International Journal of Economics, Commerce and Management
United Kingdom Vol. IV, Issue 10, October 2016
http://ijecm.co.uk/ ISSN 2348 0386

ANALYSIS OF FACTORS AFFECTING SUSTAINABILITY OF COMMUNITY BOREHOLE WATER PROJECTS IN KYUSO, KITUI COUNTY, KENYA

Patrick Muthui Mwangangi
Jomo Kenyatta University of Agriculture & Technology,
School of Entrepreneurship, Procurement and Management, Kenya
patrickmwangangi2@yahoo.com

Daniel M. Wanyoike
School of Entrepreneurship, Procurement and Management,
Jomo Kenyatta University of Agriculture & Technology, Kenya
danwanyoike@gmail.com

Abstract

Water is a natural resource necessary for sustenance of life, ecological systems and socio-economic development. There has been increased investment in safe rural water supply and sanitation projects. Nevertheless, most water projects face numerous sustainability challenges. In Kenya about 35% of the water projects fail due to poor management while it is 60% in Kitui County, Kenya. This study analyzed the factors affecting sustainability of community borehole water projects in Kyuso sub-county (community participation, community training, maintenance costs and water management committees). A descriptive design was adopted for this purpose. For the study, target population comprise of 9800 units of analysis. A sample size of 99 respondents was randomly selected and administered with semi-structured questionnaires. Collected data was edited coded and analyzed using SPSS for descriptive and inferential analyses. Findings showed majority (66.7%) were male, 46.7% were aged over 35 years while 57.3% attained secondary school education. Majority of community members did not adequately participate in the identification of project needs (mean 3.30), planning (means 3.12) and training (mean, 3.29). The community paid maintenance fees (mean 4.00). The study recommended

that community members' should be adequately involved in all the project phases and be regularly trained on maintenance. Good leadership, accountability and payment of maintenance fees should be emphasized.

Keywords: Water; Participation; Planning; committee; Borehole; Sustainability; Training; Maintenance; Cost; Project

INTRODUCTION

Water is a natural resource that is necessary for sustenance of life, ecological systems and a key resource to social and economic development. Governments, Non-governmental organizations, local and international organizations from all over the world have and still continue implementing water projects to promote safe rural water supply and sanitation. However in most project areas lack of sustainability of water infrastructures and water supply systems as most communities don't own the projects (Harvey & Reed, 2007). According to the World Health Organization (2005), 2.2 million people in developing countries, most of them children, die every year from diseases associated with lack of safe drinking, sanitation and hygiene. Improvements in these services could reduce mortality rates due to diarrheal diseases by an estimated 65% and related morbidity by 26% (WHO, 2004). In addition, the United Nations Millennium Goals (UN, 2004) specifically targeted water and sanitation measures, and the United Nations General Assembly proclaimed the years 2005 to 2015 as the International Decade for Action 'Water for Life'.

Chikati (2009) explains that over the past ten years, both in Europe and developing countries; failure rate for projects to achieve their stated objectives is extremely high, at 60% in some cases. Some of these projects have gone to full implementation but without much benefit to the communities others proved to be unsustainable while some prematurely terminated. They lacked proper financial accountability, stakeholder involvement in all the project phases, adequate skills and empowerment of the communities' involved and poor M & E framework (Summer 2001). Further, Matsumura (2008) conducted a study on causes of poor performance in World Bank Water and Sanitation projects in USA and found that most projects were overscheduled and under cost, and a small portion of projects performed poorly in terms of objectives set during project initiation phase, institutional development, and sustainability.

