

**FACTORS INFLUENCING SUSTAINABILITY OF PIPED WATER
SUPPLY IN RURAL COMMUNITIES IN KENYA: A CASE OF
LIKUYANI SUB COUNTY, KAKAMEGA COUNTY.**

BY

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DECLARATION

This Research project is my original work and has never been presented for an award in any other university.

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DEDICATION

This research project is dedicated to my husband Mr. Jackson Luseno who allowed and facilitated me to pursue this course and persevered with me. My dear children Moses, Winston and Christine for their constant encouragement, patience and invaluable support throughout the entire period of my studies.

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LIST OF ABBREVIATIONS

ASAL	Arid and Semi-Arid Lands
CBOs	Community Based Organization
CM	Community Management
DFID	Department for International Development
ESAs	External Support Agencies
FGDs	Focus Group Discussions
GoK	Government of Kenya
IMF	International Monetary Fund
JMP	Joint Monitoring Programme
LVNWSB	Lake Victoria North Water Services Board
LVSWSB	Lake Victoria South Water Services Board
MDG	Millennium Development Goals
NGO	Non-Governmental Organization
O& M	Operation and Maintenance
PPP	Public Private Partnership
PSPs	Private Service Providers
SPSS	Statistical Package for Social Sciences
UN	United Nations
UNDP	United Nations Development programme
UNICEF	United Nations Children Fund
USAID	United States Agency for International Development
WAB	Water Appeals Board
WASH	Water Sanitation and Hygiene
WASREB	Water Services Regulatory Board
WB	World Bank
WCED	World Conference on Environment and Development
WEDC	Water Engineering and Development Centre
WHO	World Health Organization
WRMA	Water Resources Management Authority

WRUAs	Water Resource Users Association
WSBs	Water Services Boards
WSPs	Water Service Providers
WSSCC	Water Supply and Sanitation Collabouration Council
WSSS	Water Supply and Sanitation Sector
WWAP	World Water Assessment Programme

ABSTRACT

This study sought to assess factors that influence sustainability of Piped water supply systems in Likuyani Sub County, Kakamega County. Despite heavy investment in water supply infrastructure, piped water supply schemes sustainability remains a challenge to communities in the rural areas as most water supplies fail or stall within a few years of development owing to several factors. This study sought to address the following objectives: to examine how management approaches influenced sustainability of the water projects in the Sub County, to determine the effect of community participation on sustainability of the projects, to investigate how finances influence sustainability of the projects and to examine how technology influences sustainability of community piped rural water supply projects in Likuyani Sub County, Kakamega County. The sample size of the study consisted of 180 registered household members of piped water supply schemes and one piped water supply management committee in focus group discussions. Key informant interview was carried out with Staff from the sub County Water Office Random sampling techniques were used to select households. Questionnaires were used to obtain data from households while interview schedules were used to obtain data from key informants. Content validity of the data collection instruments was established by expert judgment. Reliability of the instruments was established through a pre-test. Descriptive analysis was conducted and presented using frequencies which were obtained to show distribution of responses. Results have been displayed using tables,. The findings of this study reveal that sensitization and mobilization of the community before the project implementation was not done adequately. Community was not involved in the planning and design of the project. Technologies used in the implementation of the project were often selected by state implementers without taking into consideration the cost and availability of spare parts. Communities were comfortable with the tariffs levied by their water supplies but some were not willing to pay for the water services as they felt that they were not getting value for their money because the supply of piped water was neither continuous nor was it sufficient. The study concludes that community participation at all levels had an important bearing on the sustainability of the projects as it instills a sense of ownership. The study recommends adequate funding for piped water supply projects and involvement of the community in all the phases of the project right from the planning to operation and maintenance phases as essential determinants of project sustainability. It further recommends that Public Private Partnership management model be embraced to enhance the financial and technical sustainability of the piped water supply schemes.

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Globally, water supply systems play a very significant role in enabling communities' access water for their domestic use. According to WHO report (2012) about 1.1 billion people globally do not have access to improved water supply because water projects are not sustainable. Since so many people are not having access to safe drinking water, sustainability becomes more and more important. Water supply sustainability requires meeting our water needs (i.e. drinking, irrigation, industrial, recreation and energy) upon which economic development depends, while protecting the environment and improving social conditions (Ioris, Hunter, & Walker, 2008).

Millennium Development Goal (MDG) Summit Report (2010) indicated that there is progress on the MDG 7 target to reduce by half the proportion of people without sustainable access to safe drinking water by 2015. In developing countries, most national governments, local and international NGOs invest substantial amount of funds every year in the implementation of rural water supply projects. However, the construction of the water projects do not benefit the target communities since they cease to function well after a short time after completion. It is estimated that only two out of three hand pumps installed in developing countries are functioning at any given time (Rural Water Supply Network, RWSN, 2010). This challenge of rural water supply system sustainability is likely to impact negatively on the progress towards achieving the MDG 7 target.

Rural areas in developing countries across the world remain severely disadvantaged, with eight out of ten people not having access to an improved water supply from a sustainable water source. Access to water and sanitation is one of the major challenges for the 21st century. Lack of sustainability of water supplies translates to reduced access to potable water. As a result dirty water and a lack of basic sanitation continue undermining efforts to end extreme poverty and disease in the world's poorest countries.

Sustainability is now a very common word found in almost all project proposal documents as an objective of any water supply and sanitation programmes. It is not possible to claim lasting impact in terms of rural poverty reduction without ensuring this aspect of development. According to the Oxford English Dictionary (1973) Sustainability is to keep or maintain at the proper standard. However the World Conference on Environment and Development (WCED) of 1987 defined sustainability as “meeting the needs of the present generation without compromising the ability of future generations to meet their own needs (WCED, 1987). This definition encompasses both the development and environmental dimension of sustainability. Millennium Development Goal (MDG) Summit Report (2010) indicated that there is progress on MDG 7 target to reduce by half the proportion of people without sustainable access to safe drinking water by 2015 (UN, MDG Summit Report, 2010). In developing countries, most National Governments, local and international NGOs invest substantial amount of funds every year in the implementation of rural water supply projects. These projects do not benefit the target communities as they cease to function well a shortly after completion. It is estimated that only two out of three hand pumps installed in developing countries are functional at any given time (RWSN, 2010). According to Sutton, (2005) large percentage of non-functioning wells is as a result of inadequate operation and maintenance and lack of sustainable services. Further the report states in a survey conducted by Sutton in 11 countries in Sub-Saharan Africa, the percentage of functioning water systems in rural areas ranged from 35-80%.

In Tanzania, a survey carried out by Hansom, (2006) revealed that an average functionality rate among public distribution points was 45%. Across rural Sub-Saharan Africa, an average of 36% of hand pumps are non-operational at any given time, and in some countries, it is estimated that more than 60% of hand pumps are non-operational (RWSN, 2008). According to Petros, et al (2013) Gravity fed piped water supply schemes in rural Malawi are not functioning properly and hence unsustainable. Consequently the schemes have low levels of water services provided as evidenced by long down time of water points.

The reasons for such low levels of rural water supply sustainability are multifaceted and include limited demand, lack of affordability or acceptability among communities, limited community management structures, inadequate supply chains for equipment and spare parts, insufficient government support, and environmental issues (Harvey, 2008). According to WHO & UN2010 b, 78% of the inhabitants of Kenya live in rural areas. Out of these rural inhabitants, 48% do not have access to safe drinking water.

The present institutional arrangements for the management of the water sector in Kenya can be traced to the launch in 1974 of the National Water Master Plan(NWMP) whose primary aim was to ensure availability of potable water, at reasonable distance, to all households by the year 2000 (Mumma, 2005). The Plan aimed at achieving this objective by actively developing water supply systems. To do so require that the Government directly provide water services to consumers, in addition to its other roles of making policy, regulating the use of water resources and financing activities in the water sector. The legal framework for carrying out these functions was found in the law then prevailing, the Water Act, Chapter 372 of the Laws of Kenya. In line with the Master Plan, the Government upgraded the Department of Water Development (DWD) of the Ministry of Agriculture into a full Ministry of Water. DWD embarked on an ambitious water supply development programme. By the year 2000, it had developed, and was managing, 73 piped urban water systems serving about 1.4 million people and 555 piped rural water supply systems serving 4.7 million people.

In 1988 the Government established the National Water Conservation and Pipeline Corporation (NWCPC), as a state corporation under the State Corporations Act, Chapter 446 of the Laws of Kenya, to take over the management of Government operated water supply systems that could be run on a commercial basis. By 2000 the NWCPC was operating piped water supply systems in 21 urban centers serving a population of 2.3 million people and 14 large water supply systems in rural areas serving a population of 1.5 million people.

Alongside the DWD and the NWCPC the large municipalities were licensed to supply water within their areas and by the year 2000, ten municipalities supplied 3.9 million urban dwellers. Additionally, about 2.3 million people were receiving some level of

service from systems operated by self-help (community) groups who had built the systems, often with funding from donor organizations and technical support from the district officers of the Department of Water Development (Government of Kenya, 1999).

Persons not served under any of the above arrangements did not have a systematic water service, and had to make do with such supply as they were able to provide for themselves, typically by directly collecting water from a watercourse or some other water source on a daily basis. Indeed, despite the Government's ambitious water supply development programme, by 2000, less than half of the rural population had access to potable water and, in urban areas, only two thirds of the population had access to potable and reliable water supplies.

1.2 Statement of the problem

Sustainability of rural community piped water supplies continues to remain a challenge for both donors and the government with the value for investment involved being hard to realize. According to a report from Likuyani Sub County Water Office, about 75% of Piped water supply projects developed in Likuyani Sub County stalled a few years after commissioning. Efforts have been made to address this issue but with very minimal success leaving one to wonder whether the problem lies with the government, donor or the community. Likuyani is among the Sub Counties in Kakamega County having a large population without access to safe drinking water (Likuyani Sub County). New water supplies in the Sub County stop functioning within a few years after implementation.

Water is not only important for public health, but also for general livelihoods. Crop production, livestock production, industry, commerce and daily life depend on sustainable water. Water supply therefore affects health, hunger, poverty and community development which in turn affects the social and economic development of individuals and Nations and the world as a whole. Community water supplies in both developing and developed countries are more frequently associated with outbreaks of waterborne disease. Investing in piped water supplies therefore aims at reducing waterborne disease outbreaks as well as easing the health burden. (RWSN, 2007).

1.3 Purpose of the Study

The purpose of this study was to assess the factors that influence sustainability of water supply in rural communities in Likuyani Sub County, Kakamega County.

1.4 Objectives of the Study

The Objectives of the study were:

1. To establish the how management approaches influence sustainability of piped water supply in Likuyani Sub County, Kakamega County.
2. To determine how community participation influences sustainability of piped water supply in Likuyani Sub County, Kakamega County.
3. To investigate the extent to which finances influence sustainability of piped water supply in Likuyani Sub County, Kakamega County.
4. To examine the extent to which technology influences sustainability of piped water supply in Likuyani Sub County, Kakamega County.

1.5 Research Question

The study sought to answer the following research questions:

1. How do management approaches influence sustainability of piped water supply in Likuyani Sub County, Kakamega County?
2. How does community participation influence the sustainability of piped water supplies in Likuyani Sub County, Kakamega County?
3. How does finance influence sustainability of piped water supplies in Likuyani Sub County, Kakamega County?
4. How does technology influence sustainability of piped water supply in Likuyani Sub County, Kakamega County?

1.6 Significance of the Study

The study is expected to be significant to the policy makers and development agencies seeking to invest in sustainable piped water supply schemes by facilitating informed decision-making while planning and developing policies on these projects taking into consideration the paramount importance of their sustainability.

It is hoped that the findings of this study will assist County Governments and Development Partners seeking to invest in sustainable development. They shall be able to develop strategies tailored to fit the needs and conditions of the local community so as to enable them to sustainably manage their water supplies and enhance accessibility to potable water. It is expected that the findings will enable the Likuyani Sub County leaders as well as other stakeholders such as NGOs and County Governments to make informed decisions in respect to identifying, planning, designing and implementation of water interventions in the region to enhance sustainability of these projects thus achieve value for investments made. The study also intends to add to the existing body of knowledge for Development Agencies, Governments, Communities and Researchers, hence it will provide basis for further research on sustainability of piped water supply projects in Kakamega County. There is need to establish all water supplies in Kakamega County to identify the gap and hence the areas for investment.

1.7 Delimitations of the Study

The Study was delimited to Likuyani Sub County. The scope of this study was designed to cover the community within existing piped water supplies, whether functional or non-functional, management committees and key informants . The Sub County comprises of five Wards namely, Sinoko, Likuyani, Nzoia and Kongoni. Sinoko was, however not studied as there is no significant piped water supply implementation done against which sustainability could be studied.

1.8 Limitations of the Study

Factors hindered the research study included poor road networks which were mitigated by use of a motor cycle to areas that were difficult to access. The other limitation envisaged was that of language barrier which was controlled through using research assistants to interpret. To deal with the limitation of personal emotions likely to lead to bias, those involved in data collection were trained on proper and professional methods of interviewing correspondents to enhance objectivity of the research study.

1.9 Basic Assumptions of the Study

The study assumed that those interviewed were giving accurate information that would help the researcher come up with true findings. The study assumed that the Instruments used for collection of data for the research study would be valid and reliable and that the sample size used was a true representation of the target population. The study also assumed that there would be no political interference with the process of carrying out the research study.

1.10 Definition of Significant Terms as used in the Study

Community Participation is an approach through which beneficiaries and other stakeholders are able to influence project planning, decision-making, implementation and monitoring phases.

Sustainability is about whether provisions of services continue to work and deliver benefits over time. In other words, sustainability is about permanent beneficial change in provision of services.

Community ownership is about initiatives undertaken by individuals and communities to enhance their own water or sanitation services.

Water Supply System is a system providing water of adequate quality and quantity to all people within a defined area of service.

1.11 Organization of the Study

The study is organized into five chapters as follows;

Chapter 1: Introduction Background of the study, Statement of the problem, Purpose of the Study, Objective of the Study, Research Questions, Significance of the study, Delimitations of the Study, Limitations of the Study, Basic assumptions of the study, Definition of significant terms as used in the Study.

Chapter 2: Literature Review Introduction, Management approaches and sustainability of piped water supplies, Community Participation and sustainability of Piped Water Supply, Financial Factors and sustainability of Piped Water Supply, Technology and sustainability of Piped Water Supply Systems, Theoretical Framework, Conceptual Framework.

Chapter 3: Methodology, Introduction, Research Design, Target Population, Sample size & sampling procedures, Research Instruments, Pilot Testing, Validity of the Instruments.

Data collection procedures, Data Analysis Techniques, Ethical Issues.

Chapter 4: Data Analysis, Presentation, Interpretation and Discussion.

Chapter 5: Summary of findings, conclusions and recommendations, suggestion for further studies.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This section deals with reviewing related literature, theoretical framework, conceptual framework, summary of literature and the gaps in literature.

2.2 Management Approaches and sustainability of piped water supplies

Management of water supply schemes can take various forms or approaches. A completed project can be managed by the community (through a water committee), the government, a private entity, or the community partnering with the private sector.

2.2.1 Community management model

According to (Schouten & Moriarty, 2005), community management approach is aimed at strengthening the capacities and willingness of the community to take ownership and responsibilities of managing their water supply system. The cornerstone of community management states that; if communities are involved in decision-making it will result in equitable supply of services derived from community empowerment (UN, 2009/a).

Community Management (CM) has become a major subject in the design of rural water supply and sanitation projects throughout the developing world. For many years, community participation has been considered as vital for management of water and sanitation development projects, especially in rural sector. There have evolved different forms of community participation over the past few decades. For rural water supply, the prominent model is community management service model (WEDC, 2003). Community management has achieved wide spread acceptance and majority of rural water supply and sanitation projects all over Sub-Saharan Africa are currently applying it (IRC, 2003). Community management is evolved as an NGO- or donor-driven model for time-bound pilot projects. This model may play under the leadership of government with community institutions to scale up the rural water supply delivery with the support from local and

national government structures (Schouten & Moriarty, 2004). Community management as a demand driven community-led approach incorporates participatory method and decentralization strategy to successfully deliver rural water supply services better than supply driven government-led models (Lockwood, 2004). It is argued that CM can improve efficiency, meet the target of the project within planned budget and enhance sustainability of rural water management (Mazango & Munjeri, 2009).

The basic assumptions of community management allow beneficiary community to develop, own and operate and maintain their facilities or systems (Harvey & Reed, 2007). Additionally, it plays important roles during the planning and implementation phases (WEDC, 2003). According to Harvey & Reed (2007), development stages of community management for water supply are; water committee formation, training and capacity building, Setting and collecting water tariffs and management and /or implementation of O&M activities of the system.

