to interviews conducted at the Ministry of Water and Irrigation headquarters, water coverage has greatly improved as a result of the reforms. For instance budget allocation has improved from Kenya Shillings3 billion in 2003/4 Financial Year to 12 billion in 2006/2007 Financial Year. Unfortunately, this amount has mostly been allocated to rehabilitation and expansion of urban water schemes. Areas in the urban areas which previously did not receive water now can receive adequate supplies of water. Steps have been taken to minimize frequency of water breakdowns. *'To safeguard consumers from exploitation, the Government statutes stipulate that any changes in the water tariffs are to be*

approved by the Ministry of Water and Irrigation. To maintain costs at minimal levels in the rural areas, the Government will provide subsidies to rural water providers' (Ministry of Water and Irrigation, Senior Hydrolist).

However this study findings show that the rural areas have not been attractive to investors. Attributable factors identified through interviews include fear of investors to recover costs and fear of prompt payment in the rural areas.Simialrly this study established that in the urban areas of Kajiado town for instance water has been made available more frequently than previously, but costs have gone up and users felt soon affordability of safe water many be out of many of them.

The current ongoing practice established by the study regarding the issue of water costs and exemption in the rural areas is that, the water committees use the number of livestock per household to determine how much one is to contribute. This ensures fairness, as livestock is an indicator for wealth in the community. Similarly the same criterion is used when determining exemption cases. The water committee members said that by using livestock to determine the cost, it also ensures that the man who is the head of the household meets the costs of water as he has the right and power over resources in that household.

4.2.5 The second objective of the study was to examine trends in water related diseases (Hygiene and dirty water related diseases) and water Reforms.

The findings are as follows:

The ministry of Water and Irrigation emphasises that Reforms in Water is on accessibility of the community to safe water and affordability. Currently, water fetching mainly rests on the woman as confirmed by this study 82.3 % (n=51) and only 8.1% (n=5) said done by men. This creates a lot of pressure on women among other competing needs. Does this have corresponding effects on women health?. Comparison was done from two leading health facilities in the study site on the water-related morbidity patterns (Tables 6 and 7) below and established that majority of the patients suffering from water related diseases in the period 2004-2006 were women.

According to Kajiado district development plan (2002-2008), female /male sex ratio was 100:103 .This means that there are more male than female in this population, yet water related morbidity pattern seems to affect more women than men. Informant interviews with the health service providers revealed that most cases are seen during the dry season. Contributing factors were identified as lack of enough water at this time and that the little available water at household level is for bathing and basic hygiene, generally reserved for men and children. Similarly constant interaction with water, milk, coupled with dirty environment attracts more flies predisposing women even more.

4.3.1 Table 6 - Mile 46 Health Centre: Water-related Morbidity Patterns Classified Along Gender (2004 - 2006) Elangata Ewuas Sub-Location

Year	Typhoid	**Typhoid**	Eye Infections	**Eye Infections**	Skin Infections	**Skin Infections**	Dysentery	**Dysentery**
	Male	**Female**	Male	**Female**	Male	**Female**	Male	**Female**
2004	70	**82**	33	**41**	15	**23**	33	**36**
2005	69	**81**	25	**36**	12	**18**	26	**34**
2006	75	**86**	22	**28**	15	**18**	23	**28**
Total	214	**249**	80	**105**	42	**59**	82	**98**

(Source Ministry of Health: Kajiado District Hospital)

4.3.2 Table 7 - K.M.Q Health Centre: Water-related Morbidity Patterns Classified Along Gender (2004-2006): Toroka Sub Location

Year	Typhoid	**Typhoid**	Eye Infections	**Eye Infections**	Skin Infections	**Skin Infections**	Dysentery	**Dysentery**
	Male	**Female**	Male	**Female**	Male	**Female**	Male	**Female**
2004	35	**52**	34	**39**	17	**26**	21	**23**
2005	37	**35**	31	**36**	13	**21**	38	**41**
2006	36	**34**	25	**31**	17	**20**	25	**33**
Total	108	**121**	90	**106**	47	**67**	84	**97**

(Source: Ministry of Health: Kajiado District Hospital)

4.3.3 Trends In Water Related Diseases

Table 8: Water-related Diseases from Mile 46 Health Centre (Elangata Ewuas Sub -Location)

Year	Typhoid	Amoebiasis	Dysentery	Eye Infection	Skin Diseases	Total
2004	269	150	140	190	96	845
2005	249	125	150	180	79	783
2006	322	122	126	145	78	793
Total	**840**	**397**	**416**	**515**	**253**	**2,421**

(Ministry of Health: Kajiado District Hospital)

Table 9: Water-related Diseases from K.M.Q Health Centre (Toroka Sub Location)

Year	Typhoid	Amoebiasis	Dysentery	Eye Infection	Skin Diseases	Total
2004	214	282	114	174	114	898
2005	191	161	196	155	87	790
2006	171	166	163	144	95	739
Total	576	609	473	473	296	2,427

(Source Ministry of Health; Kajiado District Hospital)

(Tables 8 and 9) above , show water related morbidity trend in two main health facilities in the study site in the period 2004- 2006, when Water Reforms picked momentum.

In Toroka sub location, there has been a steady decline of water related diseases (Typhoid, amoebiasis, dysentery, eye infection and skin infections in the period 2004-2006 as indicated by (Table 9) above. In Elangata Ewuas, (Table 8), the trend is not

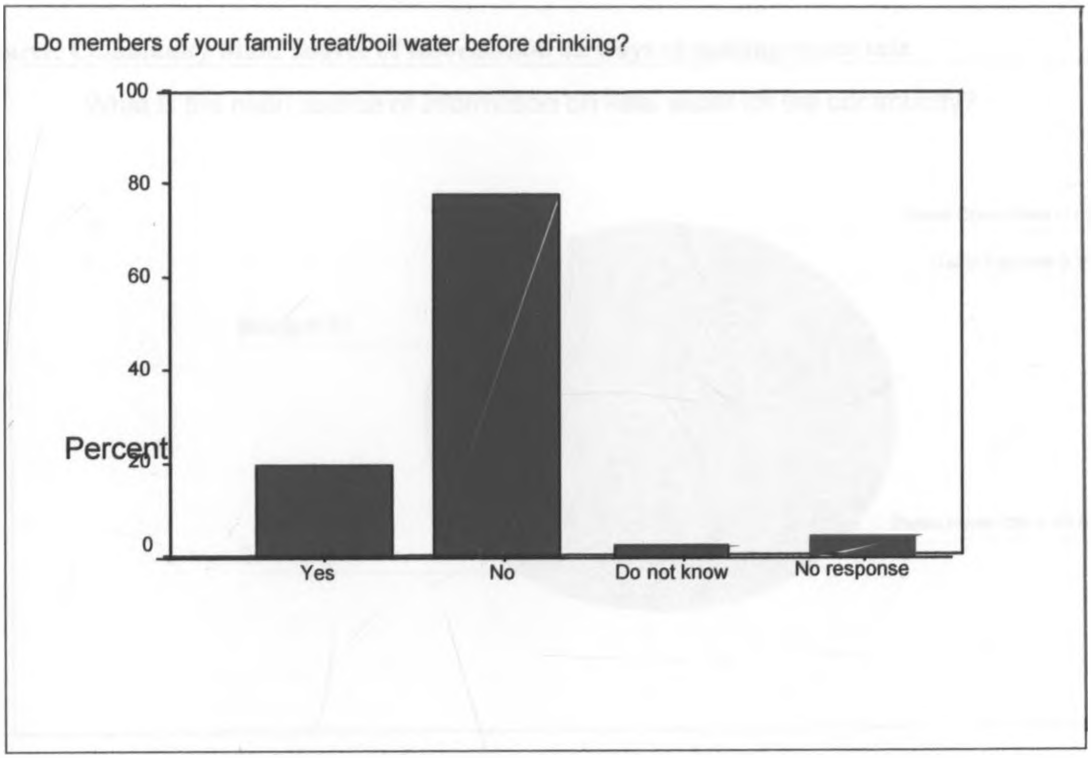
systematic. Between 2004- 2005 there was a decline, however between 2005 and 2006, there was and increase in number of patients suffering from water related diseases.

Whereas the issue of water-related disease prevalence's is a multifaceted, covering large spectrums (water storage, water use at home, hygiene habits, quantity of water at household, quality of water, livestock, human interaction among others).