Gleitsmann (2005) posited that contribution of more time and resources to the protection, operation and maintenance of rural water supply is a key action towards achieving sustainability of water supply infrastructures. According to Harvey and Reed (2007), community involvement

strongly influences the sustainability of projects. Campos (2008) in an intervention model carried out in Peru for water supply, considered community training as an important component in which the project used various methods of training including audio-visuals. Campos emphasizes that training on issues such as operation and maintenance empower the communities to look after their water supply systems thus enhancing sustainability. According to Van (2008), water projects have greater impact when women are involved. In a study conducted on community water and sanitation projects in 15 countries found that projects with full participation of women indecision making, capacity building and resource mobilization are more sustainable and effective than those that do not. This supports earlier studies by World Bank which found that women's participation was strongly associated with water and sanitation project effectiveness.

It is important to determine what the consumers of water and sanitation want , what they can and will contribute, how they participate in decision making on the technology used, location of facilities and operation and maintenance. According to Mushtaq (2004), community participation is a process by which people from all sectors of community (rich, poor, Men, women, uneducated, educated, and so on) can influence or Control those decisions, which affect their lives. According to Toole (2002), capacity building sessions to develop community awareness of water supply problems will increase local participation in developing and demanding a project that will satisfy the needs of the community. Technical training in construction, operation and maintenance will teach selected individuals' practical skills and may create an understanding and the sense of responsibility for water facilities in the beneficiary community and this enhances community ownership of water projects. In Ghana, capacity building of key actors in rural water delivery and management usually precedes the provision of the facilities. Capacities of the district assembly staff are strengthened through training and equipment supply to enhance community ownership of water projects in rural areas (Fielmua 2011).

According to Nwankwoala (2011), rural water projects in Nigeria have suffered from poor co-ordination, poor maintenance culture, and lack of community ownership, poor technical and institutional structure and over bearing bureaucratic control by various supervising ministries. Due to lack of community participation this has led to poor operation and maintenance of water projects. The demand for community water supply projects are localized demands, hence managerial decisions about levels of service, location of water facilities and cost sharing should be made locally. The community should appoint its own caretakers to receive training and tools and be responsible for corrective maintenance and repairs. The community should be ready to clean, fence and maintain the areas around the water projects It is common practice for village

water schemes to be managed by a village committee to have a major role and ownership for operation and maintenance (Harvey & Reed, 2006).

According to the draft Kenya National Water Policy (NWP) (2012), most of the rural water services systems are still not sustainable because of inadequate operation by communities leading to breakdown of facilities and low access rate, poor water quality and increased disputes. However, in spite of the new policy, legislative frameworks and increased sector investments in rural water development which rose from Ksh 3 billion in 2003/2004 financial year to Ksh 12 billion in the 2010/2011 financial year, access to improved drinking water still remains low. The country is facing a number of challenges related to performance of water projects.

Nyaguthii and Oyugi (2013) established that most community members in Mwea sub-county do not participate in management of Community Development water projects during the initiation phase, leading to failure before execution phase. Similarly, Joseph (2013) established that majority of the constituency development funded water projects in Molo sub-county face inefficient fund management practices in their operations. These findings are congruent with those of Philip and Abdillahi (2003) on the role of popular participation and community work ethic in rural development during the initiation phase. Further research done by Faith (2010) on influence of community participation on the performance of Kiserian dam water project, Kajiado County, Kenya, established that there was little involvement of the beneficiaries.

Statement of the Problem

The well-being of an individual is directly related to water as it affects all the sectors of nature and livelihoods. Inadequate access to clean water consumes time, increase prevalence rates of waterborne diseases and increase costs of accessing healthcare. This ultimately impacts the economy of an area. A household is considered to have access to improved water supply if it has sufficient quality and quantity of water for family use at affordable price, available to household members and livestock. In Kenya, most water projects implemented in the rural areas to address water accessibility and scarcity are non-operational. The failure rate for most water development projects in Africa lie anywhere from 30 to 60%. According to existing studies, 55% of all the rural water supply projects in Tanzania, Uganda and Kenya are non-operational. Various factors have been attributed to this failure: lack of demand of the project by the beneficiary community, high recurrent costs, neglect of the water facilities especially on operation and maintenance, use of inappropriate technology, locating of water points far from the community and lack of proper training. Further, community involvement; type of technology, distance, governance structures and training have been found greatly impact community

borehole water projects. Some boreholes have been dug where there is no electricity supply making investments counterproductive. In Kenya about 35% of the water projects implemented will fail due to poor management of the initiation, planning, execution and closure phases of such projects. In Kitui County, where Kyuso is found, 60% of the implemented water projects have been badly implemented while others have not been implemented though they were allocated for funds. Therefore this study intends to fill the knowledge gap on factors affecting the sustainability of community borehole Water Projects in Kyuso Sub-County.