The core value of community management is to empower and equip communities to take control of their own development (Doe & Khan, 2004). However, community management encounters a lot of challenges. First, it cannot work successfully due to absence of right configuration of markets, government institutions and tradition (Kleemeier, 2000; Kleemeier, 2010). Second, a sticky problem with the volunteer based community management of water supply is that community-level committee and care taker lose their interests or trained individuals move away, community never feel as owners of the new infrastructure (Carter et al., 1999). Third, sustainable rural water supply projects in developing countries face several threats. For instance, dependency on community spirit becomes weaker with the modernizing influences such as increased mobility through infrastructure development, more off land employment access, industrialization, rural urban drift, increased wealth, materialism and individualism which erode the traditional structures and values. Moreover, bureaucracies of government structures in developing countries which are not suitable for community management approach (Carter et al., 1999). Fourth, this management model is also fraught with types of constraints-internal and external. Internal constraints include poverty, strong traditions, misplaced priorities and unfavorable settlement patterns within the rural milieu. External

constraints noted are beyond the control of rural communities that include time constraints and sectoral development plans by External Support Agencies (Laryea, 1994). Fifth, community participation is identified as a tool for water and sanitation projects for short to medium term success (Carter et al., 1999). Doe & Khan (2004) recommended community management for smaller rural communities in which community will be involved actively. Community management model, albeit runs smoothly at the initial stage, problems begin within 1-3 years after the commissioning of systems leading to the breakdown of management system (Harvey & Reed, 2007). Moreover, Harvey & Reed (2007), identified the causes for breaking of management system which are dependency on voluntary input, lack of incentives for community members, absence of appropriate replacement policy for committee members, lack of transparency, accountability and lack of regulations, lack of legal status and authority of the water committee, absence of liaison with local government institutions, and inability to replace the major capital items. Most of the community managed water supply schemes run with acute financial shortage as this management cannot collect tariff from the beneficiary efficiently (Whittington et al., 2009).

In addition to all of these problems, Kleemeier & Narkevic (2010) have described elaborately the problems of community management approach. Significant problems include the impossibility of being able to predict funding from one year to the next. As a result it becomes very difficult to make even short term sector planning, Poorer, dispersed, and less organized communities, in most of the cases with minimal or no follow up after construction. Dramatic drop of management capacity of local water committee over the time as the people lose their interest. This is because even though, initially committee members are trained extensively, there is no provision/ option to skill upgrading, or replacement when those who are trained move away, spotty cost recovery for operation and maintenance; if too much raised, attract misuse by those in office ,otherwise more often too little is collected which cannot meet the expenses of repair when needed. These technologically complex system or large number of customers, operations and maintenance become challenging, recuperation of investment cost ideally stops fully once an upfront payment has been made, availability of spare parts, trained

manpower and tools are scarce for major repairs resulting in the infrastructure sitting idle for long period of time.

It is mentioned that in developed countries community management model could not manage piped rural water supply successfully, so it is not justified to expect breakthrough of community management in low income countries. Although community management approach is adopted unanimously in rural water supply of sub-Saharan Africa, it cannot ensure sustainability of the interventions (Harvey & Reed, 2007). However, Opare (2011) has observed that developing countries adopt community management initiatives as it removes internal differences, increase technical knowledge and management experiences. This study has found co-management with public agencies along with private firm immediately after implementation for 3-6 months made community capable of assuming the full management responsibility. This reveals that community management system works successfully, if local capacity is adequately strengthened with external support prior to assumption of full community control of water supply systems, and if assumption of responsibilities is pursued gradually. In addition, capacity building, construction supervision and providing support to the community owned management during the first year of implementation are recommended for maintaining long term functionality of water points (Jiménez & Pérez-Foguet, 2011).

2.2.2 Private Management Model

There are different forms of private sector participation in the Water and Sanitation sector. Davis (2005) identifies some types of participation arrangements which include: Service or management contract, Lease, Concession, Build-Operate-Transfer (BOT), Independent service providers. Participation of private entity in the water sector is a growing issue (DFID, 1998). In private sector management approach, the private sector manages the system, whereas communities have to pay for the service received (Harvey & Reed, 2004; Harvey & Reed, 2007; Parry-Jones et al., 2001). The search for substitute of community management is a natural and growing response by the beneficiary communities and policy makers to improve rural water services. Relevant literature review illustrates a wide range of private sector and public private partnership (PPP) initiatives are underway around the world (Kleemeier & Narkevic, 2010). Private

operators are evolving in rural water supply in the form of delegated contracting through PPPs (Lockwood & Smits, 2011).

Carter et al. (1999), Doe & Khan (2004) and Harvey & Reed (2007) have advocated for private sector participation in rural water supply sector. Harvey & Reed (2007) underline the need for exploring private sector options in the rural water supply areas, where there is resistance to community management or limited capacity for its successful operation. Carter et al. (1999) have focused on the issues which will be taken care for successful private sector participation are providing reasonable profit of service provider along with safe guarding consumers' or purchasers' proper rights, protection and choice. Giné & Pérez-Foguet (2008) have termed private sector participation model as an alternative emerging management model for rural water supply, but still it is in premature stage. Authors have also cautioned not to overestimate private sector's commitment to public service delivery as they lack sufficient skill and experience in the sector. So capacity building of private sector is essential. Besides, they focus on the pricing of service and goods, which should be affordable to the community and an agreement between consumers and service provider, need to be fair and equitable. They also indicate the weakness of water entities, low negotiation capacity that can produce unequal contracts with private operator resulting in an unequal competition where operator is likely to enjoy more benefit than users. Despite all these facts, rural private operator model for water supply appears to be the promising option for solving the problems of sustainable operation and maintenance (Kleemeier, 2010).

Lee & Jouravlev (1997) described merits of private sector management of water supply as a way of management which would reduce costs, opportunistic management and regulatory capture alongside increase investment, transparency and efficiency. However, a number of researchers Vandana (2002), Lobina & Hall (2008), Barlow & Clarke (2002), Hall & Lobina (2007), argue against private sector management that the profit motive of private corporation marginalize the poor. Without strong regulatory institution, privatization is inappropriate, adoption of incentives for externalities will make harm for environment, less competition for contract, private sector financing is costlier than public sector.

Finally their strong claim against private management is that water cannot be treated as commodity, as access of water is a human right. In addition, some researchers support their statements and observe that private sector participation in water supply is geographically segmented. Specifically, the low income areas are avoided globally, locally and regionally by private service provider (PSP) (Jimenez & Perez-Foguet, 2009). The cause behind it is clear as PSPs want safe economic returns on their investment.

During the last decade emerging trend appeared in the world water sector is that Governments of the countries are positively embracing the increased involvement of the private sector both to financing and managing the industry's infrastructure and services. There is a growing political consensus that public sector is less capable than private sector to manage new or existing assets efficiently (Martin, 1996). World Bank and the International Monetary Fund advocating for water service privatization based on the assumption that private entities can improve the management as they can invest capital to improve infrastructure, improve system performance, reduce water rates and more responsive to consumer needs (Cardenas, 2011).

However, in some cases private water services facing challenges because of much increase in water rates, economic fluctuation, decline of water quality and failure to expand the services to less profitable areas (Cardenas, 2011). Additionally, water privatizations in lower-income economies are problematic due to the technology of water provision and the nature of the product, transaction costs, and regulatory weaknesses (Kirkpatrick, Parker, & Zhang, 2006). Lewis & Miller (1987), based on the study of Public-private partnership in water supply and sanitation concluded that though private managed water supply programme fails to meet its coverage targets, but able to become financially solvent and have fostered a rapid growth in capacity through the informal sector. The authors have also made some recommendations on the basis of the experience of developing countries' water systems which favor private management of water supply. These are: Water vending and charging for water is common in developing countries and not culturally unacceptable; to ensure sound management of water supply and sanitation services provision, incentives are essential. In addition, roles of regulators are essential

for public authorities to regulate the private supply activity and monitor quality of supply to maintain competition and ensure proper and fair operation (e.g. billing, metering)

2.2.3 Public - Private – Partnership (PPP) Management Model

The Government of Kenya developed a PPP Policy 2011 and enacted PPP Act in December 2012. These policy and legal instruments provide a framework for the participation of private sector in financing development, construction, operation and maintenance, as well as management of infrastructural projects for public service delivery. Similarly, the ministry of Environment water and natural resources has developed National Water Policy of 2012 and drafted new Water Bill of 2012 to provide favorable environment for PPPs so as to cope with increased water services demand and operational efficiencies.

This model advances partnership between the private and the public in the management of community water project. The community identifies a private entrepreneur to run the operations of the water project on its behalf. In essence there is separation between ownership and management. Extension and development of infrastructure lies with the private entrepreneur. The main objective of this model is to introduce professionalism and commercialization in the management of the community water project hence sustainability

The public private management model has its own, challenges. It has faced a lot of resistance from community due to ownership issues; communities feel that the projects are being taken away from them it actually threatens the status-quo. Secondly the criteria and process of identifying viable projects must be full proof and very participatory. This model requires huge investment in terms of sensitization, mobilization, awareness creation and trainings. More so it is a model that has not been well understood by stakeholders and the government needs to do a lot of sensitization to create awareness among communities.

2.3 Community Participation and sustainability of piped water supply

According to Macqueen (2001), a community is a group of people with diverse characteristics who are linked by social ties, share common perspectives and engage in

joint action in geographical locations or settings (Macqueen, 2001). Long-term sustainability of projects is closely linked to active, informed participation by the poor. The present obstacles to people's development can and should be overcome by giving the populations concerned the full opportunity of participating in all the activities related to their development. (Munoz et al, 2008).

Generally, the way community perceive the projects funded by development partners is very essential for their sustainability. When the community feels that the water projects within their locality is owned by them and not the partner, it leads to high association with projects and potential sustainability of the project. For projects to be sustainable, they must originate from the community's needs and prioritization which assures them that their opinions are valued and therefore develop positive attitudes towards the projects. Participation is a process through which stakeholders' influence and share control over development initiatives and the decisions and resources which affects them. It is a rich concept that means different things to different people in different settings. For some it is a matter of principle, for others a practice, and still for others, an end in itself. Experience has demonstrated that people can devise their own alternatives if they are allowed to make their own decisions (Bhatnagar, 1992). Community participation by social groups, both men and women, should be in all project phases. This should be from planning, designing, constructing and managing the water supply system and in the operation and maintenance of the services. Community participation gives planners a more thorough understanding of local values, knowledge and experience, it wins support for project objectives and fosters community assistance in local implementation, and it helps resolve conflict over resource use. Community participation occurs when a community organizes itself and takes responsibility for managing its problems. Taking responsibility includes identifying the problems, developing actions, putting them into place and following through (Advocates for Youth, unpublished data from Burkina Faso, 2001).

According to Water AID, (2009) a study which attempted to relate the degree of community participation in rural water supply projects with their subsequent effectiveness and their continuing sustainability, consistently showed that beneficiary participation was more significant than any other factor in achieving functioning water

systems. Carter & Rwamwanja, (2006) argues that in cases where the best principles of community participation are taken seriously and implemented effectively then solid foundation for subsequent sustainability is provided. World Bank, (2010). According to Doe & Khan, (2004) if community members are involved in planning, implementation and maintenance of their water supply system, the infrastructure can be sustained more easily.

Community contribution in any form in project development is very critical for the ownership and sustainability. Contribution may be in terms of cash, locally available materials, both skilled and unskilled labour .Gine & Perez-Foguet (2008) conclude that community participation has gained widespread acceptance as a prerequisite for sustainability; but community management has not. Achieving full and effective community participation in development activities is not easy and a lot depends on the way that field workers, extension workers or technical consultants approach the community. Most projects fail to meet their objectives because the intended beneficiaries failed to change behavior or attitudes that are critical to the projects' success. One critical factor that many costly facilities fall into disrepair has been the failure to mobilize the will of the people.

A study carried out by in Tanzania by Water-Aid to relating the degree of community participation in rural water supply project with their subsequent effectiveness and continued sustainability showed that beneficiary participation was more significant than any other factor in achieving functioning water systems (WaterAid, 2009).

In South Africa community participation was generally found to be more successful when the community was involved in all phases of the project cycle that include planning, designing, implementing, maintaining, supervising and evaluating new water supplies (Twala, 2001). In the early 1980s, South African Communities had little say in the provision of water and decision making processes leading to failure of most projects as a result of lack of community involvement in the implementation of the cycle process. However when community groups were involved in subsequent projects, they were done to completion with members exhibiting ownership and providing security for facilities hence sustaining them (Twala, 2001).

According to ATPS, (2007) where communities have shown significant commitment, there is significant success in the management in terms of ensuring access and sustainability of the community water resource. Okafor (2005) observed that empowering communities improve efficiency, local participation yields better projects and better outcomes; greater transparency and accountability enhances service delivery; Community participation can kick start local private contractors and service providers as well as encourage donor harmonization.

Community Involvement is an arrangement in which the community and the beneficiaries at large are involved in the planning and implementation of the project and even contribute at times to the investment cost of the project either in cash or kind. This creates a sense of ownership by the community and perception of the project as their own. This can create desire or willingness to engage continuously on the project which eventually ensures sustainability. The communities take a leading role and initiative to contribute to their own projects.

Communities who are beneficiaries of the projects should not be seen as targets but should be seen as assets and partners in the development process. Experience has shown that given clear rules of the game, access to information and appropriate support, communities can effectively organize to provide goods and services that meet their immediate priorities. This is because communities have considerable capacity to plan and implement programmes when empowered i.e. given power to decide and negotiate (Tade, 2001). If communities are involved in project formulation, design and implementation, the projects are likely to be sustained, more cost effective as there is more equitable distribution of project benefit. It also leads to better designed projects (Ademola, 2008).

According to Starkey (2002), participatory user focused network can have all stakeholders work together and encouraged to collabourate and learn from each other. However for the sustainabilty to be achieved there must be government/ institutional support and the community leaders must be accountable and transparent. When local groups are actively involved in project design and implementation, they take on ownership and are more likely to continue the project when donor funding ends, compared with externally imposed projects (Ford, 1993). According to the New Nigeria

(1987), if a community or group has a genuine need for a facility and works towards its establishment, such a facility would be well protected and maintained by its members because it is their sweat.

2.4 Finances and sustainability of piped water supply

Sustainability of piped water supply today invariably depends upon communities taking financial responsibility for their schemes, which if achieved will enable scarce resources from government and donors to be targeted specifically on areas where there is no water supply

Financial factors that contribute to sustainability of a water supply system include efficient revenue collection, the ability to meet the cost of operation and maintenance and the willingness to pay for the services. According to World Bank (2007) evaluation report, sustainability of water supply projects can only be ensured if tariffs generate enough resources to operate the system and replace the infrastructure after its useful life.

Financial sustainability includes among others tariff setting, revenue collection, action against payment defaulters, proper book keeping and cost recovery(WSP,2010). Finances Are needed for Operation and Maintenance (O&M) to keep the system functioning.

A study of water systems in Western Kenya by SNV (Netherlands) mentioned the poor governance and mismanagement of collected revenues by local water committees as a main cause for the low cost recovery (Tertiary International, 2012).

In a review of literature on willingness to pay for water services in low income countries by Merret (2002), different factors are mentioned which contribute to low willingness to pay. These include hard economic life such that households take greatest care over their household expenditure, existence of a widely held view that certain public services should be free, politicians giving support to non-payment, poor quality of public services, corruption by government officials such that payment for public services are known to line the pockets of the power elite and unwillingness of government or the public water

utility to exercise sanctions against non-payment because of the likely political or public health consequences.

According to Cardone & Fonseca, (2003), a water system is regarded as being financially sustainable if there is a full recovery of all costs. After system construction, these costs are not only the costs for operation and maintenance but also other costs such as external government support. For a water service to be financially sustainable, the total costs should match with the total available money. More specific principles are given in the WHO training package for O&M of Rural Water Supply and Sanitation Systems (Brikke', 2000) .These include identifying the cost implication of the projects characteristics and the environment, maximizing the willingness to pay, clarifying financial responsibilities, optimizing O&M costs, setting an appropriate and equitable tariff structure, developing an effective financial management and organizing access to alternative financial sources.

Baumann (2006) stated that the inability of communities to collect sufficient revenue for repairs could reduce the life expectancy of installed water supplies. Most rural supplies serve poor communities. The question of whether such communities are actually able to pay for O&M of low cost technologies is often raised, but research suggests that willingness to pay is a more important issue than ability to pay (Harvey et al., 2003). Purchase of spare parts for supply in rural water supply is one of the weak links in the quest for sustainability. According to Baumann (2000) hardly anywhere has there been satisfactory spare parts distribution. In Uganda for example, sustainability of rural areas is undermined by technical issues such as spare parts supply, mechanics and social ones that includes users' roles.