However further investigations was done by the study through key informant interviews and revealed the following: that both health facilities cover a wide catchment area beyond the location. However a possible explanation of a steady decline in Toroka sub location was attributed to organizations like AMREF, CCF, UNICEF that have been instrumental in supporting setting up of bathrooms and toilets around water points and raising of community health promoters by AMREF and CCF to conduct hygiene and sanitation education in the sub location during this period. This was further picked up by the Public Health Officers and water committees who catalysed the process further in widely disseminating the information in the area. This could have had an affect in improvement of hygiene and sanitation practices by the residents of Toroka and subsequently impacting on reduction of related morbidity.

In general, data collected from both health facilities in the study site however reflects a reduction in water-related diseases. *This is therefore a confirmation that improved water supply has a corresponding effect on reduction of the disease burden* (water related). However this should be accompanied by the '*soft ware component*': Health education on safe water use, hygiene and sanitation education as evidenced in the case of Toroka sub location.

4.3.4 Graph 5: Safe Water Use at Household Level

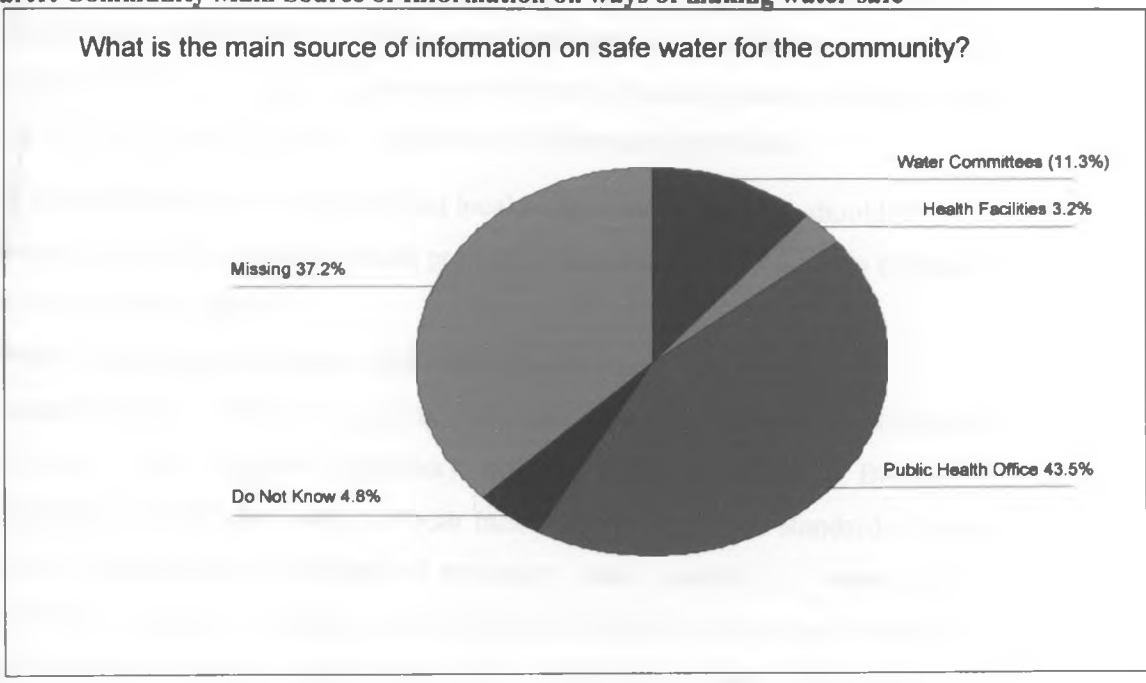


As a build up to the previous discussion on Water related morbidity and water availability, the study sought to understand community's ways of making water safe. 77.4% (n=48) of the respondents said that they do not treat or boil their water before drinking, while 19.4% (n=12) treat/boil their water before drinking. Key informant interviews established that the community perceives that boiling of water affects water taste. Similarly, women said that while they have been educated on the importance of ways of making water safe for drinking, time is a constraint. They said that they do not have time to boil water, wait it cool, sieve and store. *' You know our work is a lot, we have to fetch water, fetch firewood, milk animals, look after children, go to the market and prepare food ,among other domestic chores, where do you get time to again boil water?'* Remarked a lady key respondent.

Convenient methods of making water safe like use of aqua guard solutions and Aqua tabs in treating water should be promoted. Similarly the government should

subsidise on the pricing of such drugs and support in distribution and sensitization of the community.

4.3.5 Chart1: Community Main Source of Information on ways of making water safe



The study also wanted to know whether the community has access to Information related to water safety and whether the Water Reforms are addressing this component. Public Health Officers were identified as the main information provider 43.5% (n=27), followed by water committees 11.3 %(n=7) and a small proportion mentioned health facilities 3.2 %(n=2). However, a large proportion 37.2% (n=23), never responded.

There is therefore need to increase access to information on safe water. As shown in tables 8 and 9, water-related diseases prevalence is still high in the area. A combination of safe water delivery with health information on hygiene and safe water use will contribute to a significant reduction on water-related diseases. This should be a key component in the Water Reform process.

4.3.6 Human- Animal Interaction And Disease Prevention

On the question, whether animals can be a cause of water-related diseases, 80.6% (n=50) of the respondents are aware that water-related diseases can be spread from animals to human; therefore knowledge base is quite high. The animal, water disease relationship knowledge was attributed to local knowledge. *'Maasai spend time with animals and therefore quite informed on animal issues including disease patterns from animal to human'* (Source Key Informant Interviews).

This study therefore recommends that local indigenous knowledge should be incorporated in conventional health promotion education programmes in the area to synergise one another.

4.3.7 Water Reforms and Quality Assurance Standards

Regarding water safety and quality assurance standards, the study established that, the Water Services Regulatory Board together with Kenya Bureau of Standards (KEBS) has come up with minimum service level standards. Water service reform gives standards of minimum water quality; all water service providers must have a testing unit kit. Chlorine residue must not be less than 0.2 and not more than 0.4. The water service boards have been given powers to monitor qualities of water distributed by the water service companies. They are equipped with testing kits which they provide to their staff to randomly test water quality. If the quality is not up to standards, the service boards have powers to withdraw water service contracts from the affected companies. Regarding the content of fluoride in water, it should not be more than 1.5 parts per million. Usually no go-ahead is given to supply water with fluoride contents above this level. However, due to geographical and environmental reasons, some areas can not pass this test. These areas receive special consideration and water supply is allowed despite the fluoride level being above 1.5 parts per million.

On the issue of compliance enforcement, it was established that quote: '*we have a whole department, water solution quality control. Their work is to ensure that there is good quality water and there is good control of the supply, so that all these negative things do not occur. They have set up standards which should be adhered to. But also we have set up a national laboratory to check and monitor so that they can advice and*

develop measures to correct the situation. So those are some of the things that are handled by the water services'. (Senior Hydrologist, Ministry of Water and Irrigation).

This study found out that, whereas, World Health Organization, has its own quality standards. This is not adhered to because: *'they put up some conditions which are not flexible. For instance, they say that drinking water should not have fluoride at a level above 1.5 parts per million. If we follow this it means almost all Kenyans should not drink water, because we do not have water of that standard here'* (Senior Hydrologist Ministry of water and Irrigation).

WASRB (Water Services Regulatory Board) has therefore developed guidelines on water quality monitoring for use by the Water Services Boards and the Water Service Providers. The purpose of the guidelines is to: promote transparency in the methods of water quality monitoring employed by the WSPs (Water Service Providers) and thus build public confidence in service provision, ensure through regular monitoring that the quality of water provided meets the standards set by KEBS(Kenya Bureau of Standards), create awareness among the WSBs/WSPs on the water quality monitoring requirements, ensure that all WSPs follow a systematic way of water quality monitoring so as to have uniformity of the process, ensure a minimum standard of water quality monitoring at acceptable costs and create awareness among consumers that information regarding water quality will be made available by the providers.

In order to ensure compliance, the role of WASREB is to ensure that a specified acceptable minimum standard of practice is followed by every WSP, which includes: - monitoring the minimum required number of samples and tests on water supply and effluent discharges, collecting data on compliance on standards and Ensuring publication of test results.

'The standards apply to all areas of the country regardless of the geographic settings except for certain parameters. Deviations above the guideline values in either the short or long term do not necessarily mean the water is unsuitable for consumption. The

amount by which, the period for which, any guideline value can be exceeded without affecting public health depends upon the specific substance involved for example fluoride content of up to 3mg/l is acceptable depending on climatic conditions, volume of water consumed, and intake from other sources. Conductivity value can also be exceeded depending on water availability and climatic conditions' (Senior Hydrologist, Ministry of Water and Irrigation).

At the time of this study, all the above procedures are not in practice in the rural areas. However in the urban areas, water companies are being obliged to observe this and residents confirmed improvement in treatment of tap water.