THEORETICAL LITERATURE

The study adopted the sustainability theoretical framework developed by Carter et al (1999), resource dependency and stakeholder theories. Sustainability pertains to multiple aspects of a rural water supply, with institutional, social, technical, environmental and financial dimensions (Well, 1998). This accounts for the fact that understanding and measuring sustainability is so difficult, and why solutions are highly context specific. A motivated community needs the service more and considers the scheme as its own property. Where village level maintenance trainees are lost, new training should be given to the new trainees. Village level rural operation and maintenance has limited success if ongoing support is not provided. Demand driven approaches are effective since communities are capable of making decisions, contributions to capital costs, operations and maintenance. Strong and well-structured information campaign is necessary to empower communities to make an informed choice. Livingstone et al (1993) explained that poor program conceptualization, unimaginative planning, use of inappropriate technologies, and rigid management approaches have contributed to high rates of program failure. Implementation approaches resulting in both non-sustainability and sustainability of water supply projects should be identified and documented as a baseline for future projects. The sustainability framework is very relevant to this study in that it touches on the issues of community participation, training, maintenance costs and the role water management committees play in the sustainability of the borehole water supply projects.

Resource Dependence Theory (RDT) is based upon how the external resources of organizations affect their behavior. Organizations are dependent on resources that ultimately originate from the environment which contains other organizations. This is true when applied to the sustainability of community water borehole projects. Sustainability depends not only on financial resources but also on human resources' training, skills and knowledge in the maintenance of water facilities or infrastructure. Resources one organization needs are often in the hands of other organizations. Resources are a basis of power and legally independent organizations are interdependent (Chapman et al. 2011). The composition, influence,

knowledge, motivations and actions of stakeholders are dynamic in any given place, time and are inherently uncertain.

Resource Dependence needs a closer examination as its weakness lies in its very assertions of dependence. With changing trends of financial uncertainties, there is need to lean towards other theories of uncertainties. According to this theory, organization depends on resources for their survival; therefore, for any organization to achieve sustainability, resources are indispensable. In this research study, all the four independent variables are resource dependent and interdependent in nature. Resource uncertainties affect community participation, community training, maintenance costs and water management committees. All organizations are resource dependent in order to survive and achieve sustainability. As a result, this theory is very relevant to this study and will help in understanding the underlying obstacles affecting the sustainability borehole water projects in Kyuso sub-county.

Stakeholder theory as proposed by Freeman (1984) defines a stakeholder as any group or individual who can be affected or is affected by the achievement of the organization's objectives. Project stakeholders are individuals and/or organizations who actively participate in the project or whose interests are likely to be affected by the execution of the project or by successful project completion (PMI, 2004). Chinyio and Olomolaiye (2010) stated that stakeholders could affect an organization's functioning, goals, development, and even survival. Stakeholders could be beneficial when they facilitate the realization of the projects' goals or antagonistic when they oppose the projects' mission. Non-commitment of stakeholders to continuously support the objectives of the project may lead to failure. Khwaja (2004) posited that participation is attained through collaborative or joint involvement of project beneficiaries and the implementing agencies. The real value of participation stems from the finding that mobilizing the entire stakeholders, rather than engaging people on an individualized basis, leads to more effective results (Braithwaite et al., 1994). Simply said, change "... is more likely to be successful and permanent when the people it affects are involved in initiating and promoting it" (Thompson et al, 1990). Stakeholder theory is very fundamental in understanding the effect of community participation in all the phases of the project to foster ownership.