Mommen & Nekesa,(2010) argue that most users of rural water supplies are relatively poor and not able to pay for water service without external support. External support available to communities can be from NGOs, national and local government institutions, as well as the private sector (Carter, 2009). In recognizing that communities cannot autonomously manage services, Gine & Perez-Foguet (2008) call for appropriate institutional support where governments don't neglect their responsibilities to train technicians, encourage and motivate communities, as well as monitor service performance.

The cost of water supply should be such that it is affordable for the community targeted to be served. If it is costly, the target population will revert to using unimproved water sources or reduce their quantities thereby increasing the health risk. This means an adequate tariff should be set for recurrent costs.

2.5 Choice of Technology and sustainability of water supply systems

The aspect of O & M of small community water supplies has been neglected. This has contributed to the alarming statistics with an estimated 1.1 billion people without access to improved water sources and more than 2 billion people worldwide without access to any form of improved sanitation. Such conditions are degrading for the people and undermine their health and well being.

According to Harvey & Reed, (2003) the choice of technology can have a significant impact on sustainability of a water supply system. The choice of suitable technology is important in creating synergy between all elements of sustainability such as competence and skills needed for maintaining the facility. This should not therefore only be based on the cheapest solution, but also on the availability of spare parts and the costs of operation and maintenance.

An analysis of the performance of water systems in a variety of countries found that performance was markedly better in communities where households were able to make informed choices about the type of system and the level of service they required (Katz and Sara, 1997). Among technical factors suggested to contribute to sustainability of services are technology selection, complexity of the technology, the technical capacity of the system to respond to the demand and provide the desired service level, the technical skills required to operate and maintain the system, the availability, accessibility and the cost of spare parts and the overall cost of O&M.

System design and the complexity of the technology involved will clearly have a bearing on the relative weighting of these factors. Sustainability of facilities provided is enhanced by involving the private sector in the direct provision of services to communities and emphasizing sound financial management and adequate cost recovery by community-based organizations.

All of the above evolve with a legal and institutional framework. At national level there must be clear policies and strategies that support sustainability (Brikke et al, 2003). Support activities such as technical assistance, training, monitoring and setting up effective financing systems are all likely to influence effectiveness of O&M.

Settlement pattern of a community also influences the choice of water supply technology and O&M. For example, a hand pump would serve only a limited number of people in a settlement structure where households are located on individual farms. 19

Ground water characteristics also influence choice of technology. For example, the choice between a hand pump based system and a diesel powered system will be influenced by the size and depth of the ground water and demand or population to be served.

When expanding water supply and sanitation services, it is prudent to select technologies and institutional options that users would be willing to pay for and that would also ensure good public health and environmental conditions. Brikke' & Bredero, (2003) suggest five factors that influence the selection of community water supply technology. These are technical, environmental, institutional, community& managerial and financial factors.

There are various types of technologies that are used in a water supply development. They can be gravity fed schemes, springs, pumping systems, Boreholes or wells fitted with hand pumps or submersible pumps. As part of a demand driven approach to enhance community ownership of installed water services, Whittington et al (2008) identified the need to involve households in the choice of technology thus ensuring engineering designs which are responsive to local needs. Use of technologies that are low cost, easy to maintain, simple to use and readily available is one response to the challenge of project sustainability. Shaw (2011) argues that technology which fails to fulfil the needs of its users, which is poorly installed or which is difficult to maintain poses significant challenges to sustainability of water systems.

The selection and choice of technology for a water supply project in any particular situation is limited by affordability, social acceptance, and the environmental conditions in particular the water sources that are available locally. Where various technology options are offered or available , it is essential that communities are provided with

sufficient information to enable them make an informed choice of what is appropriate for them (Deverill et.al 2002).

2.6 Theoretical Framework

This research adopted the System Environments Theory of Community Development by Andy (2000). The author argues that although Rural Community Development is a very complex activity with so many elements involved that it seems almost impossible to describe sustainable development in a clear and organized manner, there is a method which can be used to identify many of the components and processes involved in sustaining works that are assembled for their well-being. This way of organizing information has been called System Theory. They draw their argument from General System Theory and others, who provide an analytical framework which can be used to describe some of the many factors involved in sustainable community development.

Some of the key concerns in sustainable community development, such as understanding the dynamics of inter-group relationships, and considering the changes involved in planning development activities, can be understood and described using System Theory. Terms such as systems and sub-systems, closed and open systems, system boundaries, the transfer of energy or influence across boundaries, feedback and system balance (or homeostasis) can be used to clarify what sometimes seems to be a bewildering array of information involved in community development work.

In the System Environments, the authors say that there are several environments related to any system. These can be described by referring to the following figure:

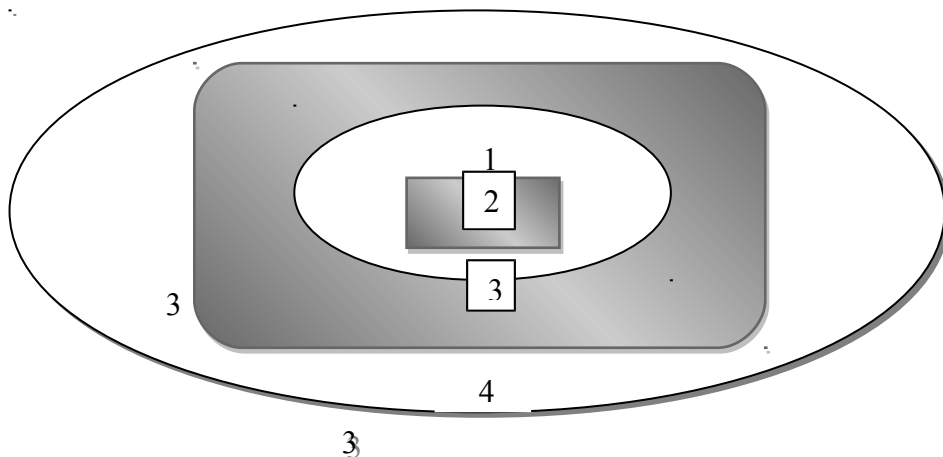


Figure 1: System Environment by Andy (2000)

1. The system under consideration, and the internal environment of which it is aware
2. The deeper internal environment of which the system is not aware
3. The system's external environment of which it is aware
4. The system's distant external environment of which it is not aware

Environments form the context within which any system exists, and energy or influence may flow across the boundary from one environment to the other thus altering the balance of any part of the system. This theory could be considered relevant in this research study because the system under consideration and the internal environment of which the system is aware could be the ultimate problem and therefore the desire of the community to long for the change. This could be triggered by a quest for intervention for its population. If the projects intervention is done without this, there are several issues which would lead to negligence hence lack of sustainability. If factored in, then sustainability could be assured, if other considerations are integrated.

The Deeper Internal Environment of which the System is unaware could be an internal struggle among community project managers for the control of the operation of the established water project. Although the project beneficiaries or members may not be aware of the struggle, such disputes or conflicts will most likely spill over into the system and cause changes in the way the community operates, hence lack of sustainability.

The External Environment of which the system is aware could be changes in the environment, such as introduction of intervention norms by the implementers that the community may neither refuse to accept nor be able to cope with it in the long-run. Lack of participatory implementation approach could either trigger or fail the projects. Another influence from the distant environment in this regard could be unfavorable decisions made in the far-away board rooms of donors and governments.

The Distant External Environment of which the system is not aware could be changes in environments which the community people can't see, such as a technological breakthrough in a remote village which would greatly increase demand for the water, and eventually create changes in the system.

Perhaps the most compelling criticism of Community Development Theory and its relevance to contemporary and future social work practice is the lack of evidence of its effectiveness. In times of governmental accountability, limited funding resources and a continued emphasis on evidence-based practice, some in the field would argue that services operating from a pure Community Development framework are not likely to secure funding. While there may be truth in this concern, Community Development theory focused social service organizations do exist and will remain committed to the theory and framework because of its value to the individuals and communities they serve. The theory of Community Development is a legitimate theoretical and practical model deserving the attention of the social work profession.

2.7 Conceptual Framework

Shields & Rangarjan(2013) define a conceptual framework as the way ideas are organized to achieve a research project's purpose and is useful as an organizing device in empirical research. This study was guided by the following conceptual framework.

Independent Variables

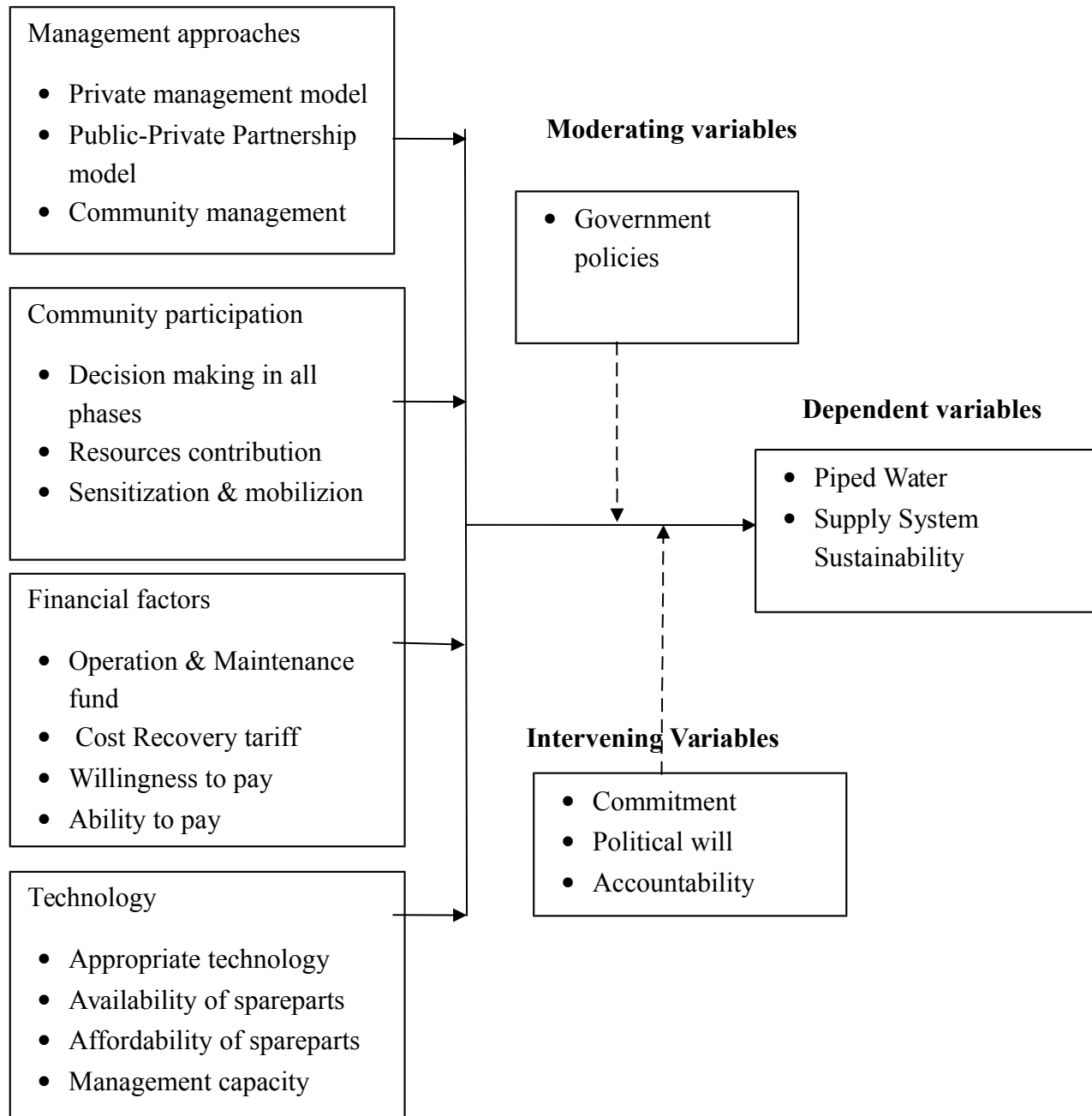


Figure 2: Conceptual Framework

Conceptual frameworks are abstract representations, connected to the research project's goals that direct the collection and analysis of data. The study identified independent variables which included; Management approaches, community participation, financial factors and technology. The study also examined the dependent variables of sustainability of piped water supply schemes which include: facilities are operational, user's benefits and maintenance of water facilities. The variables under study are represented diagrammatically in figure 2 to show the relationship between them. It also illustrates the influence of the independent variables on the dependent variable.

2.8 Summary of Literature Review

This chapter reviewed literature on management approaches and its influence on sustainability of piped water, community participation and how it influences sustainability of piped water, financial factors and how they influence sustainability of piped water supply and the influence of technology on sustainability of piped water supply. This research adopted the System Environments Theory of Community Development. The author argues that although Rural Community Development is a very complex activity with so many elements involved that it seems almost impossible to describe sustainable development in a clear and organized manner, there is a method which can be used to identify many of the components and processes involved in sustaining works that are assembled for their well-being. The variables under study were represented diagrammatically using the conceptual framework to show the relationship between the independent variables on the dependent variable.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

The chapter describes the methodologies which were used in the study. The chapter consists of research design, target population, sampling, research instruments, Data collection Procedure, data Analysis techniques and Ethical considerations.

3.2 Research Design

A research design is a scheme, outline, plan, structure or strategy of investigation conceived so as to obtain answers to research questions and control variance during the primary data collection (Kothari, 2003). The proposed study adopted a descriptive survey design. A descriptive survey design involved collecting information by interviewing and administering household level questionnaire to a sample of individuals being suitable for extensive research and an excellent vehicle for the measurement of characteristics of large populations (Orodho, 2003). Mugenda & Mugenda, (2003) contend that the purpose of a descriptive research is to describe behaviors and characteristics. Best & Khan, (2009) agreed with other scholars who argued that descriptive survey design describes and interprets phenomena and are concerned with conditions or relationships that exists, opinions that are held, processes that are going on, and effects that are evident or trends that are developing. Therefore, the study used the design in order to analyze the phenomena of factors in relation to management approaches, community participation, financial and technological factors influencing sustainability of piped water supply systems. The study also used qualitative methodology through focus group discussion, Key informant interviews (KII), and Field observation. Cooper and Schindler (2001) agreed that focus groups are panels, facilitated by a moderator who meets with the audience for a specified period of time to exchange perspectives, knowledge and opinions on a topic.

3.3 Target Population

The study targeted a population of 180 households who are registered members and beneficiaries of piped water supply in Likuyani sub-county, Kakamega County, Kenya. These households are spread out in four administrative locations namely; Likuyani, Sango, Matunda, Seregeya .Each water supply was designed to serve a certain number of households as indicated below.

In each of the water supply, simple random sampling was used to choose the households to be surveyed. Among the water management committees, one group was chosen randomly for the focus Group Discussion. Additionally the study interviewed the sub-county water office staff and the staff manning the water supply schemes.

3.4 Sample size and sampling procedures

The sample size determination for this study was derived from the table for determining sample size for research activities by Krejcie (1970). (See appendix VI). The study used sample size of 169 households as derived from the table for determining sample size activities. Mugenda & Mugenda (2003) affirm that a sample is representative if it is between 10%- 30% or more of the target population. Out of a population of 300 households, a sample size of 169 respondents represents 56.3% therefore this was considered as representative enough to allow inference of the findings.

Sampling is the process of selecting a few samples from a bigger group to become the basis for estimating or predicting the prevalence of unknown piece of information, situation or outcome regarding the bigger group Kumar (2011). The study used purposive sampling to identify villages in areas where water projects have been implemented. This is a non-probability sampling techniques which is subjective and the villages selected were those with piped water schemes. The simple random sampling method was used to choose the respondents to be included in this study. All the respondents are equally likely to be chosen in this probability sampling method.

To understand the realities of the water supply system as they are, field visits were conducted to identify/verify the type of technology, types of water sources, quality of construction and the efficiency of the water supply system.

3.5 Data Collection Instruments

The research instruments used in the study were questionnaires which were administered to households. The questionnaires were semi structured consisting of both open ended and closed ended questions. The questionnaire comprised of two parts, Part one of the survey questionnaires required the participants to provide demographic information while part two dealt with the factors influencing sustainability of community water managed water projects as conceptualized in this study. A questionnaire was used because it is a typical method through which descriptive data can be collected (Gay, 1981).

The study also used qualitative methodology through use of focus group discussions (FGD) , Key informant Interviews and observation. Focus Group Discussion (FGD) is another method through which descriptive data can be collected from selected water management committee members. A FGD guide was designed to be administered to water projects management committee leaders. This was because water committees have information that is important in addressing management challenges of the water supply projects. FGD have been found helpful in assessing needs, developing plans, testing new ideas or improving existing programmes (Krueger, 1988); (Babbie , 1992). A group of 6 (2 female and 4 male) committee members were interviewed. Cooper and Schindler (2001) describes focus groups as panels, facilitated by a moderator who meets with the audience for a specified period of time to exchange perspectives, knowledge and opinions on a topic. A combination of Open ended questions and closed ended questions was used in the study.