4.4 The third objective of the study was to find out changes in Water Management as results of the on going Reforms.

The study findings are as follows:

4.4.1 Effects of Changes in Water at National Level

Key informant interviews with the Ministry of Water and Irrigation officials reveal that a lot of achievements have been realized as a result of changes initiated through the Water Act of 2003. '*The major achievement is recognition of professionals and separation of mandates to enhance checks and balances. The role of the ministry is now clear: 'policy direction and coordination. Conflicts of interests have therefore greatly reduced'* (Senior Officer at the Ministry of Water and Irrigation).

Initially, the Ministry of Water & Irrigation through the office of the Director of Water managed 600 water supplies. The director of water was the regulator and also the service provider. The focus was more on water services and neglected water management .In addition, power was centralized at the top. For instance issuing of permits and right to use water (piped or pumping) was vested in one office (individual). The entire process took long and was bureaucratic. This has changed and powers have been devolved in several structures at different levels. Benefits of the above changes have realized the following: in Nairobi alone, The Nairobi Sewerage and Water Company currently collects Kenya shillings. 200 million per month on average, compared to Kenya Shillings 80 million per month which the local authority used to collect previously. Additionally coverage of

water distribution has increased. This means that more people have access to safe water. There is also a reduction of water that is unaccounted for due to illegal connections and poor metering. Similarly, since the enactment of these reforms, the National Water Co-operation has become a board that oversees equitable distribution of water services like the drilling of boreholes to ensure that even the arid and semi arid areas have adequate water supply to cater for the needs of the pastoral communities.

Regarding partnership and institution strengthening, it was established that the water reforms have facilitated building and strengthening of institutions. '*We now have institutions that have specific roles and responsibilities. This means that there is more focus on certain aspects of service delivery. For instance at the regional level, we have the boards (the water service boards). The boards are now addressing water supply issues, while WARMA (Water Resource Management Authority) addresses delivery and supervision of water (Water Supply and Management). These two are crucial in water provision'* (Ministry of water and Irrigation: Senior Hydrolist).

The study also established that there is rapid expansion in water services: *' I am now seeing pipes being laid down either for rehabilitation or expansion of water services, similarly, more money is now being a located to the Ministry for construction and rehabilitation of water service'*. (Senior Water Engineer- Ministry of Water and Irrigation Head Office).

In addition, inter-ministerial collaboration has been strengthened as water issues also apply in other ministries like Agriculture, especially components of irrigation and arid, semi-arid lands which incorporates elements of boreholes drilling to enhance livestock production. There have also been renewed interests in donors because of these restructuring. In addition to the above, the ministry has drilled so many boreholes in the past 3 years, '*actually they total more than all the boreholes that we have drilled in the past 20 years'* (Senior Water Engineer- Ministry of Water and Irrigation Head Office).

The negative effects noted so far may include restructuring led to laying off

manpower which is painful. A lot of workers have not been able to be absorbed into the private sector. Similarly, as part of the re-organization, the water companies are region specific and they do the actual work of revenue collection. *'That is where we have the problem; revenue collected is not remitted all due to poor financial tracking system. Revenue is therefore being lost. Accounting procedures therefore requires urgent improvement'* (Senior Civil Servant: Ministry of Water and Irrigation).

4.4.2 Effects of Water Reforms on Community structures

The study identified the following major changes at the local level. There has been contracting of water companies and trust funds to provide water services to the local people in Kajiado District. These are Olkejuodo Water and Sewerage Company limited, Olooaiser Water and Sanitation Company Limited (for Urban), Loitokitok water supply, Namanga Community Water Trust and Kerarapon Project Association for rural areas. Similarly, there has been a renewed interest by private companies and NGOs to support the sector and especially at the local level. For instance, Magadi Soda Company (a private company) with the support from Athi Water Services Board, partnered with Kajiado North Constituency to construct the Ol Donyo Nyoike Water Project, accessing over 2000 local residents with water. In addition, through section 15.5 of the Act which allows the formation of water user associations for rural water points, the above associations have been given technical expertise by water management authorities. The associations, after receiving technical expertise, are being encouraged to access funds set aside by the Ministry of Water and Irrigation, for improving water resources.

Kenya Shillings1.5 billion was set a side in the current budget (2007-2008 Financial Year) for this purpose. This money is distributed annually to all regions of Kenya by the Water Services Trust Fund and it targets the rural communities. However in the study site, there was no mention or establishment of effects of what this fund has achieved.

Further probing established that most of the above groups are at formation level. Similarly The Athi Water Services Board covers an expansive area and it has taken time for it to form and fully function. Districts falling under Athi Water Services Board are six. These are Nairobi, Kajiado, Kiambu, Machakos, Makueni and Thika. Of all these districts, Kajiado still has the least water supply coverage, estimated at 3 % (www.awsboard.com). This could explain the minimal impact of the Water Reforms in the rural areas.

At the local authorities' level, it was established that, no single local authority is a service provider as it was previously including the district water office unless they form a separate water company in future. The various water user associations that are small in scale have been asked to amalgamate to form larger associations to take advantage of economies of scale. This is clearly outlined in Section 5b of the Water Act. Previously the local authorities were running ten water supply services while the Nairobi Water Cooperation was running 48. This has changed. For instance the study established that in Kajiado District, the Athi Water Services Board (AWSB) has licensed Olkejuodo Water and Sewerage Company Limited, Olooaiser Water and Sanitation Company Limited (for Urban), Loitokitok Water Supply, Namanga Community Water Trust and Kerarapon Project Association to provide water services in the district. These providers are supposed to ensure water is available in the entire district. They are supposed to cost the water in a way that they are able to sustain themselves without dependence on external sources including the government. These have not fully rolled out in the rural areas. But in the urban areas the companies are fully operational. Residents also said that the water costs have gone up. There is also prompt billing and prompt disconnection of water to households delaying to pay as instructed on the bills.

The study findings also show that the reforms though good, they have tended to favour urban areas where revenue collection is high. For instance Athi Water Service Board (AWSB) has managed to drill and equip six new boreholes in Nairobi with a yield of 150 cubic metres per hour to serve high density areas. In

addition, the Board has extended the water distribution network in Nairobi by 24 kilometres serving an additional 54,000 people. While the arid and semi areas of Kajiado, Machakos and Makueni benefitted with construction of 17 boreholes, 11 pans and dams which together have a combined capacity of 415,000cubic metres of water. Of the 330 water supply schemes in Athi Water Service Board's area of jurisdiction, 280 are run by the local communities. However over the years, most of the water schemes were rendered inactive or collapsed altogether as a result of poor management and maintenance. The Board has been able to rehabilitate all the existing Government run water schemes and restored the stalled water projects in the five districts, leading to an increase in the volume of water produced by 25%, mostly in the urban areas.

The study findings at Loodokilani reveal that not much has changed at the grassroots level in terms of water management. Water is still being managed by water committees as the licensed providers (Water Service Providers) are still forming. Similarly, it was established that water provision in rural areas is not lucrative as in the urban areas. There is therefore lukewarm interest for investors.

However, the study noted proactive involvement of the NGOs operating in the area, the local administration and Constituency Development Committee on issues of water. These efforts have resulted in extending of water pipes, training of the water committees and close supervision and follow up of on going water activities. Water is charged at the following rates, Kenya Shillings 2000 – 3000 one off household membership registration to the borehole, then Kenya Shillings 200 annual fee and Kenya Shillings 25 per livestock per month. Normal water domestic use is costed within the livestock fee.

However, for temporal residents in the area like civil servants, a levy of Kenya Shillings 4 per 20 litres is charged. Criteria for setting costs revolve around operational costs (fuel, spares, personnel, frequency in breakdowns). A person from the area with no livestock of his/her own is considered as poor and therefore weaved from payments. Livestock from defaulters' homes are denied water and

this causes them to comply in prompt payment, since this may have a serious effect on the animals. However, some defaulter cases end up in the chief's office for arbitration. During dry seasons water charges are lowered to Kenya Shillings 15 per livestock as this is a difficult moment. The study therefore established that unlike in the urban areas where profit is the key motive, in the rural areas, water is an essential commodity and pricing is a team decision aimed at keeping the water points running, what is collected is ploughed back for maintaining the water points.

For expansion of water services and reduction in distance for affected members, the community has set a charge of Kenya Shillings of 1000 per household to support in purchase of pipes and other materials and to contribute their labour in kind .The NGOs working in the area and the CDF committee are supplementing on these efforts.