EMPIRICAL REVIEW

Effect of Community Participation on Sustainability

According to Berner and Phillips (2005), community participation is now a mainstream management theory. Hence for any rural development initiative to thrive, community participation is required in order to create empowerment and ownership among the target group. According to Majory (2009), communities can be defined by the characteristics of its people's

geographic boundaries, history, shared interests, values and power relations. There exists vital interactions and networking within the community. A community is a multidimensional system which is variable, shaped and re-shaped continuously by changing actions and relationships. Harvey and Reed (2007) define community in terms of area coverage that can be adequately served by a particular water facility. According to Lachapelle (2008), sense of ownership is frequently deemed as a significant characteristic of community development work. Therefore the strength of a group to unite and direct its members' actions will depend on the degree of interdependence and sentiment generated between members and the group as a whole (Minar & Greer, 2007). Applying the concept of ownership makes it easier in determining how the interests and actions of individuals or organizations contribute to community development work through participation. If individuals are engaged authentically and intimately, the level of dedication to the process and outcome will be enhanced and so is sustainability of water projects.

Community participation is a prerequisite for sustainability while community management is not. For community management systems to be sustainable, they require post construction technical support from an overseeing institution (Harvey and Reed, 2007). Community participation helps achieve an increased sense of ownership. Communities that feel they own a hand pump installed at a shallow well are more likely to look after it. Institutional arrangement or local community structures for managing the water projects are also important. Community participation and ownership have a valuable role to play in achieving sustainability, but can create other challenges (Nkongo, 2009). According to Boru (2012), community involvement in site selection for water facilities, provision of labor, locally available materials, cash contribution, and selection of the management type influences community ownership of water projects. To enhance community participation, regional learning centres should be established and information on good practices and innovations should be documented (International Rescue Committee, 2012). Steps and processes should be initiated to institutionalize regional learning as a strategy for identifying good practices, advocacy, innovations and information sharing (Baur and Woodhouse2009).

Effect of Water Management Committees on the Sustainability

Community Management is considered to be a major requirement for the success of community development interventions. Research has shown that strong leadership for community management is critical to sustainability of water projects (Batchelr, McKemey, & Scott, 2000). Empowerment is the expansion of assets and capabilities of poor people to own, negotiate with, influence, control, and hold accountable institutions that affect their live (Narayan-Parker 2002;

ibid. 2005). According to Wong and Guggenheim (2005), several communities driven development programmes have systematically introduced participatory public expenditure management of micro projects. Community representatives are tracking the implementation of thousands of micro-projects in a number of countries. Ad-hoc committees are set up and in charge of overseeing implementation. Mechanisms used include information disclosure and transparency on project budget, financing, contracting and procurement; anonymous grievance procedures; and community monitoring of contracts and implementation. This information is discussed publicly in villages and displayed.

Village committees established to oversee the project are required to report back regularly to the community. As a result community members are in a better position to influence local level planning and decision making. According to the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) Joint Monitoring Program (JMP) for Water Supply and Sanitation report (2004), at least 44% of the population in sub-Saharan Africa (some 320 million people) did not have access to clean and reliable water supplies from projects installed. Despite the failed water development projects, governments and international financial institutions continue investing hundreds of millions of dollars to keep the projects going (WB, 2006). The communities involved have not been empowered to manage and continue supporting the water projects after project closure.

Communities are able to actively participate in the whole process of acquisition and operation of the facilities by electing water management committees responsible for the management of water facilities. The communities are responsible for all operation and maintenance cost of the facilities. This implies that the sustainability of the facilities rest on the community. A water facility bank account is required where funds raised for new investment, operation and maintenance are kept.