3.6 Pilot Testing

It was necessary to pretest the instruments of this research on a small sample of respondents in a preparatory exercise to find out if there was any weakness so that it could be corrected. In this study, a piped Water Supply project from the neighboring Turbo Sub County study was selected for piloting. A few alterations were made on the questionnaire after the piloting. Piloting is trying out of research instruments on the respondents who will not be used in the main study. Groll (1986) notes that a pilot study

is necessary because a researcher embarking on classroom research for the first time will find it valuable to spend some time in the classroom using one or more established systems and looking at the kind of issues which will arise in turning his/ her own research questions into a set of criteria and definition for use in the classroom. It is important for a pilot study to be carried out before any research is done as stated by Peter (1994). Peter (1994) states that even the most carefully constructed instrument cannot guarantee to obtain a hundred percent reliable data.

3.7 Validity of the research Instruments

Validity is the extent to which the instrument measures what it appears to measure according to the researcher's subjective assessment (Nachmias: 1958). Validity deals with the adequacy of the instruments for example, the researcher needs to have adequate questions in the written task in order to collect the required data for analysis that can be used to draw conclusion. In this study, content validity was used to check on word and phrases in the questionnaire to ensure that they were not vague. Mehrens, *et al.*, (1987) refers face validity to whether the test looks valid "on the face of it." Expert judgment was used by the researcher with the guidance of the supervisor. Pre-test of the questionnaire was carried out to ensure that the content in the questionnaire remains unbiased.

3.8 Reliability of the research instruments.

According to Seliger & Shohamy (1989) reliability is the extent to which data collection procedures and research tools over time are consistent and an accurate representation of the total population under the study. Kirk and Miller, (1986) came up with three types of reliability which relate to quantitative research as: the degree to which a measurement, given repeatedly, remains the same, the stability of a measurement over time; and the similarity of measurement within a given period of time. Worthen, et al, (1993) defines reliability as a measure of how stable, dependable, trustworthy, and consistent a test is in measuring the same thing each time. In this study the Pearson's product moment formula for the Test-retest was employed in order to establish the extent to which the contents of the

questionnaire would elicit the same responses every time the instruments will be used. 10 questionnaires were administered to households. After three weeks the same questionnaires were administered to the same households impromptu to check on the consistency of the responses. The results of pre- test showed that some of the questions required rephrasing for the respondents to understand and be able to respond accordingly.

The instruments were found to be reliable as the latter responses were consistent with the former responses. According to Mugenda & Mugenda, (2003). In any research study, a reliability coefficient computed and found to be 0.80 implies a high degree of reliability of the data.

3.9 Data collection Procedures

Data was collected by administering questionnaires, Interview guides were used to collect data through the focus group discussions and also for the key informant interviews. The questionnaires were pilot tested to determine their suitability to both the committee members and households. The questionnaires had both open ended and closed questions for issues related to the problem.

Three research assistants were recruited the three areas of piped water service coverage to assist in data collection. The Research Assistants recruited from the local area were briefed on the process and procedures for administering and recording data. The Research Assistants were also briefed on ethical issues prior to embarking on the research. Prior information was passed to all research participants on the interview dates, locations and times. Every effort was made to ensure research participants were not inconvenienced and time lines adhered to. The researcher obtained consent from all relevant institutions such as the Ministry of Environment, Water and Natural Resources Kakamega County , the Sub county water office, the water supply management committee and individual participants.

3.10 Data Analysis Techniques

The research data was analyzed quantitatively. All questionnaires were numbered and checked to confirm that they were correctly filled. The field data obtained from the field was edited and then coded to enable it to be analyzed using the Statistical Package for Social Scientists (SPSS) computer programme. . Specific responses to the structured questions were each assigned a number to give it a numerical code. A code book was prepared in which the frequencies of all the responses derived from the research objectives and questions were recorded. Data was analyzed using descriptive statistics, calculated and presented using frequencies and percentages. It was displayed using tables. The analyzed data obtained was organized into themes that were used to answer the research questions.

3.11 Ethical issues in research

The researcher obtained permission from the relevant institutions including University Nairobi School of graduate studies. The researcher obtained a research permit from National Council of Science, Technology and Innovation (NACOSTI). The researcher reported to and briefed the local provincial administration officials of the intended study and request for their cooperation. Confidentiality of information and anonymity of data recording was assured. Participants were also briefed on the nature of the study before the commencement of the interviews. Only those who voluntarily consented to participate in the study were interviewed.

CHAPTER FOUR: DATA ANALYSIS, PRESENTATION, INTERPRETATION AND DISCUSSIONS

4.1 Introduction

This chapter presents the findings of the study. The results have been presented according to the objectives of the study. The results are descriptive and analytical in nature guided by the themes in the literature review and the research questions.

4.2 Demographic characteristics

This section presents the demographic characteristics of the respondent providing a basis of understanding their composition in terms of gender, age, average monthly income and education level.

4.2.1 Responses by gender of the households

The study sought to find out the gender distribution of households who are registered members and acted as respondents and beneficiaries of piped water supply in Likuyani sub-county, Kakamega County. The respondents were asked to indicate their gender and the results were recorded in Table 4.1.

Table 4.1: Gender distribution of respondents

Gender	Frequency	Percentage %
Male	98	54.40
Female	82	45.60
Total	180	100

More males(54.4%)than females (45.6%) participated in the study. In most households males were more conversant with details concerning the water supply infrastructure than their female counterparts, hence more willing to participate and give the information that was needed for this study.

4.2.2 Age of respondents

The study sought to find out the age distribution of households who are registered members and acted as respondents and beneficiaries of piped water supply in Likuyani sub-county, Kakamega County. The respondents were asked to indicate their age and the results were recorded in Table 4.2.

Table 4.2: Age Distribution of respondents

Age (Yrs)	Frequency	Percentage (%)
18-30	26	14.40
31-50	86	47.80
Above 50	68	37.80
Total	180	100.00

The Study revealed that most respondents (47.8%) were aged 31-50 years . Most respondents were household heads who were in their middle ages. 14.4 % were aged between 18-30 years, while 37.8% of those who participated in the interview were aged above 50 years.

4.2.3 Economic status of respondents.

The researcher sought to establish the economic status of the respondents in order to understand the average monthly income earned by the community members . The results are as displayed in Table 4.3.

Table 4.3: Economic status of respondents.

Income (Ksh)	Frequency	Percentage (%)
Less than 5,000	68	37.80
5,000-10,000	63	35.00
More than 10,000	26	27.20
Total	180	100.00

The data collected reveals that 68(37.80%)earn less than Ksh.5000,63(35.00%)earn between Ksh.5000-Ksh.10000 and 26(27.20%) earn more than Ksh.10000. From these results it can be seen the community has a challenge of insufficient funds bearing in mind the high cost of living. Income is an important indicator of purchasing power and sustainability.

4.2.4 Distribution of the respondents by highest level of education attained.

Table 4.4: The highest level of education of respondents

Education level	Frequency	Percentage (%)
Not Schooled	08	4.44
Primary	63	35.00
Secondary	72	40.00
Tertiary	30	16.67
University	07	3.89
Total	180	100.00

Most respondents had secondary (40%) and primary (35%) level education. 16.67% of the respondents had attended tertiary institutions, 3.89% had attained university level of education while only 4.44% were not schooled.

4.3 Management approaches influencing sustainability of the project

This section presents the findings for objective one. The objective set to determine management approaches by implementing agencies and how they influence sustainability of water projects.

4.3.1 Organizations that facilitated implementation of the project

The study established the organizations that facilitated implementation of the water supply projects. Results have been displayed in Table 4.5.

Table 4.5: Organization that facilitated implementation

Implementing Agency	Frequency	Percentage (%)
Government	91	50.60
NGO	59	32.80
Both Government & NGO	30	16.70

Total	180	100.00
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The results revealed that the government is the leading implementing agency of piped water supplies (over 50.6%), followed by the NGOs (32.8%) and Government partnering with NGOs (16.7%). FGD discussions revealed that the amount of funding from the government was far much greater than that from NGOs intervening in issues of water and sanitation. Interviews with the key informants revealed that most people relied on water projects initiated by the government though the flow is inconsistent due to the high demand as a result of increase in population which has surpassed the ultimate design demand.

It needs to be noted that Community management is evolved as an NGO- or donor-driven model for time-bound pilot projects. This model may play under the leadership of government with community institutions to scale up the rural water supply delivery with the support from local and national government structures (Schouten & Moriarty, 2004). Community management as a demand driven community-led approach incorporates participatory method and decentralization strategy to successfully deliver rural water supply services better than supply driven government-led models (Lockwood, 2004).

The study sought to establish the different management approaches used for managing the Piped water supply schemes. The results are as shown in table 4.6 below.

Table 4.6: Mode of Management of piped Water Supply Project

Managing Entity of Water Supply	Frequency	Percentage (%)
Government(Public)	60	33.33
NGO(private)	00	00.00
Community	120	66.70
Public-Private Partnership	00	00.00
Total	180	100.00

Most of the water supplies schemes are managed by the community (66.7%), the rest are managed by the Government (33.33%) through community management committees. This seems to agree with Mazango & Munjeri (2009) who argued that Community Management can improve efficiency, meet the target of the project within planned budget and enhance sustainability of rural water management.

Various sensitization approaches were adopted by the government during entry into the community. The findings are illustrated in Table 4.7.

Table 4.7: Sensitization/awareness creation approaches

Sensitization/awareness creation		Name of Water Supply			Total
		Little Nzoia	Sango	Soy	
Local leaders	F	8	4	18	30
	%	16.7	8.3	37.5	62.5
Local administration	F	4	1	6	11
	%	8.3	2.1	12.5	22.9
Posters and charts	F	0	5	2	7
	%	0.0	10.4	4.2	14.6
Total		%			100.0

Most implementers utilized local leaders for sensitizing the community about their projects (62.5%), 22.9% used local administrators and 14.6% of the implementers used posters and charts. Posters and charts are suitable when the target audience can understand the messages being conveyed hence suitable when the literacy levels are higher.

According to FGD discussions, most government officers relied on the local administration for sensitizing and mobilizing the community about development projects especially through Chiefs Barazas.

4.3.2 Community mobilization approaches by the government

The government employed several approaches in mobilizing the communities. This is illustrated in Table 4.8.

Table 4.8: Community mobilization approaches by government

	Name of Water Supply	Total
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Approach of mobilization of the community			Little Nzoia	Sango	Soy		
	Local leaders	F	17	8	16	41	
		%	30.9	14.5	29.1	74.5	
	Local administration	F	1	3	8	12	
		%	1.8	5.5	14.5	21.8	
	Posters and charts	F	0	0	1	1	
		%	.0	.0	1.8	1.8	
	Don't know	F	0	0	1	1	
		%	.0	.0	1.8	1.8	
	Total		%				100.0

Government implementers mostly utilized local leaders(74.5%) in mobilizing the community,followed by local administrators(21.8%) and only 1.8% utilized posters and charts.1.8% of the respondents did not know.

One of the respondents quoted by saying “I have of always been informed of government development project in this area through our village elder, he delivers the information from house to house”.

Through these mobilizations of the community, Harvey & Reed (2007) indicated that it allows beneficiary community to develop, own and operate and maintain their facilities or systems. Additionally, the process of community management will play important roles during the planning and implementation phases (WEDC, 2003).

4.3.3 Government approaches to political influence

The government utilized various approaches in managing political influence. The results are displayed in Table 4.9. Participants of the FGD discussion from Sango affirmed that they had not experienced political interference in development projects initiated by the government.

Table 4.9: Government approaches to political influence

Political Influence			Name of Water Supply			Total
			Little Nzoia	Sango	Soy	
	Local leaders	F	6	1	9	16
		%	20.7	3.4	31.0	55.2

	Local administration	F	0	0	2	2
		%	.0	.0	6.9	6.9
	No political interference	F	1	1	6	8
		%	3.4	3.4	20.7	27.6
	Nothing was done	F	0	0	3	3
		%	.0	.0	10.3	10.3
Total	%				100.0	

55.2% of the Government implementer preferred using local leaders in managing political influence and 6.9% used local administrators. Sango and Little Nzoia water supply incurred few cases of political influence(3.4% reported in each case). There were no political interference as observed by 27.6% of respondents.

4.3.4 Reasons why governments approaches lead to failure

The researcher sought to establish reasons for failure by the approaches employed by the government in community entry. The results are illustrated in Table 4.10.

Table 4.10: Reasons why government approach contributed to project Failure

Reasons why approach contributed to project Failure		Name of Water Supply			Total
		Little Nzoia	Sango	Soy	
Don't know	F	0	3	1	4
	%	.0	25.0	8.3	33.3
Limited funds	F	0	0	3	3
	%	.0	.0	25.0	25.0
Conflicts among members	F	0	1	1	2
	%	.0	8.3	8.3	16.7
Lack of political goodwill	F	0	0	1	1
	%	.0	.0	8.3	8.3
Limited access to information	F	1	0	1	2
	%	8.3	.0	8.3	16.7
Total	%				100.0

Most respondents (33.3%) were not aware why government approaches lead to failure of the project. 25.0% cited limited funds, 16.7% of the respondents cited limited access to information and 8.3% indicated that lack of political goodwill lead to failure of the project.

Participants of the FGD discussions across all the water supplies cited lack of adequate information on projects implemented by the government hence most respondents were not aware of the reasons that lead to failure of the projects.

Harvey & Reed (2007), identified the causes for breaking of management system that in turn can lead to project which are dependency on voluntary input, lack of incentives for community members, absence of appropriate replacement policy for committee members, lack of transparency, accountability and lack of regulations, lack of legal status and authority of the water committee, absence of liaison with local government institutions, and inability to replace the major capital items. Most of the community managed water supply schemes run with acute financial shortage as this management cannot collect tariff from the beneficiary efficiently (Whittington et al., 2009).

4.3.5 Reasons why governments approaches lead to success

Various reasons were identified to have led to the success of the government implemented projects. The reasons are illustrated in Table 4.11. Participants of the FGD discussions indicated that projects that the community were effectively engaged and the projects had been handed over to the community.

Table 4.11: Reasons why government approach contributed to project Success

Reasons why approach contributed to project Success		Name of Water Supply			Total
		Little Nzoia	Sango	Soy	
Community participation & ownership	F	4	5	13	22
	%	12.9	16.1	41.9	71.0
Enhanced transparency	F	0	2	3	5
	%	.0	6.5	9.7	16.1
Presence of cohesion	F	1	0	3	4
	%	3.2	.0	9.7	12.9
Total		%			100.0

71.0% of the respondents cited Community participation and ownership as the reason why government approaches lead to success, 16.1% cited enhanced transparency and 12.9% cited presence of cohesion. Crosstabulation results revealed that all respondents

who had tertiary level education indicated that the success of the governments approach was because of community participation and ownership. Most respondents with primary (62.5%) and secondary (45.5%) education cited community participation and ownership.

Cross tabulation results between sensitization approaches and reasons why they lead to project success revealed that posters and charts did not enhance transparency and promote cohesion in the community but to a larger extent contributed to community participation and ownership. Local leaders (70.6%) contributed more to community participation than local administration (57.1%). Local leaders (85.0%) and Local administrators (50.0%) were most effective in mobilizing the community. 71.4% of the respondents who cited community participation and ownership as the reason for the project success indicated that there was no political interference. Local leaders (42.9%) were effective in handling political influence through promoting cohesion while the local administrators (100.0%) through community participation and ownership.

In addition to these, Carter et al. (1999), Doe & Khan (2004) and Harvey & Reed (2007) have advocated for private sector participation in rural water supply sector. Harvey & Reed (2007) underline the need for exploring private sector options in the rural water supply areas, where there is resistance to community management or limited capacity for its successful operation. Hopefully, these will make the projects to be successful.

4.3.6 Community sensitization/awareness approaches by the NGOs

The researcher further sought to establish sensitization/awareness approaches by the NGOs. The results are displayed in Table 4.12.

Table 4.12: Sensitization/community awareness approaches by NGOs

Sensitization/community awareness mode			Name of Water Supply			Total	
			L.Nzoia	Sango	Soy		
	Charts & flyers/posters	F	0	1	7	8	
		%	.0	3.3	23.3	26.7	
	Local administration	F	0	1	2	3	
		%	.0	3.3	6.7	10.0	
	Local leaders	F	6	8	2	16	
		%	20.0	26.7	6.7	53.3	
	Meetings	F	0	1	2	3	
		%	.0	3.3	6.7	10.0	
	Total		%				100.0

From the table, 53.3% of the respondents perceived Local leaders to be the most effective in sensitizing the community in projects implemented by NGOs, 26.7% indicated charts, flyers and posters were used by NGOs in sensitization, 10% said they used Local administration and another 10% used meetings.