This study identified the following as areas that require improvement: financial management. The committees had not so far adopted the basics of financial management, like separation of authority, conducting of annual audits. Similarly, the committees do not enforce their own laws of holding elections; neither do they enforce guidelines to educate the members on processes for identifying good leaders. Gender issues and level of education though recognized as important, they are not strictly adhered to. Similarly, capacity to develop linkages and partnership for supporting rapid expansion of water points was identified as limited. In addition, prioritization of key issues like health education and sanitation and search for existing opportunities like exploring ways of tapping into other funds (like the Ministry of Water and Irrigation budget for rural water programmes) other than the Constituency Development Fund was also identified as lacking.

4.4.3 Water Reforms and Conservation and Pollution

Regarding pollution issues, the study established that for the first time, industries are to seek permits for the purpose of discharging effluent. *'All industries are to be*

constantly monitored. Any industry found discharging effluent to water sources is fined an amount of Kenya Shillings100, 000 for the first offense. A further offense would cause the industry to be fined another Kenya Shillings 100,000 plus a six months jail term for the owner or senior officer of that industry. Similarly, National Environment Management Authority (NEMA) which is in charge of taking care of the environment is coming up with mechanism of reinforcing and stopping all non-industrial pollution for example washing vehicles in the river. Pollution is very high, but this can be managed and controlled with combined efforts and political goodwill. The farming practices (silt and soil), industrial chemicals, informal sector (Jua Kali) practices like changing of engine oil contribute to pollution' (senior Hydrologist Ministry of Water and Irrigation).

It was also established that the Water Act touches on conservation and mandates WARMA to deal with conservation issues in partnership with the National Water Conservation and Pipeline Corporation. This body is currently putting up conservation structures to address all areas under their jurisdiction including areas that are marginal. However in the study site, conservation issues are being addressed by water committees through controlling of pollution, drainage and campaigns for tree planting.

The prayer below that we got from the field clearly attests that the Maasai culture embraces conservation and abhors pollution:

> "*Father-mother earth, we pray thee at sunrise and sunset, that you may not abandon your sacred duty of sustaining our lives. The water that quenches our thirst, the air that we breathe the trees that provide shade and the animals that give us company and make life real and creation complete.*
>
> *We the children of the earth, pray for wisdom, that we in turn may be good custodians of these precious gifts to us and unborn generations. For if we fail to safeguard these resources, man's moral standing as the most intelligent animal will be questionable. Furthermore if we fail nature, we shall have failed ourselves and the generations that come after us. And judgment will be very harsh on us.*" (Senior Ministry Official Water and Irrigation).

5.0 The fourth objective of the study was to examine the community perceptions of the water reforms

The findings are as follows:

Key informant interviews regarding the water reforms revealed that there are fears and misconceptions of the water reforms. It is true that the knowledge is high regarding the Reform process but that has not translated into trust of the government on issues of Reforms.

The poor feel it is a way of the rich enhancing control over resource as reflected in the Kiswahili quotation below by a mother in one of the water points in the study site:

> *'Hii ni ŋjia moja ya matajiri kuchukua maji yote kwa sababu wako na ngombe nyingi'*'), English for –
> '*This is one way of the rich to own water points as they are the one with many livestock'.*

Women interviewed expressed fear that the changes may focus more on livestock needs at the expense of water for household needs. They felt there is little concern and involvement of women in the water Reform discussions.

Community 'elites' like teachers, retired civil servants on their part felt that Reforms are re-introduction of the 1990s SAPs, through the back door and expressed fears that multinationals and bilateral may drive the process with a view of privatising water and creating investment opportunities for their companies.

Members of the water committees felt that if the government fully withdrawals from the water points support, the burden may be heavy and they may not afford especially in the event of a major breakdown.

'*Is the government tactfully pulling out of the water service sector and abandoning her people?*' posed a chairman of the water committee in one of the water points.

However others were optimistic that with proper mentorship and training, the Reforms will translate into better management of water points, more generation of revenues, attraction of even more investors and power and freedom for the

community to make decisions and plans regarding water and natural resources like sand harvesting and environment conservation. This views were mainly shared by the local administrators and clan heads.

6.0 The fifth objective of the study was to assess the objectives of the water reforms and emerging effects on the community

The findings are as follows:

The objectives of the water Reforms are Preservation, conservation, and protection of available water resources and allocation of water in a sustainable, affordable, rational and economic way, and supplying good quality water in sufficient quantities to meet various needs. The findings are that both in the urban and the rural, the water supply has improved and there is less break downs. However the costs have gone up, raising fears that water will soon be a preserve of the rich. Conservation issues remain a challenge as the community requires the skills and policy direction. Sand harvesting continues affecting river banks as the community is caught between survival (poverty) and conservation. Similarly tree planting is low as this is not a priority to the community. Moreover, accessibility to seedlings is still a challenge for those who are interested. Moreover the issue of animals destroying the seedlings especially goats enjoying leaves of young trees for food remains a challenge as the Maasai will prefer health animals over trees. The study therefore suggests the following, that water points with fresh water be linked to the Ministry of Environment and natural Resources to initiate tree nurseries and encourage the community to plant trees during the dry season. Environmental education should also be initiated for the local leaders, who in turn should influence the community to adopt the practices. Water conservation methods at water points and at home be initiated since this is a water scarce area. The devolved water structure in the local area seems overwhelmed and therefore unable to handle extra duties due to capacity and lack of strategic direction. Training to enhance capacity therefore is critical.

CHAPTER FIVE

7.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.1 Summary

The broad objective of this study was to investigate the impact of water reforms on the health of the Maasai community of Loodokilani Location of Central Division, Kajiado District. This was broken down into specific objectives as discussed in respective summary sections below.

7.1.1 Objective I: To investigate how reforms in the water sector has affected the Maasai pastoral community (Loodokilani Location, Central Division, Kajiado District)

This study has established that the on going water reforms had both positive and negative effects on the Maasai community. Positive effects include increased collaborations between the community and the water sector providers, increased water supply, less breakdowns of water points, establishment of new structures that has realized the following: increased revenue collection in the urban places, clear guidelines on management of water catchment areas, increased water availability especially in the urban areas, control of wastages through illegal connections and a general decline in water-related diseases. Contributing factors outside the reform agenda includes the adaptation of result based management model by Government commonly known as rapid results initiatives (RRIs) requiring all Government employees to set targets, that are periodically evaluated to justify their relevance. The creation of Constituency Development Fund (CDF) to support community projects and pretence of international and local organizations in the study s area addressing water-related issues greatly contributed in realisation of water access to the people in the area.

The negative effects of this water reforms include: there has been less emphasis on water and health education to promote safe water use, which would have had a major corresponding effect on the reduction in water-related diseases. Regarding gender, reforms have not alleviated water burdens for women, neither has there

been a significant reduction in distance to water points. More efforts therefore are still required in correcting this imbalance. Similarly, the reforms in water are to a large extent, revenue collection focused. More efforts have been on billing and prompt collection of money from water users and self reliability of water service sector. This can not be attained overnight. The Water Reforms therefore have neglected other fundamental elements that require a lot of support. For instance, transferring of the burden of water costs to Water Services Providers (WSP) in low income communities in the rural areas has been a challenge as tariffs that would ensure sustainability are beyond the reach of water users in the rural areas. These schemes have not been attractive to investors and therefore dependent on the Ministry of Water and Irrigation, which has both staff and resource shortages. NGOs, private companies are providing fall back option as the government grapples with reforms teething problems in the rural areas that is not as smooth as in the urban areas.

7.1.2 Objective 2:To examine trends in water-related diseases (hygiene and dirty water-related diseases) and water reforms

The study has noted that typhoid, amoebiasis, dysentery, eye and skin infections which are to a large extent water related has had a general decline as evidenced by morbidity data from the leading health facilities in the area for the period 2004-2006. There are a number of factors contributing to the occurrence of this scenario. There has been increase in water supply, water, sanitation and hygiene education and multi sectoral collaboration involving CDF committee, Government, NGOs, private companies and local water committees.

Increased water supplies that are safe, affordable and accessible coupled with sanitation and hygiene education will significantly translate into a reduction in water related diseases and improved quality of life.

7.1.3 Objective 3:To find out changes in management of water as a result of water reforms

There has been decentralisation of water services into regions, Kajiado district being clustered under The Athi Water Services Board that also covers Nairobi, Kiambu, Machakos, Makueni and Thika.

The following companies have been licensed by The Athi Water Services Board to provide water services in Kajiado district: Olkejuodo Water and Sewerage Company Limited, Olooaiser Water and Sanitation Company Limited (for Urban), Loitokitok Water Supply, Namanga Community Water Trust and Kerarapon Project Association for the rural. These providers are supposed to ensure water is available in the entire district. However despite all these developments, of all these districts under The Athi Water Services Board Kajiado still has the least water supply coverage, estimated at 3 %. There has been a lukewarm interest for investors in the rural areas because of perceived fears of low returns. The government is looking at ways of addressing this issue and in the 2007/2008 financial budget, Kenya Shillings1.5 billion was set a side to support rural water Services Trust Funds. This is aimed at subsidizing running costs and attracting investors in water for rural areas.