Kenya has a strong culture of self-help which has been harnessed for many development activities especially in the rural areas. According to a report by (World Bank, 2003) for the eight million Kenyans who had access to improved water in rural areas, 30% were served by management water supply schemes. These schemes are led by water community committee or caretakers. One challenge observed in the management of these committees is the relationship between the water committee and community that is often disrupted because of lack of communication, misunderstanding of the rules of the executive, lack of accountability of the management of the systems. The ministry of water and irrigation in Kenya has made efforts time and again to enlighten the community on the importance of their participation in the water issues including the projects of the same, citing the CPC which has empowered the members of the community. According to CPC (2007), CPC is an approach developed to enhance the

capacity of the communities to apply for, implement, manage, and maintain their own water supply projects.

Effect of Community Training on Sustainability of Community Borehole Water Projects

According to Toole (2002), capacity building sessions to develop community awareness of water supply problems will increase local participation in developing and demanding a project that will satisfy the needs of the community. Technical training in construction, operation and maintenance will teach selected individuals' practical skills and may create an understanding and the sense of responsibility for water facilities in the beneficiary community and this enhances community ownership of water projects. In Tanzania, only 46% of existing rural water points are functional and a quarter of the newly installed systems fail after only two years of operation. Lack of sustainability is associated with lack of finance especially for operation and maintenance, lack of technical personnel at the project level, lack of spare parts and lack of community participation and ownership.

Targeting women for training is critical to the ownership and sustainability of water projects, especially in technical and managerial roles to ensure they actively participate in decision making process this influences community ownership of projects (Harvey and Reed, 2007). Ngetich (2009) did an assessment of factors influencing sustainability, the case of community water projects in Keekonyokie central location, Kajiado district, Kenya. He recommended community training for empowerment and sensitization to environmental concerns. Ochelle (2012) did a study on factors influencing sustainability of community water projects in Mulala division, Makueni County and recommended training of water management committee members on operation and maintenance to enhance sustainability. Implementers of water projects should ensure that water management committees are formed and members adequately trained. According to Mclvor (2008), various water programmes implemented in the Zambezi Valley, Zimbabwe failed due to the fact that the local communities did not regard the water facilities e.g. dams and boreholes "as their own." They considered them to be someone else's responsibility. This is because of an inadequate process of consultation with local people prior to the construction of such facilities and training them (Harvey and Reed, 2007).

Communities should be trained to maintain pumps. Previously, the local government authority was responsible for repairing pumps that had broken down, even though the repairs were often minor. Yet in some cases repairs by this authority would take many months, since they had little transport to service the entire region. Training of members of the community including women and children, in stripping a pump, replacing washers, reinserting pipes etc. will lead to a significant reduction in the number of water-points not functioning (Gicheru 2012). In

terms of technological change, a decision has to be made by several agencies to introduce manageable pumps for children (Mwakila 2008). Pumps which require less effort to utilize and only one child to operate.

Effect of Maintenance Costs on Sustainability

The long term success of any water programme, depends almost entirely on effective maintenance although it is as an aspect that is very often neglected. It does not just entail having technical aspects but also encompasses social, gender, economics and many other aspects (Brikke et al, 2003). Water supply is a service, and just like any service it involves manpower, repairs, spare parts, energy and other inputs. These services as argued by Boland and Whittington (2000) are not free and therefore in order to provide a safe and sustainable water supply, a cost recovery system has to be introduced. According to Folifac and Gaskin (2011) provision of potable water supply services involves costs which are incurred at the design, construction and operational stages of any water supply system. However, the magnitude of these costs is utility specific and would depend in part on the type of technology used and management practices.

And once these basic services are in place and communities develop the skills and resources for changing their environment they continue to further their development (Keen, 2007). If community water and sanitation projects are to succeed, technical, social, economic and environmental aspects must be well coordinated. A very important contribution to these aspects is the participation of the community involved in the project. Without the interest and support of the target beneficiaries using the system, no project will succeed; however well designed and planned. The success of a project depends on people understanding; accepting and using systems they have selected for themselves. Brikke and Rojas (2001) states that decisions that need to be made when designing a system of cost recovery include deciding on appropriate rate and type of tariff to apply to water users. Tariffs can be set per volume of water consumed or standardized as one uniform price paid by all members of the community regardless of usage.