Cross tabulation results revealed that most respondents with tertiary education (87.5%) indicated that charts, flyers and posters were used by NGOs in sensitization. Most respondents (80.0%) who earned less than Kshs. 5,000 indicated that NGOs used charts & flyers/posters for sensitization. Majority of the respondents who earned between Ksh. 5,000-10,000 indicated that NGOs used local leaders for sensitization purposes.

FGD discussions revealed NGOs implementers preferred local leaders' not necessarily local administration leaders. One of the FDG respondents from Sango water supply was quoted saying "most NGOs come through churches and school head teachers to sensitize and mobilize community members on upcoming development projects".

4.3.7 Community mobilization approaches by the NGOs

The researcher sought to establish community mobilization strategies employed by NGOs in implementing organizations. Results are as illustrated in Table 4.13.

Table 4.13: Community mobilization approaches by the government

Mobilization of the community	Name of Water Supply	Total
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			Little Nzoia	Sango	Soy		
	Local Administrators	F	4	6	5	15	
		%	15.4	23.1	19.2	57.7	
	Local leaders	F	1	2	3	6	
		%	3.8	7.7	11.5	23.1	
	Don't know	F	1	1	1	3	
		%	3.8	3.8	3.8	11.5	
	Posters	F	0	1	1	2	
		%	.0	3.8	3.8	7.7	
	Total		%				100.0

57.7% of the respondents noted that Local administrators were the most commonly used by NGOs in mobilization of the community during project implementation, 23.1% used local leaders and 7.7% noted that Posters were employed form of mobilizing the community.

Cross tabulation results revealed that most respondents (86.6%) with tertiary education indicated that local administrators were used by NGOs in mobilization of community members. Local administrators were perceived to mobilize the community across all levels of education of the respondents.

4.3.8 Non-governmental organizations approaches to political influence

The researcher sought to establish approaches by the NGOs in countering political influence during project implementation.

Table 4.14: NGOs approaches to political influence

Political Influence		Name of Water Supply			Total
		Little Nzoia	Sango	Soy	
Don't know	F	1	3	8	12
	%	5.9	17.6	47.1	70.6

	Local	F	1	3	1	5
	leaders	%	5.9	17.6	5.9	29.4
Total		%				100.0

70.6% of the respondents were not aware of the approaches used by Donors/NGOs in countering political influence in implementing the project while 29.4% said that Donors/NGOs used local leaders.

4.3.9 Reasons why approaches by NGOs lead to failure

The study established reasons why approaches by NGOs in implementation of the projects lead to failure. The results are displayed in Table 4.15.

Table 4.15: Reasons why approaches by NGOs lead to failure

Reasons why approach contributed to projects Failure		Name of Water Supply			Total	
		L.Nzoia	Sango	Soy		
	Mismanagement	F	2	0	1	3
		%	20.0	0.0	10.0	30.0
	Political interference	F	0	1	3	4
		%	.0	10.0	30.0	40.0
	Do not know	F	1	1	1	3
		%	10.0	10.0	10.0	30.0
Total		%				100.0

Most projects implemented by NGOs failed due to political interference (as cited by 40% of the respondents), 30.0% cited mismanagement while the other 30.0% did not know the reason for why approaches by NGOs lead to failure. Cross tabulation results indicated that majority of the respondents (50.0%) with tertiary level education cited mismanagement as the cause for failure. Respondents who never schooled did not know why the approaches by the NGOs lead to failure of the project. All respondents who earned above Kshs. 10,000 cited mismanagement as the reason for failure of the projects.

The NGOs face challenges; may face a lot of resistance from community due to ownership issues, communities' feel that the projects are being taken away from them it actually threatens the status-quo. Secondly the criteria and process of identifying viable projects must be full proof and very participatory. (The Government of Kenya, PPP Policy 2011)

4.3.10 Reasons why approaches by NGOs lead to success

The study identified reasons for success of the projects implemented by the NGOs. The results are displayed in Table 4.16.

Table 4.16: Reasons why approaches by NGOs lead to projects Success

Reasons why approach contributed to projects Success		Name of Water Supply			Total	
		Little Nzoia	Sango	Soy		
	Cohesion/unity	F	0	3	0	3
		%	.0	20.0	.0	20.0
	Community ownership	F	3	1	6	10
		%	20.0	6.7	40.0	66.7
	Do not know	F	1	0	1	2
		%	6.7	.0	6.7	13.3
Total		%				100.0

66.7% of the respondents indicated that projects implemented by NGOs succeeded because of community ownership. FGD discussions revealed that NGO projects just like government projects succeeded because of community ownership. 20.0% of the respondents indicated that projects implemented by NGOs succeeded because of Cohesion/unity while 13.3% did not know.

4.4 Influence of community participation on sustainability of the projects

This section presents findings of the second objective of the study. The second objective focused on the influence community participation on sustainability of the water projects.

4.4.1 Distribution of water projects by their initiator

The researcher sought to establish the initiator of the project. The results are displayed in Table 4.17.

Table 4.17: Distribution of water supply by initiator

Initiator of the project		Name of Water Supply			Total
		L. Nzoia	Sango	Soy	
Community members	F	19	36	21	76
	%	30.6	60.0	35.6	42.0
Local leaders	F	7	10	7	24
	%	11.3	16.7	11.9	13.3
Government	F	32	3	9	44
	%	51.6	5.0	15.3	24.3
NGO/CBO	F	1	10	3	14
	%	1.6	16.7	5.1	7.7
Both Government/ NGOs and the Community	F	0	0	10	10
	%	.0	.0	16.9	5.5
Don't know	F	3	1	9	13
	%	4.8	1.7	15.3	7.2
Total					100

From the study, 42.0% of the respondents said that Community members initiated most of the projects in the study areas, 24.3% said that they were initiated by the Government, 13.3% said were initiated by local leaders, 7.7% said they were initiated by NGO/CBO, 7.2% did not know and 5.5% said they were initiated by both Government/ NGOs and the Community. Local leaders and NGO/CBOs initiated most of their projects under Sango Community water project than in other water supplies.

FGD discussions further revealed that community members were in the forefront of identifying their water problems and forwarding proposals for intervention to relevant response stakeholders particularly the government. It was observed that organized community groups in the form of CBOs played crucial role in rallying community members to initiate water projects.

4.4.2 Distribution of water projects by entity that choose the project site

The researcher further sought to establish the entity that sought to establish the water supply project. The results have been cross tabulated with the names of the water supplies and presented in Table 4.18.

Table 4.18: Entity that choose the project site

Entity that choose the project site		Name of Water Supply			Total
		Little Nzoia	Sango	Soy	
Community members	F	7	26	20	53
	%	11.7	44.1	34.5	29.9
Local leaders	F	2	13	13	28
	%	3.3	22.0	22.4	15.8
Government	F	36	8	9	53
	%	60.0	13.6	15.5	29.9
NGO/CBO	F	6	9	2	17
	%	10.0	15.3	3.4	9.6
Don't know	F	9	3	14	26
	%	15.0	5.1	24.1	14.7
Total		%			100.0

Community members and the government choose most of the sites for implementing the projects (29.9% respectively), 15.8% of respondents cited local leaders, 14.7% did not know and 9.6% cited NGO/CBOs. In Sango Community water supply, most of the sites were chosen by community members while in Little Nzoia water supply the government dominated site selection for implementing projects. Local leaders in Soy water supply engaged more in site selection compared with other water supplies. NGOs/CBOs participated more in selection of sites at Sango Community water supply compared with the other water supplies.

FGD discussions revealed that government implementers choose the project sites most of the time with minimal consultations with the community compared with NGO implementers who fronted community members is selecting sites for implementing new projects.

4.4.3 Participation in the planning process

The researcher further sought to establish whether respondents participated in the planning process of the project. The results are presented in Table 4.19.

Table 4.19: Participation in the planning process

Participated in the planning process of the water project			Name of Water Supply			Total
			Little Nzoia	Sango	Soy	
Yes	F	5	20	16	41	
	%	2.8	11.0	8.8	22.7	
No	F	57	40	43	140	
	%	31.5	22.1	23.8	77.3	
Total						100.0

According to 77.3% of the respondents, respondents did not participate in the planning process. Only 22.7% did. Cross tabulation results indicated that most participation (11.0%) was reported in Sango community water supply compared to other supplies. More males (13.3%) than females (9.4%) participated in the planning process. Participation in the planning process increased with level of education of the respondents.

According to FDG discussions, it was revealed that the communities were not involved in the planning processes. One participant was quoted saying, “we were never consulted on our preferred location of our current water kiosk, the kiosk was not centrally located. Another participant was quoted saying most implementers especially from the government came with the plans already which the contractor followed hence input from the community was often overlooked during planning. Carter & Rwamwanja, (2006) argues that in cases where the best principles of community participation are taken seriously and implemented effectively then solid foundation for subsequent sustainability is provided. Moreso, World Bank, (2010), Doe & Khan, (2004) describe that, when community members are involved in planning, implementation and maintenance of their water supply system, the infrastructure can be sustained more easily. Participation in planning by respondents was not given priority as seen in the study.

4.4.4 Participation in the development/construction of the water project

Respondents were asked if they participated in the development/construction of the water projects. Results are as illustrated in Table 4.20.

Table 4.20: Participation in development/construction of the project

Participated in the development/construction process of the water project			Name of Water Supply			Total
			Little Nzoia	Sango	Soy	
Yes	F	31	41	38	110	
	%	17.2	22.8	21.1	61.1	
No	F	31	18	21	70	
	%	17.2	10.0	11.7	38.9	
Total		%				100.0

61.1% of the respondents participated in the project development/construction. 38.9% did not. Cross tabulation results indicated that most participation in development/construction by the respondents (11.0%) occurred at Sango community water supply compared with other water supplies. More males (13.3%) compared to females (9.4%) participated in the development/construction of the projects. Participation increased with decrease in age of the respondents. Respondents with primary (7.4%) and secondary (12.2%) level education participated more compared to those with other educational levels.

FGD discussions revealed that participation by community members was more effective in projects implemented by NGOs than those implemented by government. In Little Nzoia, participants indicated that government tendered contactors who consrcuted the projects because they were paid hence the community had very little to contribute during th e construction phase.

4.4.5 Lead people in the implementation of the project

Respondents were asked to indicate the lead people in the project implementation process. Results are displayed in Table 4.21.

Table 4.21: Lead people in the implementation of the project

Lead people in the project implementation process		Name of Water Supply			Total
		Little Nzoia	Sango	Soy	
Only GoK/NGOs or their agents	F	31	11	5	47
	%	17.6	6.3	2.8	26.7
Both GoK/NGOs and the community	F	25	41	15	81
	%	14.2	23.3	8.5	46.0
GoK, development agencies and other community members (women & youth)	F	6	5	37	48
	%	3.4	2.8	21.0	27.3
Total		%			100.0

According to 46.0% of the respondents, both the government/NGOs and the community mostly lead the project implementation process. 27.3% said GoK, development agencies and other community members lead the project implementation process and 26.7% said Only GoK/NGOs or their agents did it. Cross tabulation results revealed that in Little Nzoia water supply, mostly the governments/NGOs or their agents (16.6%) lead people in project implementation. In Sango community both the government/NGOs and the community most frequently (23.3%) lead people in the project implementation. In Soy water supply, the government, development agencies and other community members (women and youth) most oftenly laed the people in project implementation.

FGD discussions revealed that in Sango community memebtrs were actively engaged in implementation of the projects as opposed to Little Nzoia where the government still dorminated most of the project implementation.

4.4.6 Involvement during project implementation

The researcher established the nature of involvements by the respondents during project implementation. The results are displayed in Table 4.22.

Table 4.22: Nature of involvement during project implementation

Contribution	Frequency (n)	Percent (%)
Planning and supervision	2	0.7
Cash contribution	123	40.2
Labor contribution	118	38.6
Provision of construction materials	6	2.0

Attending meetings	36	11.8
Cooking for laborers	2	0.7
Nothing	14	4.6
Others	5	1.6
Total	306	100.0

40.2% of the respondents were involved in contribution of cash, 38.6% in Labor contribution, 11.8% in attending meetings, 4.6% did nothing, 2.0% in Provision of construction materials, 1.6% did others which were not specified and 0.7% were involved in planning and supervision.

Cross tabulation results indicated that more males (40.6%) than females (26.9%) were involved in labour contribution, more males (36.0%) than females (34.3%) were involved in cash contributions. At least 10.0% of both men and women attended meetings. Majority of the respondents aged 31-70 years (60.4%) contributed cash and provided labour (56.7%) and attended meetings (16.3%). Involvement during the project implementation decreased with increase in income level. Most respondents who earned less than Kshs. 5,000 were involved in cash contribution (28.3%), contribution of labour (29.2%), and provision of construction material (4.4%).

According to FDG discussions, contribution from the community came in both kind and cash. Cash contributions was mainly during implementation was geared towards purchasing food for the labourers. Kind contributions was in form of free labour, donating of construction materials and ensuring the construction site was secure.

Gine & Perez-Foguet (2008) agrees with the study; for instance notes that community contribution in any form in project development is very critical for the ownership and sustainability. Contribution may be in terms of cash, locally available materials, both skilled and unskilled labour. Gine & Perez-Foguet (2008) concluded that community participation has gained widespread acceptance as a prerequisite for sustainability; but community management has not. Achieving full and effective community participation in development activities is not easy and a lot depends on the way that field workers, extension workers or technical consultants approach the community. Most projects do not succeed or fail to meet their objectives because the intended beneficiaries failed to

change behavior or attitudes that are critical to the projects' success. One critical factor that many costly facilities fall into disrepair has been the failure to mobilize the will of the people.

4.4.7 Rating of community participation during implementation

The respondents were asked to rate the participation of community member during project implementation. The results were cross tabulated with the various water supplies and presented in Table 4.23.

Table 4.23: Community participation during the water project implementation

Community participation during the water project implementation			Name of Water Supply			Total
			Little Nzoia	Sango	Soy	
Very good	F		12	22	33	67
	%		6.7	12.3	18.4	37.4
Good	F		44	35	20	99
	%		24.6	19.6	11.2	55.3
Poor	F		3	1	1	5
	%		1.7	.6	.6	2.8
Don't know	F		1	2	5	8
	%		.6	1.1	2.8	4.5
Total		%				100.0

Most respondents 55.3% rated community participation in the implementation of the water supplies very good with Little Nzoia being rated highest compared to the rest. Those who rated community participation the water supplies good were 37.43% respondents. Only 2.8% of the respondents rated community participation poor.

At least 50% of the participants in the FGD discussions rated community participation in implementation of the water projects poor. They blamed poor participation on low levels of awareness and limited access to information. It was also evident that poor mobilization of the community contributed to poor participation. One respondent was quoted saying “I was never informed in time of the project, so I had very little to contribute”.

4.4.8 Contribution by respondents towards development of the project

The study further sought to establish contribution by respondents towards development of the water project. The results are displayed in Table 4.24.

Table 4.24: Nature of contributions by respondents in development of the project

Nature of contributions	Frequency	Percentage (%)
Provision of construction material	5	1.80
Unskilled labor	135	47.5
Skilled labor	8	2.8
Cash	121	42.6
Nothing	15	5.3
Total	284	100.00

47.5% of the respondents provided unskilled labour, 42.6% Contributed cash towards development of the project, 5.3% contributed nothing, 2.8% contributed skilled labour and 1.8% Provision of construction material. Contribution by respondents towards development of the project ranged from providing unskilled labour to cash. Gine & Perez-Foguet (2008) argues that contribution may be in terms of cash, locally available materials, both skilled and unskilled labour and as such concluded that community participation has gained widespread acceptance as a prerequisite for sustainability.

4.4.9 Reasons for contribution towards the project

Respondents were asked to indicate the reasons for their contribution towards the project. The results are illustrated in Table 4.25

Table 4.25: Reasons for contribution towards the project

Reason for contributions	Frequency	Percentage (%)
Promised to be paid cash for labor	7	4.2
Understood the necessity for ownership labor	157	94.0
Others	3	1.8
Total	284	100.00

According to 94% of the respondents, they contributed towards the project because they understood the necessity for ownership while 4.2% contributed because promised to be paid cash for labor.

Respondents were asked to indicate the reasons for not contributing. The results are illustrated in Table 4.26.