7.1.4 Objective 4: Examine the community perceptions of the water reforms

Key informant interviews regarding the water reforms revealed that there are fears and misconceptions of the water reforms. It is true that the knowledge is high regarding the Reform process but that has not translated into trust of the government on issues of Reforms. Gender, costing, power and control issues still remain emotive.

7.1.5 Objective 5: Assess the objectives of the water Reforms and emerging effects on the community

The objectives of the water Reforms are Preservation, conservation, and protection of available water resources and allocation of water in a sustainable, affordable, rational and economic way, and supplying good quality water in sufficient quantities to meet various needs. The findings of the water Reforms in relation to manifest

(intended) and latent (unintended) results(RobertMerton;s Functionalism) is varied. In the urban and the rural, the water supply has improved and there is less break downs. However the costs have gone up, raising fears that water will soon be a preserve of the rich. Conservation issues remain a challenge as the community requires the skills and policy direction. The water committees regard this as added roles which they had not envisioned doing, therefore reluctant to adopt. This brings in issues of manifest and latent outcomes of the Reforms as envisaged by Robert Merton in Functionalism theory (one of the study framework).

7.2 Conclusion

This study was guided by the following three research questions: -

What is the effect of water reforms on water-related diseases?

How have reforms in the water sector affected the Maasai of Loodokilani Location, Central Division, and Kajiado District?,Are perceptions of the community an impediment to the Water Reforms process?

As already discussed in the summary section, The Reforms began in earnest in 2004 rolling out systematically in the whole country. It shouldo be emphasised that reforms are not one time event, but a continuous process that should be implemented in relation to the changing circumstances and in consultation with water users at all levels.

However the government should always be reminded that Water is life and it is the government's responsibility to ensure that it is accessible and affordable.

The community has expressed fears of water costing going high and expressed fears of the government withdrawing altogether from water sector in the long run. These fears must be addressed by the government through listening to the people and convincing them that this is not reintroduction of SAPs of the 1990s through the back door. Full commercialization of the water sector as being interpreted by the community may limit access to safe water to a majority of Kenyans impacting negatively on the Millennium Development Goals (MDGs) and the quality of life of most Kenyans living below poverty line.

7.3 Recommendations

This study came up with the following recommendations:

To improve the health of the people, water provision should be intertwined with, health promotion and education targeting women who are mainly involved in water use at household level, schools and existing informal groups and committees. A multi–faceted approach is required to cater for the literates and illiterates who are the majority. Targeting of women in safe water use and hygiene promotion will have a greater impact at household level (reduction in Dysentery, Trachoma, skin infections, Diarrhoea and Typhoid).

The newly licensed water service providers for Kajiado district: Olkejuodo Water and Sewerage Company Limited, Olooaiser Water and Sanitation Company Limited (for Urban), Loitokitok water supply, Namanga Community Water Trust and Kerarapon project Association, should carry out a survey to obtain community data to establish a basis for responding to water needs of the district and future forecasting (Schools, hospitals, industries, livestock, population growth, markets, offices, urban centres).

The water service providers need to institute a tracking system to ensure prompt water point's mentainance to control breakdowns.

Continuous Community education and sensitization on the new changes in water should be sustained to increase understanding by the community members.

Leadership and governance remains a critical need at the grassroots. Training in good governance and sensitization of the community to demand accountability from the leaders is essential. Similarly, proper structures of succession should be put in place to encourage smooth hand over and mentoring of others into position of leadership. This will control monopolizing of power along clans and specific families

Gender is a major concern. The Maasai community is patriarchal investing powers of decision-making in men. This limits women participation in water committees. In, addition, basic human rights should be embedded in the routine community activities especially women issues. Similarly water for home use and domestic chores are heavily dependent on the woman and by extension the girl-child. This negatively impacts on the health of women and career of girls especially during the dry seasons when long distances are covered in search of water.

Alternative water harvesting, like roof harvesting from institutions, conservation of the environment through planting of appropriate trees, control of river silting requires urgent prioritization by both the leaders and the policy makers.

The government should educate the community on the key benefits of the reforms and why it is undertaking these reforms. Similarly, the government should allay fears being raised by the community and mainstream major suggestions being made by the community

Borehole spares were identified as exorbitant and beyond the reach of the community. This was one of the main reason in delays in rehabilitation of broken down boreholes .Water is critical to life and development. This study recommends zero rating of water related engines and spares to bring down prices within reach for the majority Kenyans.

7.4 Recommendation for Further Research

Further research should be carried to establish why women are more prone to water-related morbidity in this community with view of establishing recommendations to inform policy process.

REFERENCE LIST

Abercrombie Nicholas, Hill Stephen, Turner B.S (2000): "The Penguin Dictionary of Sociology 4th Edition. Penguin Books. London, England

Abraham Francis (2004): Tenth Impression: Modern Sociological Theory: An Introduction Oxford University Press, New Delhi, India

Aday Luam (Editor) (2005): Re-inventing Public Health Policies for a healthy Nation, Bass Publishers San Francisco USA

Aina Akina , Chacheges et al(Editors):(2004): Globalisation and Social policy In Africa, Council for the Development of Social Research in Africa, Senegal

AMREF (2001): Participatory Poverty Assessment Report Kajiado District, AMREF Nairobi Kenya

Awoundo Odegi: (1990) Life In The Balance, Ecological Sociology of Turkana Nomads, ACTS Nairobi,Kenya

Caroline F, Cecillia T. et al (2003): Rethinking Water management , Innovative Approaches to Contemporary Issues, Creative Print, London UK.

Caincross Sandy, Ian Carruthers :(1980): Evaluation of Village water supply planning, Center for Community Water Supply, The Hague Netherlands

Chambers Robert (1983): Rural Development : Putting The Last First, Prentice Hall, Edinburgh – England

Cockerham William (2001): Medical Sociology 8th Edition, Prentice Hall London U.K.

Gigch John (1978): Applied General Systems Theory 2nd Edition, California State University Press USA

Gilbert White, David Bradley, Anne White (1972): "Drawers of Water: Domestic Water Use in East Africa" The Chicago Press, USA.

Government of Kenya, Central Bureau of Statistics (2004): Kenya demographic and Health Survey 2003, Government Printers Nairobi Kenya

GOK, Ministry of Planning and Finance (2002): Kajiado District Development Plan 2002 – 2008. Kenya Government Press, Nairobi

Government of Kenya (2002): Kenya Gazette Supplement Act 2002, Government Printers Nairobi.

Government of Kenya (2001): (1999) Population and Housing census Report, Central Bureau of Statistics, Government Printers Nairobi

Government of Malawi& International Development Research Centre (1981): Rural Water Supply in Developing Countries, IDRC- Canada Proceedings of a workshop- Zomba Malawi

Guy Howard, (2002): Healthy Villages: A guide for Communities and Community Health Workers, WHO, Geneva

Kish and Leslie (1965): Survey Sampling, John Wiley and sons, New York USA

Maggie Black (1998): Learning What Works , UNDP- World Bank Water & Sanitation Programme, UNDP- World Bank Water and Sanitation Program, Washington DC

Mukhisa Kituyi (1990): Becoming Kenyans, Socio economic Transformation of the Pastoral Maasai, ACTS Press, Nairobi Kenya

Mugenda Oliver, Mugenda Abel (1999): Research Methods Quantitative & Qualitative Approaches Acts Press, Nairobi Kenya

Mzee A. (1980): Rural Water Supply: Ministry of Water, Government of Tanzania

Ndetei Musyimi David et al (2006): The African Text Book of Clinical Psychiatry and Mental Health – AMREF, Nairobi Kenya

Nachmias CF, Nachmias David 5th Edition (1996): Research Methods in the Social Sciences: Arnold Publishers Great Britain

Naidoo Jennie, Jane Wills et al (1994): Health Promotion , Foundations For Practice Brailliere Tindall, London UK

Nyamwaya D, Munguti K, and Akuma P. (1994): "A Guide to Health Through Water and Sanitation AMREF, Nairobi, Kenya.