The Value for Money Study (Price Waterhouse Coopers, 2007) says 57% of the entire water supply investment in rural areas of Kenya is unproductive, as the invested infrastructures are not functional. The water development projects' failures thus far raise serious doubts about the ability of international donors to achieve lasting progress anywhere, even as institutions pour billions more dollars into global water development projects as they keep failing (Ochelle,2009). There is little proof on the critical success factors of a particular part of the project management

such as risk management and financial management but rarely on project life cycle management on performance of water projects (Jennifer, 2004).

According to McCommon (2009), the communities must understand its options and be willing to take responsibility for their system, willing to invest in capital and recurrent costs. The community must be empowered to make decisions to control the system. Effective external support must be available from governments, donors, and the private sector e.g. training, technical advice, credit, and construction. To achieve this, attention should be given to the community involvement in all the stages of projects implementation (Gicheru, 2012 & Mwakila, 2008).According to Baur and woodhouse (2009) the principal objective is to return a significant measure of responsibility of decision making about management of water to local people themselves. It is an initiative that seeks to challenge the idea that it is always "experts" who know best about solutions to problems (Mwakila 2008). According to Mwakila (2008), a decision has to be made if communities are genuinely to own their water resources, some contribution in terms of cost would have to be made so as to reinforce a feeling of ownership. Water charges are small, yet they enable spare parts to be purchased and fences to be installed to protect water-points from livestock damage (Baur & Woodhouse 2009).

Sustainability of Borehole Water Projects

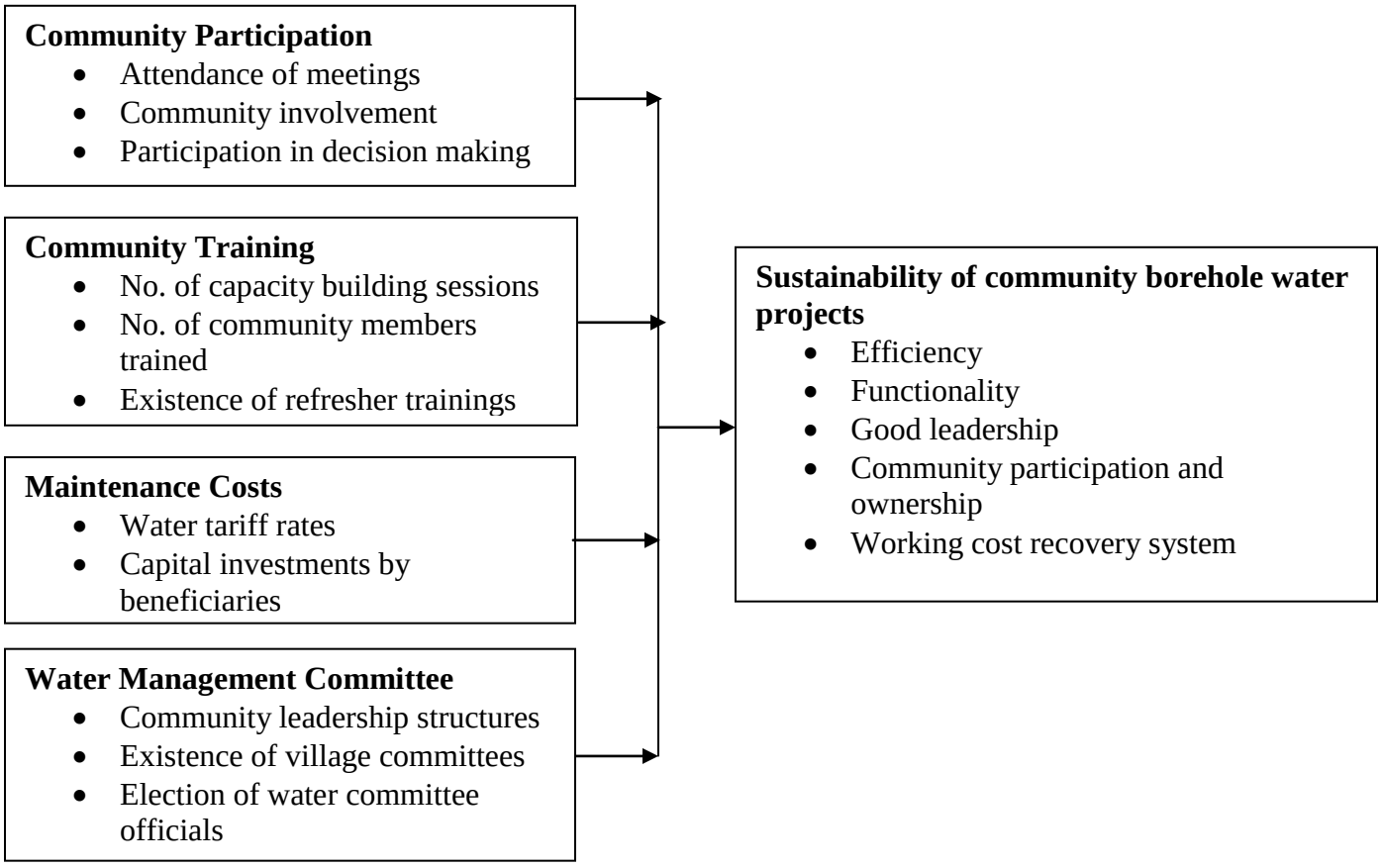
The concept of sustainability has been closely linked to environmental issues and, in ecology, is defined as the amount or degree to which the earth's resources may be exploited without damage to the environment (Carter and Rwamwanja, 2006). The United Nation World Commission on Environment and Development (WCED) report defined sustainable development as development that meets the needs of the present generation without compromising the ability of future generations to meet their needs. This definition marked an important shift away from the idea of sustainability as primarily a concern of ecology to one that emphasizes the economic and social processes of development (DFID, 2000).