Table 4.26: Reasons for failing to contribute

Reason for failing to contribute	Frequency	Percent
Not asked to contribute	2	22.2
Did not know what was required of me	6	66.7
Project belonged to implementers hence were to provide everything	1	11.1
Total	9	100.0

66.7% of the respondents did not know what was required of them hence failed to contribute 22.2% were not asked to and 11.1% indicated that the Project belonged to implementers hence were to provide everything. FGD discussion indicated limited access to information and untimely mobilization was key among the reasons community members failed to contribute.

Despite reasons for respondents failing to participate in project planning and implementation, Starkey (2002) argues that Participatory user focused network can have all stakeholders work together and encouraged to collaborate and learn from each other. However for the sustainability to be achieved there must be government/ institutional support and the community leaders must be accountable and transparent. When local groups are actively involved in project design and implementation, they take on ownership and are more likely to continue the project when donor funding ends, compared with externally imposed projects (Ford, 1993).

4.5 Influence of technology on sustainability of the water projects

This section presents the results for objective three of the study which focused on examining the influence of technological factors on the sustainability of the water supplies.

4.5.1 Nature of Water supply

The researcher sought to establish the nature of water supply of the water supply project. The results have been presented in Table 4.27.

Table 4.27: Nature of water supply

Nature of Water supply	Frequency	Percent
Gravity fed scheme	109	46.6
Pumping scheme	25	10.7
Both pumping and gravity scheme	51	21.8
Spring	8	3.4
Well/borehole with pump	1	0.4
Dam/water pan	40	17.1
Total	234	100

Results showed that 46.6% of the respondents indicated that Most water supply projects were gravity fed schemes, 21.8% said was from both pumping and gravity scheme, 17.1% from dam/water pan, 10.7% from pumping scheme, 3.4% from spring. Only 0.4%

of the implemented projects were wells/boreholes with pumps. Cross tabulation results revealed that wells/boreholes with pumps and both pumping and gravity schemes were mostly implemented by donors/NGOs. Most gravity fed schemes and pumping schemes were implemented by the government. FGD participants in Little Nzoia indicated that most of their water supply projects were gravity fed.

With these various types of technologies that are used in a water supply development, Whittington et al (2008) argues that as part of a demand driven approach to enhance

community ownership of installed water services, there is need to involve households in the choice of technology thus ensuring engineering designs which are responsive to local needs. Use of technologies that are low cost, easy to maintain, simple to use and readily available is one response to the challenge of project sustainability. Shaw (2011) argues that technology which fails to fulfil the needs of its users, which is poorly installed or which is difficult to maintain poses significant challenges to sustainability of water systems.

4.5.2 Distance in accessing water point

The respondents were asked to indicate the distance they covered between their homes and the water point. The results were cross-tabulated with the various water supplies and presented in Table 4.28.

Table 4.28: Distance covered in accessing water

Distance accessing water point		Name of Water Supply			Total
		Little Nzoia	Sango	Soy	
0-1 Km	F	59	60	36	155
	%	32.6	33.1	19.9	85.6
1-3 Km	F	1	0	16	17
	%	.6	.0	8.8	9.4
3-4 Km	F	1	0	2	3
	%	.6	.0	1.1	1.7
> 4 Km	F	1	0	5	6
	%	.6	.0	2.8	3.3
Total	%				100.0

Majority of the respondents (85.6%) accessed water at a distance of between 0-1 Km. In Sango community water project all the respondents accessed water at a distance of between 0-1Km. Soy water supply had the highest number of respondents (12.7%) who accessed water at a distance greater than 1 Km. 9.4% accessed water at a distance of 1-3km, 3.3% a distance greater than 4km and 1.7% a distance of 3-4 km. FGDs across all the water supplies revealed that it was becoming rare to find community members accessing water more than 1.5km away.

The researcher sought to establish the owner of the idea for choosing the type of technology used for the water supply project. Results have been displayed in Table 4.29.

Table 4.29: Owner of the idea on the choice of technology for water supply

Owner of the idea on the choice of technology for water supply			Name of Water Supply			Total	
			Little Nzoia	Sango	Soy		
	Community members	F	4	1	5	10	
		%	2.	.6	2.8	5.6	
	local leaders	F	1	4	12	17	
		%	.6	2.2	6.7	9.4	
	Government	F	39	18	21	78	
		%	21.7	10.0	11.7	43.3	
	NGOs/CBOs	F	4	24	4	32	
		%	2.2	13.3	2.2	17.8	
	I don't know	F	13	13	17	43	
		%	7.2	7.2	9.4	23.9	
	Total		%				100.0

According to 43.3% of the respondents, the government choose the type of technology for most projects. 23.8% of the respondents did not know whose idea it was for the technology of their water supply, 17.8% cited NGOs/CBOs, 9.4% cited local leaders and 5.6% cited Community members. Cross tabulation results with the water supplies revealed that community members (2.8%) in Soy water supply participated more in decided the choice of technology compared to other water supplies. NGOs/CBOs (13.3% influenced more the choice of technologies in Sango community water supply compared to the other supplies.

Though community ,local leaders,government or NGOs/CBOs,the selection and choice of technology for a water supply project in any particular situation is limited by affordability, social acceptance, and the environmental conditions in particular the water sources that are available locally. Where various technology options are offered or availabe, it is essential that communities are provided with sufficient information to enable them make an informed choice of what is appropriate for them (Deverill, Bibby, Wedgwood, & Smout, 2002).

4.5.3 Design and maintenance manual

The study sought to establish the design and operation knowledge of the water supplies from the respondents. Results have been presented in Table 4.30.

Table 4.30: Design and maintenance of the water supply

		Responses			Total
		Yes	No	Don't Know	
Design document exists	F	70	7	104	181
	%	38.7	3.9	57.5	100.0
Scheme was completed as per the design	F	85	8	107	180
	%	36.1	4.4	59.4	100.0
Operation and maintenance manual available	F	128	12	41	181
	%	70.7	6.6	22.7	100.0

From the study, 70.7% of the respondents indicated that the operation and maintenance manual were available, 59.4% said that they did not know if Scheme was completed as per the design and another 57.5% did not know if Design document exists.

4.5.4 Availability of technicians and spare parts

The researcher established whether trained technicians and operators were conversant with the technology and also whether spare parts were available. Results have been presented in Table 4.31.

Table 4.31: Trained technicians, operators and spare parts

Technicians and operators		Yes	No	Total
Trained technicians and operators conversant with the technology	F	172	9	181
	%	95.0	5.0	100.0
Spare parts for technology available	F	132	48	180
	%	72.9	27.1	100.0

The study showed that 95% of the respondents indicated the availability of trained technicians, operators who were conversant with the technology while 72.9% of the respondents indicated that spare parts were available in the water supplies. Participants in

the FGDs revealed that there were a number of technicians in the community including plumbers in the community who were able to fix repairs in case of breakdown.

4.5.5 Facilities available in the water supply

Respondents were asked to indicate the facilities available at their water supply. The results are displayed in Table 4.32.

Table 4.32: Facilities available at the water supply

Facility	Frequency (n)	Percent (%)
Elevated tanks	30	8.9%
Ground tanks	68	20.2%
Air valves	74	22.0%
Washout valves	79	23.4%
Water kiosks	33	9.8%
Break pressure tanks	2	0.6%
Water treatment plants	46	13.6%
Total	337	100.0

From the table, most respondents did not know what their water supply consisted of in terms of the technological components.

Though participants revealed that there were a number of technicians in the community including plumbers in the community who were able to fix repairs in case of breakdown and some facilities at the water supplies, Kleemeier & Narkevic (2010) described elaborately the problems of community management approach. For technologically

complex system or large number of customers, operations and maintenance are challenging, recuperation of investment cost ideally stops fully once an upfront payment has been made, Availability of spare parts, trained manpower and tools are scarce for major repairs resulting in the infrastructure sitting idle for long period of time.

4.6 Influence of finance on sustainability of water projects

This section presents the results on last objective of the study. The objective sought to establish the financial factors affecting the sustainability of water supply projects. The section presents results on tariffs and maintenance costs.

4.6.1 Payment for the water

Respondents were asked to indicate whether they paid for the water and the frequency of payments. The results are presented in Table 4.33.

Table 4.33: Mode of payment of water

Pay for the water collected from the project		Frequency of financial contributions		Total
		Monthly payment	Weekly payment	
Yes	F	130	0	130
	%	72.2	.0	72.2
No	F	48	2	49
	%	26.7	1.1	27.2
Total	%			100.0

Results showed that 72.2% of the respondents paid for the water monthly. 26.7% did not pay monthly. Only 1.1% did the payments weekly. Cross tabulation results revealed it was only in Little Nzoia water supply where some respondents made weekly payments. Majority of respondents are willing to pay for water.

However, Merret (2002) mentioned some factors which contribute to low willingness to pay that include; Hard economic life such that households take greatest care over their household expenditure, existence of a widely held view that certain public services

should be free, politicians giving support to non-payment, poor quality of public services, corruption by government officials such that payment for public services are known to line the pockets of the power elite and unwillingness of government or the public water utility to exercise sanctions against non-payment because of the likely political or public health consequences. Moreover, Mommen & Nekesa(2010) argued that most users of rural water supplies are relatively poor and not able to pay for water service without external support. External support available to communities can be from NGOs, national and local government institutions, as well as the private sector (Carter, 2009).

The respondents were asked to indicate the nature of their connection to the water supply. 86.7% indicated that they had a flat rate connection while 13.3% had metered connection. FGDs concurred with the above results. It emerged that most community members preferred a flat rate monthly payment compared to metering. The discussions revealed that low support for metering was due to low awareness levels on the importance of metering aiming the beneficiaries. Most beneficiaries perceived they would pay more incase their water was metered.

4.6.2 Cost of operation and maintenance of the water supply

The resecher established whether the respondents were able to meet the cost of operation and maintainance of the project. The results are illustrated in Table 4.34.

Table 4.34: Ability to meet the cost of operations and maintenance

Ability to meet the cost of operations and maintenance of the water project			Name of Water Supply			Total
			Little Nzoia	Sango	Soy	
Yes	F	58	50	38	146	
	%	32.2	27.8	21.1	81.1	
No	F	3	10	21	34	
	%	1.7	5.6	11.7	18.9	
Total		%				100.0

The results showed that 81.1% of the respondents were able to meet the cost of operation and maintainance of the project, 18.9% did not. Those who were not able to meet the cost

of operation and maintenance of the project indicated various reasons as presented in Table 4.35.

Table 4.35: Reasons for not being able to meet the O&M of the water supply

	Frequency	Percent
Spare parts not available	4	10.3
Spare parts are expensive	20	51.3
Technicians labour charges are high	5	12.8
User fee from the project is not sufficient to meet O & M	9	23.1
No user fee is raised from the project	1	2.6
Total	39	100

51.3% of the respondents said that cost of spare parts was the major limitation to meeting the cost of operation and maintenance of the projects. 23.1% cited that lack of user fee raised from the project was the least cited reason for failure to meet the cost of operation and maintenance. 12.8% cited Technicians labour charges being high, 10.3% mentioned Spare parts not being available and 2.6% mentioned no user fee being raised from the project. FGDs revealed that community members were not able to meet the cost especially where the project funder pulled out immediately. The indicated that poor management of the water supplies often hampered sustainability. According to Cardone & Fonseca, (2003), a water system is regarded as being financially sustainable if there is a full recovery of all costs. After system construction, these costs are not only the costs for operation and maintenance but also other costs such as external government support. For a water service to be financially sustainable, the total costs should match with the total available money.

More specific principles are given in the WHO training package for O&M of Rural Water Supply and Sanitation Systems (Brikke, 2000) .These include; Identifying the cost implication of the projects characteristics and the environment, maximizing the willingness to pay, clarifying financial responsibilities, optimizing O&M costs, Setting an appropriate and equitable tariff structure, developing an effective financial management and organizing access to alternative financial sources.

The study sought to further establish the rating by the tariff by the respondents. The results were cross tabulated with average monthly income of the respondents and presented in Table 4.36.

Table 4.36: Rating of tariff by the respondents

Perception on the tariff (fee) level		Average Monthly Income			Total
		<Kshs 5,000	Kshs 5,001-10,000	>Kshs 10,000	
Too high	F	22	16	9	47
	%	19.0	13.8	7.8	40.5
Fair	F	25	26	16	67
	%	21.6	22.4	13.8	57.8
Don't Know	F	1	1	0	2
	%	.9	.9	.0	1.7
Total	%				100.0

Most respondents (57.8%) perceived that the tariffs were fair. Majority of the respondents who earned less than Kshs. 10,000 perceived that the tariffs were fair. 40.5% perceived the tariffs being too high and 1.7% did not know.

FDGs affirmed that the tariffs were fair since most community members were able to pay. Baumann (2006) stated that the inability of communities to collect sufficient revenue for repairs could reduce the life expectancy of installed water supplies. Most rural Supplies serve poor communities. The question of whether such communities are actually able to pay for O&M of low cost technologies is often raised, but research suggests that “willingness” to pay is a more important issue than ability to pay (Harvey et al., 2003). Purchase of spare parts for supply in rural water supply is one of the weak links in the

quest for sustainability. According to Baumann (2000) hardly anywhere has satisfactory spare parts distribution.

4.7 Interview Guide Analysis from NGOs and SCWOs.

Key Informant Interviews was done with NGOs and SCWOs. The researcher sought to establish the performance of the water supplies under different management models(government,Private, community management and public private partnerships), the water supply and sustainability of the same. Most respondents indicated that they were not satisfied with the performance of the management approach of their water supply. Sango was under community management, Soy scheme was being managed by the community in partnership with the government while Little Nzoia was a gazetted scheme purely managed by the government. None was being managed under the Public Private Partnership. They indicated that the water supply was inadequate in terms of quality and quantity provided by the water service provider were poor and inconsistent because of the frequent breakdowns some occasioned by high electricity bills. The study sought to establish the composition of the management committees. The respondents said that most management committees had both men and women but were dominated by male.

The researcher wanted to establish how long it had taken for the water supply project to stall if it ever stalled since its implementation. Majority of the respondents indicated that the project stalled / broke down frequently. Majority indicated that it had stalled at least 1-3 times in a year while others said it had stalled more than 3 times in a year. According to the respondents, duration taken to restore operations by water supplies after ceasing to operate was dependent on the cause of breakdown. Major breakdowns such as those caused mechanical breakdown of pumps and disconnection of electricity take about three to six months or even more. This was mainly noted in Soy and Little Nzoia schemes which depend on the government department for technical and financial assistance.The breakdowns in Sango community water supplies which is managed by the community were restored immediately. This was attributed to the type of technology used, because the scheme is mainly gravity hence only minor breakdowns such as bursts of pipelines

are frequently experienced. Little Nzoia water supply which is purely manned by the County government through the sub county water office took the longest time greater than six months to be restored. This was attributed to the bureaucracies in the government procurement procedures.

The study sought to investigate how finances affect sustainability of water supply projects. It was established that most respondents felt that the tariff set for water user fees were fair and affordable. However, they were not willing to pay for the services because they were not getting value for their money as a result of poor services occasioned by frequent breakdowns. Most of the beneficiaries who were not satisfied with quality and quantity were drawn from Little Nzoia water supply.

Respondents were asked to indicate how the management committees operated and maintained the water supply system. Majority of the respondents said that most management committees operated and maintained the water supplies through community collections/savings and through seeking financial support. Some water supply had engaged in fund raising to operate and maintain the water supply. During the Focus Group Discussions it was established that revenue collection in these water supplies was not being done efficiently.

The researcher sought to establish other factors affecting sustainability of rural water supply projects both positively and negatively. These are the factors that respondents gave: Lack of capacity building of communities, inadequate involvement of community in project planning and implementation, inadequate revenue, Lack of political goodwill, Poor management of project and Dependency on donor funding by communities.

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Overview

This chapter presents the summary of findings after the analysis of the research, conclusion after interpreting the results and recommendations of the findings sighting the proposed areas for future study.

5.2 Summary of findings

The results of the study were discussed based on the objectives of the study and the themes that were identified around the issues discussed in the literature review, which were guided by the research questions. Quotes from the interview transcripts were used to substantiate the themes.

The findings of the study showed that the water supply project members did not participate in the planning and decision to construct their water supply project. The government played a significant role in the establishment of the projects without the involvement and participation of the user communities.

The study also revealed that the projects were not being managed adequately hence were not performing optimally. The results also showed that most community members did not participate during the planning phase of the project cycle. During the implementation of the majority of the water supply community did not contribute anything, a few participated through provision of local and unskilled labour and contribution of cash. This was mostly out of ignorance. Sensitization and mobilization of communities was not adequately done by the planners and implementers of the project.

The findings further revealed that community members did not play any role in the choice of the site and technology for the projects. This was mostly done by implementers without involving the communities. It revealed that gravity fed water supply schemes are easier and cheaper to maintain as compared to pumping schemes. It also revealed that the

choice of technology whether gravity fed or pumping was dependent on the topography/landscape of the area.