Nyamwaya David, Oduol E, (Editors): (1994): Health Education, An Essential Text for Schools, AMREF, Nairobi Kenya

Noma Musambayane e tal (2000): Demand Responsiveness, Participation, Gender and Poverty: Eastern and Southern Africa Regional Synthesis Report, World Bank Washington USA

Nordberg Erik (Editor): (1999): Communicable Diseases – 3rd Edition, AMREF Nairobi, Kenya

Orieko Chitere, Roberta Mutiso :(1991): Working With Rural Communities, A participatory Action Research in Kenya, University of Nairobi Press

Subramanian Ashok atal (Editor) (1994): User Organizations for Sustainable Water Services, World Bank Washington DC

Soussan John (2004): Water and Poverty: Fighting Poverty Through Water Management, Asian Development Bank, 3rd World Water Forum March 2003 Kyoto Japan

Tina Wallace, Candida March (1991): Changing Perceptions: Writing on Gender and Development Oxfam – U.K.

UNICEF, WHO (2004): Meeting the MDG Drinking Water and Sanitation, A midterm Assessment of Progress, UNICEF, New York, USA.

UNDP (2001): Human Development Report 2003, UNDP New York USA

UNDP (2003): Human Development Report 2003, UNDP New York USA.

Wehmeier Sally, Ashby Michael (Editor) 2000: Oxford Advanced Learners Dictionary, Sixth Edition, Oxford University Press, Oxford UK.

Wamalwa David (Editor) :(2006): Hand Book on Hygiene & Sanitation Promotion Through Schools, AMREF, Nairobi Kenya

Wood C.H, De Glanville, and et al (Editor): (1997): Community Health, 2nd Edition AMREF, Nairobi –Kenya

WHO (2003) : Health Promotion: A Strategy for African Region: WHO Regional Office For Africa – WHO Afro

WHO (1998): Health Promotion Glossary, WHO Geneva Switzerland

WHO (1994): Financial Management of Water Supply and Sanitation, a hand book, WHO, Geneva Switzerland

WHO, Canadian Public Health Association (1986): Health Promotion: The Ottawa Charter WHO, Geneva Switzerland

WHO/UNICEF: 2001: Global Water Supply and Sanitation Assessment Report for 2000, Geneva Switzerland

World Bank (2000): Water and Sanitation Programme Report 1999-2000. World Bank, Washington, D.C. USA

World Bank (2004): Water Resources Sector Strategy: Strategic directions for World Bank Engagement, World Bank Washington D.C USA

JOURNALS AND TECHNICAL PAPERS

A journal for Medical and Health workers vol.32 No.3 July 2001- AMREF publication

African Journal of Sociology Vol.V, Number 1, 2002, Department of Sociology, University of Nairobi

British Medical Journal Volume 327, July 5th 2003.

Government of Kenya, Ministry of Water Resources, Sessional Paper No.1 of 1999 on National policy on water resources management and development

Government of Kenya, Ministry of Water and Natural Resources: Southern Nyanza, Integrated Community Development project, Working Paper VI

PLA notes/Journal, Community Water Management, International Institute for Environment and Development Number 35, 1999, Number 53, 2006.

Journal of Water and Health: Vol. 4 Supplement 1, 2006, IWA publishing House London U.K

Journal of Water and Health: Vol. 3, No 3, September 2005, IWA Publishing House London U.K

Social Science Medical Journal (Vol 34, No1, PP 1- 9,1992).

Social Science Medical Journal (Vol. 36, No.11, PP1397- 1405 , 1993
World Bank 2002, Number 215, Rural Water Projects: Lessons Learned

International water and sanitation centre, WHO collaborating Centre: Training community motivators in water supply and sanitation occasional paper series 11, occasional paper 1987.

Manzungu U. Emmanuel 2004: Water for All: Improving Water Resource Governance in Southern Africa: Gatekeeper Series No. 113, International Institute of Environment and Development, London U.K.

Mera : Medical Education Resource Africa Issue 4, March 2003.

Mera : Medical Education Resource Africa Issue 6, July 2003.

Salman M.A (1997): The Legal Framework for Water user's Associations: A Comparative Study: Technical Paper No. 360.

Kandawire J.A.KA: sociological Approach to water development, Technical Paper: Workshop Proceedings 5th- 12th August 1980, International Development Research Centre Ottawa Canada

Journal of Public Health (2003), 117, 452-456, The Royal Institute of Public Health, London, UK

Mbatia Paul (1996)- Provision of Health Care by the State in Kenya: A fragile State versus civil Society, Ph.D Thesis- Indiana University USA

WEB SITES

(http://oc.nci.nih.gov/services/theory

www. health.go.ke

www.awsboard.com

www.unesco.org

www.wsscc.org

www.netwas.org/newslettre/articles/2003/09/03.

www.water.go.ke

www.planning.go.ke

www.amref.org

www.worldbank.org

www.iucn.org/themes/law

APPENDIX 1: TOOL ONE: QUESTIONNAIRE

TOOL ONE (HOUSEHOLD QUESTIONNAIRE)

CONFIDENTIAL: DATA USED FOR RESEARCH PURPOSES ONLY

Section 0: Identification Information

No	Question		Response	Code
	Questionnaire ID (Office Only)			/__/__/__/___/
	Site	1. Kajiado – Central division		----/-----/
	Residence		Peri-urban Rural	1 0
	Province	Rift Valley		/__/
	Estate- Village/area (name)			
	Visit 1 **Result_____**	Visit 2 **Result_____**	Visit 3 **Result_____**	Visit codes 1 Complete 2 Refused 3 Incomplete 4 Postponed 5 other
J.	Date (dd/mm/yy) /__/__/__/__/__/	Date (dd/mm/yy) /__/__/__/__/__/__/	Date (dd/mm/yy) /__/__/__/__/__/__/	
K.	Interviewer's code/Name Name _____ Code_____	Interviewer's code/Name Name _____ Code_____	Interviewer's code/Name Name _____ Code_____	
L.	Total no of HH members listed ____/____/__	Total number of respondents(eligible*8 years and 55 years)* ___/____/___		
M.	Start time _____am/pm	Stop time_____am/pm		
N.	Field supervisor code/name	Office Editor Code / name	Data entry clerk code/name	

Good morning/afternoon. My name is _____ . Today we are talking to various people about safe water management issues. You have been selected at random to participate in this study. The purpose of the study is to understand health behaviors of people in your community. I would like to ask you some questions on safe water management matters and I assure you that your answers and opinions will remain confidential. Would you agree to participate in this survey? Yes ---------- continue No……..

Q1.Now we would like some information about the people who usually live and eat in your household or who are staying with you now, starting with the household head

LIST ALL HOUSEHOLD MEMBERS IN THE TABLE BELOW, INTERVIEW AT MOST ONE ELIGIBLE RESPONDETS !!! ALL PERSONS IN THIS HOUSEHOLD AGED BETWEEN 18 AND 55YRS (inclusive)

A	B	C	D		E
Name of all household members		Age	Gender		Tick if age is between 10 and 55 yrs
			M	F	
1.	Start with name of the Household head		1	0	
2.			1	0	
3.			1	0	
4.			1	0	
5.			1	0	
6.			1	0	
7.			1	0	
8.			1	0	
9.			1	0	
10.			1	0	
11.			1	0	
12.			1	0	
13.			1	0	
14.			1	0	
15.			1	0	
16.			1	0	
17.			1	0	
18.			1	0	
19.			1	0	
20.			1	0	

BACKGROUND CHARACTERISTICS

READ OUT:
First I would like to ask you some questions about yourself.

101	**Respondent's line number**	_____		
102	**Determine** sex of respondent	Male..... Female.....	1 0	
103	In what month and year were you born?	Month of birth_____ **(Don't Know month =98)** Year of birth_____ **(Don't Know year =98)**		
104	How old were you at your last birthday?	Age in Years_____		
105	What is the **highest** level of education you have attained?	None ..... Nursery/ kindergarten..... Primary complete)..... Primary (incomplete)..... Secondary (complete) ..... Secondary (incomplete)..... Higher/College ..... ***Adult education***	0 1 2 3 4 5 6 7	
106	Are you **currently** attending primary or secondary school?	Yes ..... No.....	1 0	
107	How religious do you consider yourself? **(READ OUT RESPONSES)**	Strongly religious/born again..... Somewhat Religious..... Not at all religious.....	1 2 3	
109	What is the **main** source of water for members of your household? **Single response**	Piped water into dwelling..... Piped water in to the Compound/ Plot Public tap..... Open well in compound..... Open public well..... Covered well in compound..... Covered public well..... Spring..... River/stream..... Pond/ lake..... Dam..... Borehole..... Rain water..... Bottled water..... Water vendors..... Other (specify) _____.....	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	

110	What is the **main** source of drinking water for livestock of your household? **Single response**	Piped water into dwelling..... Piped water in to the Compound/ Plot Public tap..... Open well in compound..... Open public well..... Covered well in compound..... Covered public well..... Spring..... River/stream..... Pond/ lake..... Dam..... Borehole..... Rain water..... Water vendors..... Other (specify) _____.....	1 2 3 4 5 6 7 8 9 10 11 12 13 14 16	
111	What kind of toilet facility do you use **most** of the time?	Own Flush toilet..... Public flush toilet..... Own Pit latrine..... Public pit latrine..... No facility/Bush/Field..... Other (Specify) _____.....	1 2 3 4 5 6	
112	What is your **main** source of income?	Parental/relative support..... Farming..... Private sector employment..... *Civil Service/government*..... Spousal support..... Casual work..... Domestic work..... Juakali/Informal sector..... Business/Self employed..... Pension..... Other.....	1 2 3 4 5 6 7 8 9 10 11	

your household per day?	25-50 litres..... 51-75 litres..... 76-100 litres..... 101-125 litres..... 126-150 litres..... 151-175 litres..... 176-200 litres..... Other.....	2 3 4 5 6 7 8 9	
Does the water fetched in the house for drinking sufficient for daily household needs?	Yes..... No.....	1 2	
In average what is the distance in kilometers to the **nearest source** of water for the members of your household?	0-5 kms..... 6-10 kms..... 11-15 kms..... 16-20 kms..... 21-25 kms..... 26-30 kms..... Other.....	1 2 3 4 5 6 7	
What is the **common** method of transporting water from the source to your house hold? **Single Response**	Foot..... Bicycle..... Wheel barrow..... Animal Carts..... Donkeys..... Other.....	1 2 3 4 5 6	
Who **mainly** collects water for use in this house hold?	Men..... Women..... Don't know..... No response.....	1 2 8 9	
Who **mainly** takes livestock to the watering point?	Men..... Women..... No response.....	1 2 9	
RENESS			
Is it possible for water borne diseases to **spread** from animals to human beings?	Yes..... No..... Dont know.....	1 2 8	

210	Do the members of your household **boil** water before drinking?	Yes ..... No..... Do not know..... No response.....	1 2 8 9	
211	Do the members of your household **treat** water before drinking?	Yes ..... No..... Do not know..... No response.....	1 2 8 9	
211 (A)	Do you get any information regarding water uses and safety?	Yes No	1 2	**If No skip 212**
212	What is the **main** source of information on safe water for the people of your community? **Single code**	Water committees..... Health facilities..... Public health officers..... Chief barazas..... Other (specify) _____..... Do not know..... No response.....	1 2 3 4 5 8 9	
213	Do you think **water provision** in your community is improving or not?	Improving..... Not improving..... Other (specify) _____..... Do not know..... No response.....	1 2 3 8 9	

WATER MANAGEMENT				
301	Are there **water** points in this area?	Yes..... **No**.....	1 0	**If No skip to q401**
302	How are water points **maintained** in this area?	Charging user free..... Donor maintained..... Govermment maintained..... Other..... Dont know.....	1 2 3 4 5	
303	Are you satisfied the way water points are **managed** in this area?	Yes..... *No*..... Dont know.....	1 0 8	
304	Who **adresses** water issues in your community?	Members of the water commitee..... Government officials..... Health workers..... Other s..... Dont Know	1 2 3 8 9	
305	Does the water you collect sufficient for the daily the household needs?	Yes..... No..... Dont know.....	1 2 9	
306	Are there **levies** paid by the members of the community in order for them to access water?	Yes..... No..... Dont know.....	1 2 9	**If No or D/K skip to q308**
307	How are **issues** of the community members who may not be able to pay for water levies due to poverty or old age solved?	Exempted from levies..... Pay in kind..... Pay throug next of kin ..... Other..... Dont know.....	1 2 3 8 9	
308	How does the community ensure **fairness** when requesting contributions from the households for water activities?	Population of the h/hold..... No. of livestock..... Nature of economic activities of the household..... Source of income from the members of the h/hold..... Other..... Dont know.....	1 2 3 4 8 9	

REFORMS IN WATER

	Now I am going to read to you some statements. Please tell me if you think they are true or false:	True	False	Don't Know
401	There has been changes in the water sector that you have noticed in your community in the last 5 years	1	0	8
402	Water has been made available to you in your community in plenty	1	0	8
403	Safe drinking water has been made available to the people of your community	1	0	8
404	The changes in water management in this community have been properly addressed	1	0	8
405	The challenges related to water changes (reforms) Have been properly addressed in this community	1	0	8
406	The changes in water in this community emphasizes on proper utilization and conservation!!	1	0	8

End interview and thank the respondent.

Stop time_____am/pm

APPENDIX TWO: KEY INFORMANT INTERVIEWS TOOLS AND OBSERVATION CHECK LIST

TOOL TWO QUESTIONNAIRE (KEY INFORMAT INTERVIEWS)

Ministry of Water & Water Management Authority and Water Board

1. Would you share with me changes you are noticing in the water sector since the enactment of the Water Act of 2003

2. How are water users, donors, private sector, professionals and the general public involved in the water reform process?

3. From reviews and reports in the field what are some of the noticeable positive and negative outcomes of water reforms

3. In your view, how do water reforms address issues of water-related diseases?

4. How has water reforms affected local water structures?
(Probe Power dynamics among different stakeholders, Efficiency, Management)

5. How are issues of water management and water source maintenance addressed in the water reforms? (Probe for system breakdowns, type of technology, who decides what, when and why, reliability of supply)

6. How are human and livestock issues addressed in Water reforms?
(Probe on how pastoralist groups and other nomadic groups issues are being Addressed in the water reforms)

7. How are issues of water use and water conservation addressed in the water reforms? (Probe for wastage and control measures in place)

8. How is water pollution and contamination addressed in the water reforms?

9. What are the quality assurance systems put in place to ensure water for human consumption is safe?(Probe for WHO/ National quality assurance standards)

10. How do you ensure compliance of the above standard? (In Question 9) in a diverse geographical setting with different water sources?

11. In your own opinion has the water reforms improved water access in Kenya?
(Probe for different sources of water, costs for water connections, water-related materials like water harvesting etc)

END.

TOOL THREE QUESTIONNAIRE (KEY INFORMAT INTERVIEWS)

Local Water Committee Members/Leaders

1. How are people appointed in the Water Committee in this community?
2. How are water points organized and manage this community?
3. In your own opinion, why do some water points in this community functioning, while others do not?
4. How is water charges set in this community?
5. How is water charges collected in this community?
6. How are issues of water defaulters addressed in this community?
7. How are issues of poverty addressed in water costing?
8. What plans are being put in place by water committees in this area for ensuring that:-
    a) Distance to the water points is reduced, regardless of the season of the year
    b) What measures are being put in place by water committees, for ensuring that water is safe for human consumption?
9. How are water conservation and water pollution address by the Water Committee?
10. How are issues of water wastage addressed by the water committee?
11. How are issues of gender addressed by the water committee in this area?
12. Would you Pease share on your views regarding the on going reforms in water by the government?
13. How are issues of water washed and Water borne diseases addressed by the Water Reforms and this committee?
14. How do the community perceive water reforms?
15. How do water reforms affect the community?