The findings of the study also showed that most of the water supply project beneficiaries earn more than Ksh5000 is sufficient to provide for their families needs and also meet other basics services e.g. payment for water services. The water tariffs set are fair and affordable but people are not willing to pay the user fees because they are not satisfied with the services offered. This contributes to financial unsustainability of water supply schemes

According to the study, most of the water supply schemes have water management committee but insufficient skills and knowledge to manage the water supply schemes remains a challenge and contributed to the unsustainability of the projects.

5.2.1 Demographic characteristics

Summary of findings was made on Demographic characteristics and as per the analysis of the objectives.

More males(54.4%)than females (45.6%) participated in the study. The Study revealed that most respondents (47.8%) were aged 31-50 years. The data collected reveals that Majority of the respondents earned less than Kshs. 5,000 per months. Most respondents had secondary (40%) and primary (35%) level education.

5.2.2 Management approaches influencing sustainability of the project

The objective set to determine management approaches by implementing agencies and how they influence sustainability of water projects.The results revealed that the government is the leading implementing agency of piped water supplies (over 50.6%), followed by the NGOs (32.8%) and Government partnering with NGOs (16.7%). Most of the water supplies schemes are managed by the community (66.7%), the rest are managed by the Government (33.33%) through community management committees. Most

implementers utilized local leaders for sensitizing the community about their projects(62.5%), 22.9% used local administrators and 14.6% of the implementers used posters and charts. Government implementers mostly utilized local leaders(74.5%) in mobilizing the community. 55.2% of the Government implementer preferred using local leaders in managing political influence. 70.6% of the respondents were not aware of the approaches used by Donors/NGOs in countering political influence. Most projects implemented by NGOs failed due to political interference (as cited by 40% of the respondents), 30.0% cited mismanagement. 66.7% of the respondents indicated that projects implemented by NGOs succeeded because of community ownership.

5.2.3 Community participation's influence on sustainability of the projects

From the study, 42.0% of the respondents said that Community members initiated most of the projects in the study areas, 24.3% said that they were initiated by the Government. Community members and the government choose most of the sites for implementing the projects (29.9% respectively. According to 77.3% of the respondents, respondents did not participate in the planning process. 61.1% of the respondents participated in the project development/construction. According to 46.0% of the respondents, both the government/NGOs and the community mostly lead the project implementation process. 40.2% of the respondents were involved in contribution of cash, 38.6% in Labour contribution. 66.7% of the respondents did not know what was required of them hence failed to contribute .FGD discussion indicated limited access to information and untimely mobilization was key among the reasons community members failed to contribute.

5.2.4 Influence of technology on sustainability of the water projects

Results showed that 46.6% of the respondents indicated that most water supply projects were gravity fed schemes. Majority of the respondents (85.6%) accessed water at a distance of between 0-1 Km. According to 43.3% of the respondents; the government choose the type of technology for most projects. 70, 7% of the respondents indicated that the operation and maintenance manual were available. 95% of the respondents said that trained technicians, operators conversant with the technology and 72.9% indicated that spare parts were available in the water supplies.

5.2.5 Influence of finance on sustainability of water projects

When asked the frequency of water payment, 72.2% of the respondents paid for the water monthly. It emerged that most community members preferred a flat rate monthly payment compared to metering. The results also showed that 81.1% of the respondents were able to meet the cost of operation and maintainance of the project. 51.3% of the respondents said that cost of spare parts was the major limitation to meeting the cost of operation and maintenance of the projects. 23.1% cited that lack of user fee raised from the project was the least cited reason for failure to meet the cost of operation and maintenance. 12.8% cited Technicians labour charges being high, 10.3% mentioned Spare parts not being available and 2.6% mentioned no user fee being raised from the project. FGDs revealed that community members were not able to meet the cost especially where the project funder pulled out immediately. Most respondents (57.8%) perceived that the tariffs were fair.

5.2.6 Water project management

Most water supplies (47.8%) were stalled hence not operational despite having management committees in place. Most management committees had both men and women. From the study, 99.2% of the respondents indicated that the projects had ever stalled / broken down since they were implemented. According to 37.3% of the respondents, duration taken to restore operations by water supplies was more than six months. 71.8% of the respondents said that most management committees operated and maintained the water supplies through community collections/savings. 45.2% of the respondents indicated Poor project management, 22.2% indicated inadequate involvement of the community in the planning and implementation affected project sustainability adversely. Other factors cited inadequate revenue, lack of capacity building of communities, Lack of political goodwill and dependency on donor funding by communities to have affected project sustainability. (44.2%) of the respondents were not satisfied with the quality and quantity of water.

5.3 Conclusion

The government was the dominant implementer of water projects in Likuyani Sub County. Both state and non-state actors utilized similar approaches in sensitizing the community and managing political interference. However, state and non-state actors differed in their community mobilization approaches where the former preferred local leaders while the later preferred local administrators. Reasons for project failure differed across the implementers with limited funds and poor management being key to failure of state projects while political interference for non-state actors. Community participation was vital to the success of the projects across the implementer divide.

Community members were not in the forefront of initiating projects in the Sub County. Government actors and community members were not actively involved in site selection.

Community members were also not actively involved in construction/development of the project. Contribution by community members was not adequate and was normally in form of cash and casual labour. Poor participation by community members in the project was noted at the planning and design stages.

The choice of technologies utilized in the projects was mainly done by government implementers. Community members were not aware of the design and operation requirements of their projects except for a few trained technicians, operators who were accessible to spare parts.

Most beneficiaries of the water projects paid on monthly basis since tariffs were fare and affordable. Approximately half of the water projects in the Sub County had stalled hence not operational. Most projects experienced at least 1-3 breakdowns within their first year of implementation. Management committees were present in most projects and were charged with the responsibility of operation and maintenance using savings collected from payment of tariffs by the beneficiaries. Sustainability of the projects was hindered by poor management. Quality and quantity of the water from the projects was of great concern to the beneficiaries.

5.4 Recommendations

Approaches focusing on enhancing community participation and ensuring a thorough understanding of the projects should be prioritized at levels. Funds allocated to government implementers should be adequate and should be availed on time to facilitate project completion within the required scope. Non-state actors need to put in place appropriate measures for curbing political interference and stop relying on local administrators.

Community members should be engaged actively across all the phases of the project particularly during the planning and design phase. Engagement of community members needs to go beyond mere site selection and contribution of cash and provision of labour but input into the design and planning for the project.

Community members should be given priority in the selection of locally appropriate and acceptable technologies other than imposing on them. In cases where locally appropriate technologies are not feasible the technologies should be blended so as to promote ownership and acceptance by the communities.

Handing over of the water supply projects should not be abrupt but rather should be gradual stretching to at least 1 year following implementation of a new project. This will allow implementers enough time for detecting corrective actions including mainstreaming the management committees, the quality and quantity of the water from the projects.

It further recommends that Public Private Partnership management model be embraced to enhance the financial and technical sustainability of the piped water supply schemes.

5.5 Suggestions for further study

From the foregoing, this study suggest further study in the following areas;

- i. Assess the impact of adequate funding on sustainability of community water projects implemented by government
- ii. Evaluate the impact of community participation in the planning and design phases on sustainability of community water projects
- iii. Establish the effect of blending locally appropriate technologies with conventional technologies on the sustainability of community water projects
- iv. Assess the effect of the handing over approaches on sustainability of community water projects

REFERENCES

- A.H.Maslow. (1954). *A Theory of Human Motivation, Psychological Review*.
- Ademola, G. (2008). *Achieving project Sustainability through community participation*.
(2001). *Advocates for Youth, unpublished data from Burkina Faso*. Washington DC.
- Anderson, J., & Poole, M. (2001). *Assignment and Thesis writing*. John Wiley & Sons publishers.
- ATPS. (2007). *Africa's Technology Policy Studies Network*. Retrieved from Africa's Technology Policy Studies Network:
http://www.atpsnet.org/publications/annual_reports/2007/index.php
- Babbie, E. (1992). *The Practice of Social Research*. Belmont,CA.
- Bank, W. (2010). Post-Construction Support and Sustainability in Community- Managed.
Rural Water Supply, Case Studies in Peru, Bolivia, and Ghana: World Bank .
- Barlow, M., & Clarke, T. (2002). Blue gold: the battle against corporate theft of the world's water. *Earthscan* .
- Baumann, E. (2006, July). Do Operational and Maintenance pay? *Waterlines Vol. 25. No. 1* .
- Best, J., & Khan, J. V. (2004). *Research in Education 7th Ed*. New Delhi: India.
- Bhatnagar, B. e. (1992). *Participatory Development and the World Bank*. Washington, DC: The World Bank.
- Black, M. (1985). "1978-1998 Learning what works: A 20 year Retrospective view on International water and sanitation cooperation". *UNDP- World Bank water and sanitation programme* .

- Blanchard, K. H., Randolph, A., & John, P. C. (1996). *Empowerment takes more than a minute*. San Francisco: Berret -Koehler.
- Board, L. V. (2012). *CPC Water Point Mapping Report*.
- Brikke', F. (2000). *Operation and Maintenance of Rural Water Supply and Sanitation Systems; A training package for Managers and Planners*. Geneva,Switzerland: IRC International Water and Sanitation centre& World Health Organization.
- Brikke', F., & Bredero, M. (2003). *Linking technology choice with O&M in the context of community WSS*. Geneva Switzerland: WHO & IRC water and sanitation centre.
- Briscoe, J., & de Ferranti, D. (1988). *Water for Rural Communities: Helping people help themselves*. Washington DC.
- Cardenas, S. C. (2011). Does private management lead to improvement of water services? Lesson learnt from the experiences of Bolivia and Puerto Rico. *Unpublished* .
- Cardone, R., & Fonseca, C. (2003). *Financing Cost Recovery; Thematic Overview Paper*.. The Netherlands: IRC International Water and Sanitation Centre.
- Carter, R. C. (2010). *Study of Sustainability of water supply services in Madagascar*. United Kingdom: Water Aid.
- Carter, R. C., & Rwamwanja, R. (2006). Functional sustainability in community water and sanitation; . *A case study from South West UgandaDiocese of Kigezi Cranfield University* .
- Carter, R. C., Tyrrel, S. F., & Howsam, P. (1999). Impact and sustainability of Community Water Supply and Sanitation Programmes in Developing Countries. *Chartered Institution of of Water and Environmental Management* , 13, 292-296.
- Conference, R. o. (2001). *From System to Service- Scaling up Community Management*. The Hague, The Netherlands.
- Cooper, D. R., & Schindler, P. S. (2001). *Business Research Methods*. Mc Graw Hill .

- Davis, J. (2005). Private-sector participation in the water and sanitation sector. *Annual Review, environmental Resources* , 30, 145-183.
- Deverill, P., Bibby, S., Wedgwood, A., & Smout, I. (2002). *Designing Water Supply and Sanitation Projects to meet Demand in Rural and Peri-Urban Communities: Book 1. Concepts, principles and practice*. UK: Water Engineering Development Centre.
- DFID. (1998). Better water services in Developing Countries. *Public-Private partnership, the way ahead* .
- Doe, S. R., & Khan, M. S. (2004). The boundaries and limits of community management: Lessons from the water sector in Ghana. *Community management journal* , 39, 360-371.
- DPHE, & JICA. (2008). Evaluation of the Performance. *Village Piped water Supply Systems(120 schemes)Dhaka, Department of PublicHealthEngineering (DPHE),JICA* .
- Ford, D. (1993, May 19-21). Community level progress in Sustainable Development : Population and Environment. *Proceedings of a workshop on sustainable development in Sub-Saharan Africa held in Baltimore Maryland in 1991* .
- Gavel, J. E. (1997). *Practical assessment, research and evaluation*. Retrieved November 27, 2012, from PARE Online.net/getvn.
- Gay, R. (1981). *Educational research: Competencies for analysis and application*. McMillan publishing company, incorporated.
- Gine, R., & Perez -Foguet, A. (2008). Sustainability assessment of National Rural Water Supply Program in Tanzania. *Natural Resources Forum Volume 32* , 327-342.
- Hall, D., & Lobina, E. (2007). Profitability and the poor: corporate strategies, innovation and sustainability. *Geoforum* , 38(5), 772-785.

- Harvey, P. (2008). Poverty Reduction Strategies: Opportunities and Threats for Sustainable Rural Water Services in Sub-Saharan Africa. *Progress in Development Studies* , 8(1): 115-128.
- Harvey, P. A., & Reed, R. A. (2004). Rural water supply in Africa. *Building Blocks for hand pump sustainability* .
- Harvey, P. A., & Reed, R. A. (2007). Community-Managed Water Supplies in Africa: Sustainable or Dispensable? *Community Development Journal* , 42(3), 365.
- Harvey, P. A., Ikumi, P. N., & Mutethia, D. K. (2003). *Sustainable hand pump projects in Africa; Report on field work in kenya*. UK: Water Engineering and Development Centre Loughborough University.
- Haysom, A. (2006). *A study of Factors Affecting Sustainability of Rural Water Supplies in Tanzania*. Bedfordshire UK: Cranefield University.
- Hodgkin, J. (1994). *The sustainability of donor-assisted rural water supply projects*. Washington, DC: U.S. Agency for International Development.
- Ioris, A., Hunter, C., & Walker, S. (2008). The development and application of management sustainability indicators in Brazil and Scotland. *Journal of Environmental Management*, 88(4) , 1190-1201.
- IRC, & WHO. (2000). *Management of operation and maintenance of rural water and sanitation programmes -A training package for managers and planners*. Geneva : World Health Organization.
- IRC. (2003). *Community Water Supply Management: History of Concept*. Delft: IRC. Delft, the Netherlands.
- J.E otiende, W. R. Environmental Education. University of Nairobi Printing press.
- JICA. (1992). *JICA* .
- Jimenez, A., & Perez- Foguet, A. (2009). International investments in the water sector. *International Journal of Water Resources Development* , 25(1), 1-14.

- Jimenez, A., & Perez-Foguet, A. (2011). Water point mapping for the analysis of rural water supply plans: Case study from Tanzania. *Journal of Water Resources Planning and Management* , 137(5), 439-447.
- Kaliba, A., & Norman D, W. (. (2004). Assessing Sustainability of Community-Based Water Utility Projects in Central Tanzania with the Help of Canonical Correlation Analysis. *Journal of Environmental Assessment Policy and Management*, 6(1). , 73-90.
- Kirk, J., & Miller, M. L. (1986). *Reliability and Validity in qualitative Research*. Beverly Hills: Sage Publications.
- Kirkpatrick, C., Parker, D., & Zhang, Y. F. (2006). An empirical analysis of state and private-sector provision of water services in Africa. *World Bank Economic Review* , 20(1), 143-163.
- Kleemeier, E. (2000). The impact of participation on sustainability: an analysis of the Malawi rural piped scheme program. *World Development* , 929-944.
- Kleemeier, E. (2010). Private Operators and Rural Water Supplies, A desk review of experience.
- Kleemeier, E., & Narkevic, J. (2010). A global review of private operator experiences in rural areas. *Private Operator Models for Community Water Supply* .
- Kothari, R. C. (2003). *Research Methodology Methods and Techniques*. New Delhi: International Ltd Publishers.
- Krueger, R. A. (1988). *Focus groups: A Practical guide for Applied Research*. Newbury Park, CA: Sage Publications.
- Kumar, R. (2011). *Research Methodology*. New Delhi: Sage Publications Ltd.
- Laryea, N. O. (1994). Challenges and prospects of community management in Ghana. *Inaffordable Water and Sanitation* .