END

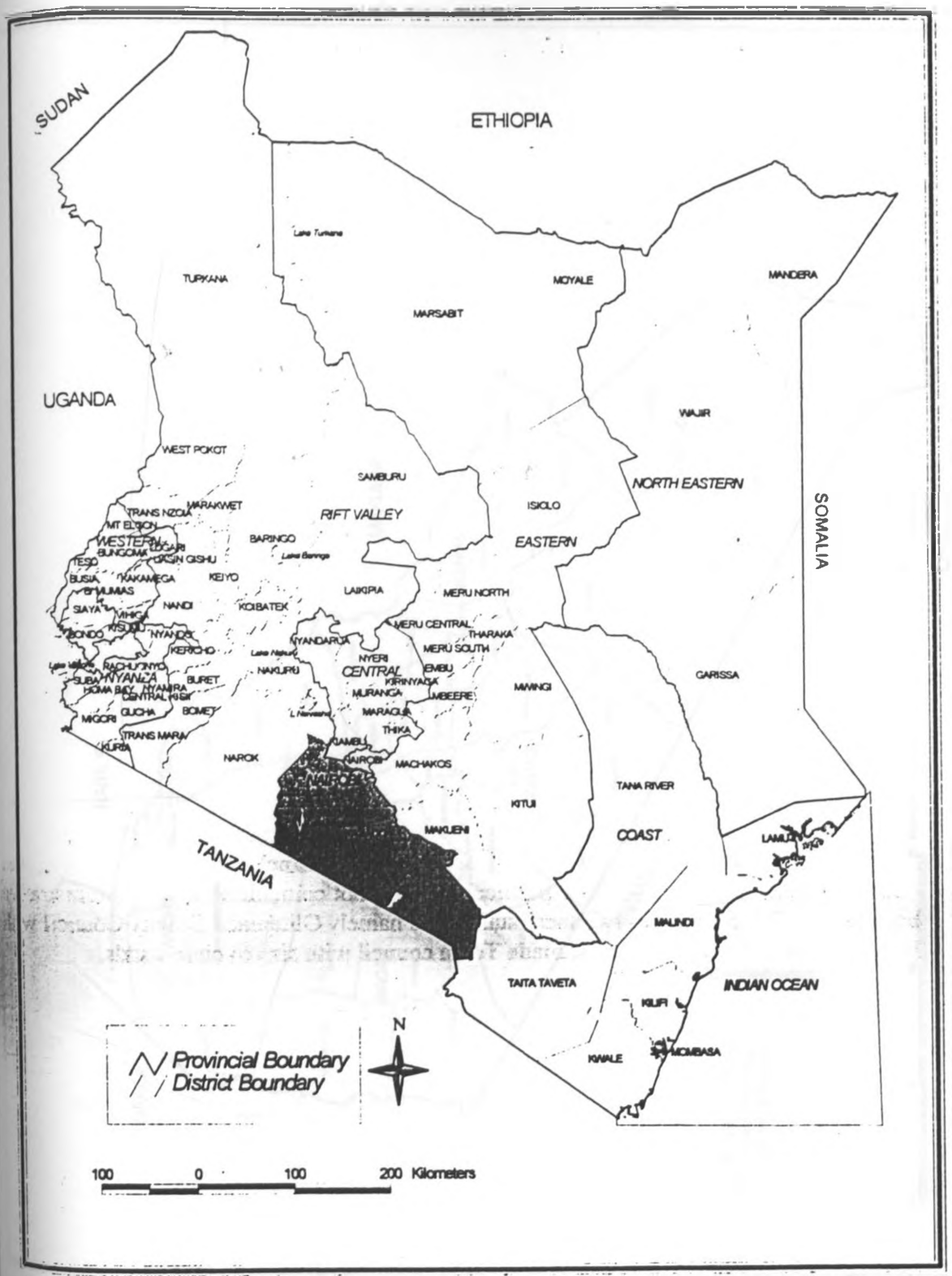
Tool Four: Observation Check List

The observation check list will entail the following

a) Observation of decision making processes at meetings
b) Observation of water safety procedures from collection point to user point
c) Observation of Livestock and human interactions at water point(who is given first priority)
d) Colour of water
e) Volume of water
f) How records are kept

APPENDIX 3: MAP SHOWING THE STUDY SITE

LOCATION OF KAJIADO IN KENYA

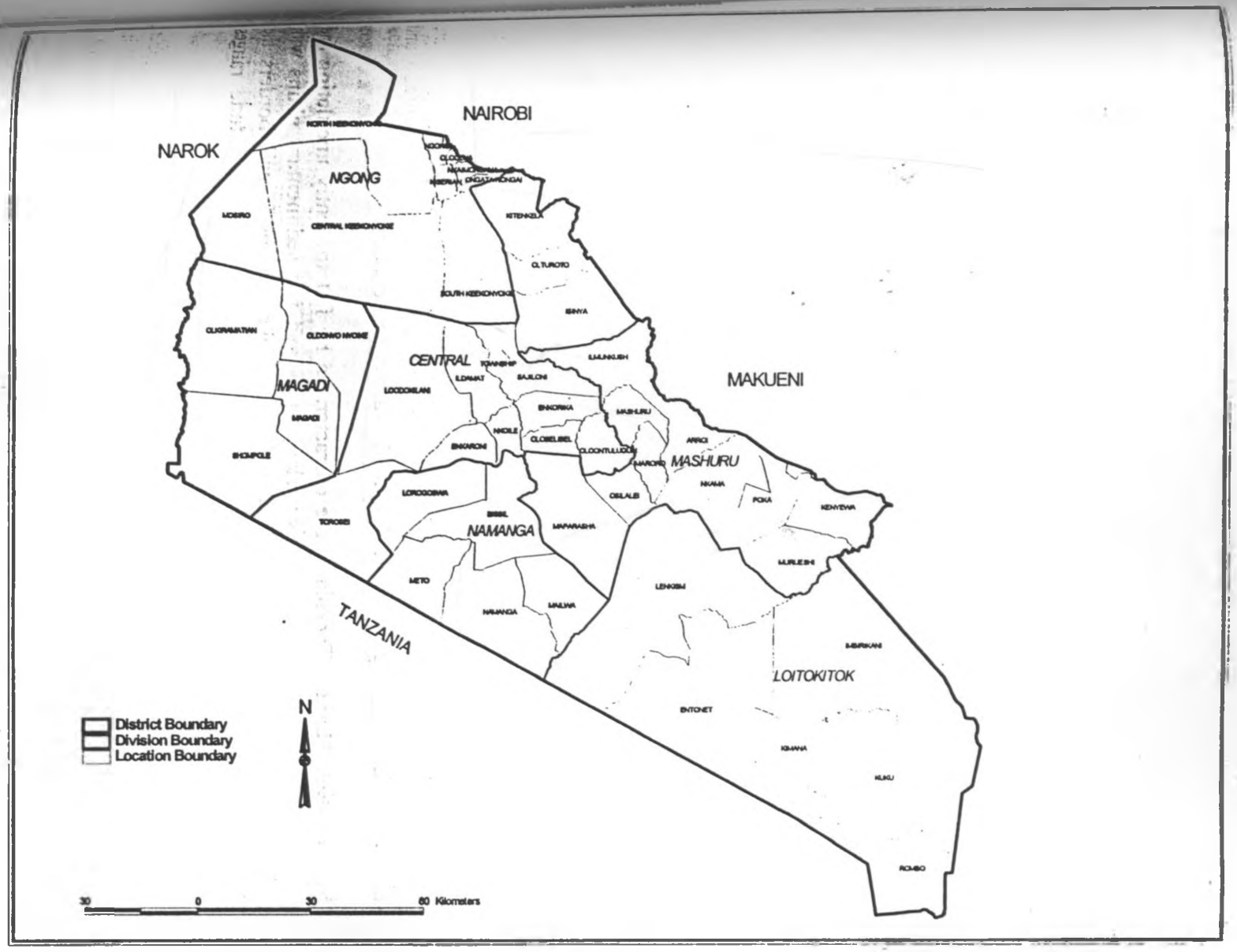


Prepared by CBS, 1999 Pop. Census

This map is not an authority over administrative boundaries

Source: GOK: CBS 1999

Source: GoK: CBS 1999



Prepared by Central Bureau of Statistics, 1999 Population Census

This map is not an authority over administrative boundaries

APPENDIX 3: MAP SHOWING THE STUDY SITE

APPENDIX 4: RESEARCH PERMIT

MINISTRY OF SCIENCE AND TECHNOLOGY

Telegram: SCIENCE TECH", Nairobi
Telephone: Nairobi 318581
Email:psmst@education.go.ke
When replying please quote

JOGOO HOUSE "B"
HARAMBEE AVENUE
P.O. BOX 9583-00200
NAIROBI

Ref. MOST 13/001/ 37C 415/2

16th JULY 2007

Samuel Obara
University of Nairobi
P.O. Box 30197
NAIROBI

Dear Sir

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on, ***'The Effects of Water Reforms on the Health of Maasai Community of Central Division, Kajiado District'***

I am pleased to inform you that you have been authorized to carry out research in Kajiado District for a period ending 31st December 2007.

You are advised to report to the District Commissioner and the District Education Officer Kajiado District before embarking on your research project.

On completion of your research, you are expected to submit two copies of your research report to this office.

Yours faithfully

M. O. ONDIEKI
FOR: PERMANENT SECRETARY

Copy to:

The District Commissioner
Kajiado District

The District Education Officer
Kajiado District

PAGE 2

IS TO CERTIFY THAT:

Dr./Mr./Mrs./Miss SAMUEL OBARA
IVERSITY OF NAIROBI
ddress) P.O.BOX 30197
ROBI

een permitted to conduct research in

Location,
KAJIADO District,
RIFT VALLEY Province,

e topic THE EFFECTS OF WATER
ORMS ON THE HEALTH OF MASAI
MUNITY OF CENTRAL DIVISION
IADO DISTRICT

period ending 31ST DECEMBER, 2007

PAGE 3

Research Permit No. MOST 13/001/37/415

Date of issue 16.7.2007

Fee received SHS.500.00

For PERMANENT SECRETARY
MINISTRY OF SCIENCE AND TECHNOLOGY

M.O.ONDIEKI

Applicant's Signature

FOR *Permanent Secretary*
Ministry of
Science and Technology