- Lee, T. R., & Jouravlev, A. (. (1997). Lee, T. R Private Participation in the Provision of Water Services: Alternative Means for Private Participation in the Provision of Water Services. *Economic Commission for LatinAmerica and the Caribbean(ECLAC)*. , Santiag.
- Lewis, M. A., & Miller, T. R. (1987). Public-Private Partnership in water supply and sanitation in sub-Saharan Africa. *Health Policy and Planning*, 2(1), , 70.
- Lobina, E., & Hall, D. (2008). The comparative advantage of the public sector in the development of urban water supply. *Progress in Development Studies* , 8(1), 85.
- Lockwood, H. (2004). *Scaling up community management of rural water supply*.
- Lockwood, H., & Smits, S. (2011). Supporting Rural Water Supply. *Moving towards a service delivery approach* .
- Lockwood, H., Bakalian, A., & Wakeman, W. (2003). *Assessing sustainability in rural watersupply: the role of follow-up support to communities*. NY: World Bank, New York.
- Mackintosh, G., & Colvin, C. (2003). Failure of rural scemes in South Africa to provide potable water. *Environmental Geology* , 44(11), 101-105.
- Macqueen, K. M. (2001). What is community? An evidence based definition for participatory public health. *Am J Pub. Health* 91 , 1929-1938.
- Martin, L. (1996). Insitutional Issues. *Water Policy* .
- Mazango, N., & Munjeri, C. (2002). *Water management in a hyperinflationary environment : Case study of Nkayi district in Zimbabwe*.
- Merret, S. (2002). Willingness to pay- A review; Deconstructing households' willingness-to-pay for water in low -income countries. *Waterpolicy* 4 , 157-172.
- Minten, L. B., & Razafindralambo, R. (2006). "Unravelling the linkages between the Millenium Development goals for poverty, education access to water and

- household water use in developing countries: Evidence from Madagascar." .
Journal of Development studies 42(1) , 22-40.
- Mommen, B., & Nekesa, J. (2010). Connected hand pump mechanics for improved service delivery: A key study of district-based associations of hand-pump mechanics in Uganda as a supporting mechanism.
- Montgomery, M. A., Bartram, J., & Elimelech, M. (2009). Increasing Functional Sustainability of Water and Sanitation Supplies in rural Sub-Saharan Africa. *Environmental Engineering Science* , 26(5), 1017-1023.
- Mugenda, A. G., & Mugenda, O. M. (2003). *Research Methods; Quantitative and Qualitative Approaches*. Nairobi: African Centre for Technology Studies.
- Mumma, A. (2005). Kenya's new water law: an analysis of the implications for the rural poor. *International Workshop on "African Water Laws: Plural Legislative Frameworks for Rural Water Management in Africa"* (pp. 26-28). Johannesburg: South Africa.
- Munoz, D. R. (2007). *In Search of Sustainable Community Development through Practice*. USA: Colorado School of mines.
- MWI. (2007). *Value for Money Study*. Nairobi: GoK. (1999). *National water policy on Water Resource Management*. Government of Kenya. Government of Kenya.
- Ogutu, V. (2010). *Factors influencing sustainability of community water projects initiated by NGOs in Asego Sub County, Homa Bay District. M.A. Project. University of Nairobi*.
- Okafor, c. (2005). CCD: "Concepts and Procedure. Paper delivered at the LEEMP workshop in Kainji National Park, New Bussa , 2-10.
- Opare, S. (2011). Sustaining water supply through a phased community management approach: Lessons from Ghana's "oats" water supply scheme. *Environment, Development and sustainability* , 13(6), 1021-1042.

- Orodho, A. J. (2003). *Essentials of Education and Social Sciences Research method*. Nairobi: Masola Publishers.
- Page, K. (2000). "USAID/ "Kenya Strategic Plan: environmental Threats and Opportunities Assessment". . *Natural Resource Management and Development Portal* . , 1-40.
- Parry-Jones., R. S. (2001). Sustainable Handpump Projects in Africa: A literature Review. *WEDC, Loughbrorough University*. Leicester,UK.
- Petros, N. ., Raphael, A., & Khumbo, K. (2013). *Sustainability of Piped Water Supply Schemes in Rural Malawi through Community Management*. Blantyre: University of Malawi.
- RWSN. (2007). *Installation and Maintenance Manual for the Afridev Hand pump*. Switzerland: RWSN.
- RWSN. (2008). Sustainable Rural Water Supplies,. *myths of the rural water supply sector, Perspectives No. 4. St.Gallen.RWSN Executive Steering Committee (2010)* .
- RWSN. (2010). Retrieved from Rural Water Supply Network: <http://www.rwsn>
- Saleth, R. M., & Dinar, A. (2004). The Institutional Economics of Water. *A Cross Country Analysis of Institutions and Performance* .
- Sara, J. &. (1997). *Making the rural water supply sustainable: Report on the impact of project rules*. UNDP- World Bank Water and Sanitation Program.
- Schouten, T., & Moriarty, P. (2004). Scaling up the community management of rural water supply. *Waterlines* .
- Schouten, T., & Moriarty, P. (2005). *"Community Water, Community Management- From system to service in rural areas"*. IR: ITDG Publishing .
- Shaw, D. (2011). Study of water supply sustainability:. *A review of Water Aid's work in Monze District Zambia. 1st Edition* .

- Starkey, p. (2002). Local Transport solutions for Rural Development.
- Sugden, S. (2003). *Indicators for the Water Sector: examples from Malawi*. WaterAid. Mal: WaterAid.
- Sutton, S. (2004). *Preliminary desk study of potential for self supply in Sub-saharan Africa*; . London,UK.
- Sutton, S. (2004). Self Supply: A fresh approach to Water for Rural Populations.
- Sutton, S. (2005). *Self Supply: A fresh approach to water for rural populations*. Water & Sanitation Programme, Cranefield University.
- Tade, P. (2001). *Community Participation*. Ibadan: Adams Publishers.
- Tamas, A. (2000). *System Theory in Community Development*. Retrieved from www.tamas.com: http://www.tamas.com/samples/source-docs/System_Theory
- Tertiary, I. (2012). *Commercial viability analysis of water systems in LVNWSB& LVSWBS*. Nairobi: SNV Netherlands Development Organization.
- Twala, W. D. (2001). *Community participation is a necessity for project success: A case study of rural water supply project in Jeppes Reefs, South Africa*. Brighton: Institute of Development Studies.
- UN. (2009). *Human Development Reports*. Retrieved from hdr.undp.org: <http://www.google.com>
- UN. (2009). *In a changing world: The United Nations World Water Development Report*. Retrieved from UN: http://www.unesco.org/water/wwap/wwdr/wwdr3/pdf/WWWDR3water_in_a_changing_World.pdf
- UN. (2010). *MDG Summit Report*. Retrieved from [un.org](http://www.un.org/en/mdg/summit2010): <http://www.un.org/en/mdg/summit2010>

- UNDP, & programme, W. B. (1996). *Transport, water and urban development*. Washington DC: The World Bank.
- UNDP. (2011). *Making Rural Water Supply Sustainable*. Retrieved from World Bank Water and Sanitation Program: <http://www.its.caltech.edu/>
- UNICEF, & WHO. (2012). *Progress on Drinking Water and Sanitation*. USA.
- Vandana, S. (2002). *Water Wars: Privatization, Pollution and Profit*. Cambridge: South End Press.
- Vision 2030*. Government of Kenya.
- WASH, I. (2012). Ghana IRC international water sanitation. *Ghana fast facts* .
- Water.org. (2011). Retrieved from Water.org,"water facts": <http://water.org/learn-about-the-water-crisis/facts>
- WaterAid. (2009). *Management for sustainability: Practical lessons from three studies on sustainability of rural water supply schemes, Tanzania*.
- WCDE. (1987). *Our Common Future*, . Oxford and New York.: Oxford University Press.
- WCED. (1987). *Our Common Future:World Commision on Environment and Development* . Retrieved from UN-documents: <http://www.un-documents.net/wced-ocf.htm>
- WEDC. (2003). *Community and Management*. UK: WEDC, Loughborough University,.
- Whittington, D., Davis, J., Prokopy, L., Komives, K., Thorsten, R., Lukacs, H., et al. (2009). How well is the demand-driven community development model for rural water supply systems doing? *BWPI working paper 22* .
- WHO, & UNICEF. (2010.b). Progress on Sanitation and Drinking Water-2010 update. *WHO AND UNICEF Joint Monitoring Programme for Water Supply and Sanitation*, .
- WHO-UNICEF. (2009). *Annual Report 2008*. UNICEF.

WWAP. (2003). *World Water Assessment Programme*. Retrieved from
webworld.unesco.org: <http://webworld.unesco.org/water/wwap/wwdr/wwdr1>

Zeithamal, B. a. Management function and strategy. IRWIN.

Zelalem, G. (2005). Determinants of Sustainable Rural Water Supply System in Ethiopia:
The case of Two Rural Water Supply Systems : Amuyee Serra and Habru Seftu
Schemes(MA Thesis). *Sweedish University of Agricultural Sciences* .(1987,
December 16). *New Nigerian Newspaper* . Kaduna: New Nigerian Newspaper
Ltd.

APPENDICES

Appendix I: Letter of Transmittal

Floice N. Wangwe

University of Nairobi

Department of CDE,

To the County Education Officer,

Kakamega County,

Dear Sir/ Madam,

RE: RESEARCH PROJECT

I am student of University of Nairobi, Department of Education and Extra Mural Studies, School of Continuing and Distance Education undertaking MA in Project Planning and Management. I wish to carry out a research study Evaluating factors influencing sustainability of piped water supply projects in Likuyani Sub County, Kakamega County, Kenya. The purpose of this research is for academic use and confidentiality is guaranteed. It is my hope that this study will result to findings that will lead to beneficial recommendations that will assist in addressing sustainability challenges in the rural set ups. Thank you.

Yours faithfully,

Sign.....

Floice N. Wangwe

Appendix II: Questionnaire for Community Members

My name is and I am collecting household surveys data for a research study which is being conducted by M/s Floice Wangwe on performance of water supply projects in your community.

I would like to ask you some questions about your water supply project. The information you give will be used to evaluate this project, and for M/s Floice’s research Study. The information can further be used to make future projects better. We hope that you will answer these questions as honestly and correctly as possible. I am not interested in receiving any particular answers, only answers that represent your opinion.

I would like to emphasize that any information you give will be processed anonymously and no personalized data will be handed over to anybody. We guarantee that your privacy will be protected. If you have any questions about the survey, you can ask me,

Date of visit.....

Code.....

Part I: Demographic Information

1. District:..... Sub County:.....Location

2. Name of the water supply project:.....

3. Gender of the respondent. **a)** Male **b)** Female

4. Age of the respondent **a)** 18-30 yrs **b)** 31-50 yrs **c)** **d)** 51–70 yrs **[e)** >70 yrs

5. Average monthly income a) < Kshs 5,000 b) Kshs 5,001-10,000 c) >Kshs 10,000

6. Education Level a) Not schooled b) Primary c) Secondary d) Diploma e) Graduate

Part II: Factors Influencing Sustainability Of Water Project

Section A: Management Approaches

7. Which of the following agencies facilitated the implementation of your project?
- a) Government
 - b) Donors/NGOs
 - c) Donors/NGOs & Government
8. Please describe the manner in which the implementing agency made entry into the community with reference to the following themes:
- a) Sensitization of the community /awareness creation.....
 - b) Mobilization of the Community.....
 - c) Political influence.....

Section B: Community Participation

Please tick(√) where appropriate

9. Who initiated the project?
- a) The community members.....
 - b) Local leaders....
 - c) Government.....
 - d) NGO/CBO.....
 - e) Both Government/ NGOs and the community
 - f) I don't know.....
10. Who chose the site for the project?

- a) The community members.....
- b) Local leaders.....
- c) Government.....
- d) NGO/CBO.....
- e) I don't know.....

11. Did you participate in the planning process of the water project?

- a) Yes.....
- b) No.....

12. Did you participate in the development/construction process of the water project?

- b) Yes.....
- b) No.....

13. Who were the lead people in the project's implementation processes?

- a) Only GoK/ Development Agencies or their agents.....
- b) GoK/ Development Agencies and the community.....

14. How were you involved during the project implementation?

- a) Planning and Supervision.....
- b) Cash Contribution.....
- c) Unskilled labour.....
- d) Skilled Labour
- e) Provision of construction materials. ,[Local materials (sand, ballast, hardcore)].....
- f) Attending meetings.....
- g) Cooking for labourers.....

- h) Nothing.....
- i) Others (specify).....

15. How was the community participation during the water project implementation?

- a) Very good.....
- b) Good.....
- c) Poor.....
- d) I don't know.....

16. What was the reason for your contribution towards the project?

- a) Was forced by leaders to contribute.....
- b) Was promised to be paid cash for labour.....
- c) I understood the necessity for ownership.....
- d) Others....(specify)

17. If you contributed nothing, what were the reasons that made you not to contribute?

- a) Was not asked to contribute.....
- b) Did not have the resources.....
- c) Feared the project would soon fail.....
- d) Did not know what was required of me.....

Section C: Technological Factors

18. What is the type/nature of your water supply project?

- a) Gravity fed scheme.....
- b) Pumping scheme (motorized/electricity).....

- c) Both pumping and gravity scheme.....
- d) Other (specify).....

19. What is the distance of coverage from your home to the water point?

- e) 0-1 Km..... b) 1-3 Km.....
- c) 3-4 Km..... d) > 4Km.....

20. Whose idea was it to choose the type of technology used for the water supply project?

- a) The community members.....
- b) Local leaders.....
- c) Government.....
- d) NGO/CBO.....
- e) I don't know....

21. Does a design report exist?

- a) Yes..... b) No.....c) Don't know.....

22. Was the scheme completed as per the design?

- b) Yes..... b) No.....c) Don't know.....

23. Is an operation and Maintenance manual available ?

- a)Yes..... b) No.....c) Don't know.....

24. Do you have trained technicians and operators conversant with the technology used for the water supply easily available and accessible within the community?

- a) Yes..... b) No.....

25. Are the spare parts for the technology used readily available, and accessible to the community?

- a) Yes..... b) No.....

Section D: Finance

26. Do you currently contribute or pay for the water you collect from the project for use? a) Yes..... b) No.....

27. What is the frequency of the financial contributions?

- a) Monthly payment.....
b) Weekly payment.....
c) Payment per Jerrycan of water.....

28. How are you connected to the supply system?

- a) Metered connection.....b) Flat rate connection.....

29. Are you able to meet the cost of operations and maintenance of your water project?

- a) Yes..... b) No.....

30. If No, what are the reasons for not being able to meet the cost of O&M for your water supply system?

- a) The spare parts are not available.....
b) The spare parts are expensive.....
c) The technician's labour charges are high.....
d) The user fee raised from the project is not sufficient to meet the O&M costs.....
e) No user fee is raised from the project.....

31. What is your perception on the tariff (fee) level?

a) Too high.....b) Fair.....c) Too low.....d) I don't know.....

Appendix 11I: Guide for Key Informant Interviews with NGOs and SCWOs

1. What is your rating of the current performance of your water project?
 - a) Functional or serving well and in good condition.....
 - b) Stagnating or deteriorating.....
 - c) Stalled /not operational
2. Is there a water management committee managing your water supply project?
3. If yes, who constitutes the management committee? Men only, Women only, Both men and women.....
4. Has the project ever stalled/broken down since the implementers left?
 - a) Yes.....
 - b) No.....
5. If Yes, how many times? a) 1-3 times in a year b) 3 times in a year.....
6. How long does it take to restore the operations?
 - a) Immediately, < 1month, 1-2 months, > 6months.....
7. How do the management committees operate and maintain the water supply system?
 - a) Seek financial support from GoK/NGOs.....
 - b) Community collections/savings (on voluntary basis.....
 - c) Fund raising.....
8. What factors (both positive and negative) affect project sustainability?
 - a) Lack of capacity building of communities.....
 - b) Inadequate involvement of community in project planning and implementation...
 - c) Inadequate revenue.....

- d) Lack of political goodwill.....
 - e) Poor management of project.....
 - f) Dependency on donor funding by communities.....
9. Are you satisfied with the quantity and quality of water you get per day for your needs?

Appendix IV: Observation guide

Mark (√) appropriately in one of the spaces provided

	Item	Observations	Mark (√)
1.	Nature or type of the project	a. Ease of use by community b. Technical, needs experts to operate	1... 2...
2.	Gender of project membership	a. Both male and female b. Female c. Male	1... 2... 3...
3.	Record keeping (minutes, cash books, receipts, materials)	a. Available & updated b. Available & not updated c. Not available	1... 2... 3...
4.	General condition of the project (physical status, functionality, hygiene and sanitation status)	a. Good b. Moderate c. Dilapidated	1... 2... 3...
5.	Customer Focused (customer feedback mechanism, complaints register)	a. Good b. Fair c. Poor	1... 2... 3...

Appendix V: Focus Group Discussion Guide

1. Background of water projects in the area.
2. The organizations/government and development agencies that support(ed) water supply projects
3. What is the type of your water supply system? Do you understand how it operates?
4. In what ways did the community participate in the implementation of your water supply system?
5. Do you collect any fee from the beneficiaries of you water supply system? Do the members of the community afford the rate that you charge?
6. Who manages your water supply system? Do you have a water management committee? What do they do?
7. Have you been trained on operation and maintenance of your water system?
8. How are women involved in water projects?
9. What are some of the challenges faced by your water project?
10. Are you conversant with water laws and regulations?
11. Is your water project committee registered and licensed with Water Resource Management Authority (WRMA)
12. Factors for non- sustainability
13. Factors for sustainability
14. Suggestions for enhancement of sustainability.

Thank you.

Appendix VI: Table for Determining Sample Size from a Given Population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380

Note: “N” is population size; “S” is sample size

Krejcie, Robert V., Morgan, Daryle W., (1970): *Determining Sample Size for research Activities: Educational and Psychological measurement*