A number of studies have identified various determinants of sustainability of rural water supply system. However according to Harvey and Skinner (2002), sustainability of rural water supply facilities is dependent on many factors including policy, legal and institutional framework, social factors such as demand for water, community participation and community organization; economic and financial factors such as ability to meet the cost of maintenance and ability to pay for services; technological factors such as technology choice, availability of spare parts and operation and maintenance and lastly management factors.

In addition, communities often have considerable difficulty in sustaining operation and maintenance (O&M) of water supply infrastructure over the useful life of the hardware (Davis,

2008).In spite of the huge efforts and investments in the construction of water supply infrastructure, around 63.1% of rural population (16.5m people) is relying on unsafe water (Kenya Census, 2009). The post construction operation and maintenance (O&M) of water supply systems is cited as the major challenge. In rural water supply projects, a key issue of sustainability is community ownership and management. Meaning that, the communities take the final decision on important aspects of the planning and implementation of water supply schemes in sustainable rural water supply systems. Good leadership play a number of different roles in community based projects, all of which require trust and good working relationships with local people and professionals. In order to establish good rapport, leaders need time, resources and authority to invest in a project. Flexibility is critical in the way leaders interpret their own and others' roles and in the activities they undertake.

Figure 1. Conceptual Framework



Critique of Reviewed literature Relevant to the Study

The stakeholders theory though it emphasizes on the importance of participation and involvement, it has not provided a criteria for stakeholder analysis and selection. Resource dependency theory too has not provided a framework through which communities could contribute and manage water maintenance funds. A sense of ownership has been described as a concept through which to assess various needs of the stakeholders and beneficiaries. However, there still exist wrangles in project ownership by communities. The degree of interdependence and sentiment generated between members and the group has not been tackled to a conclusive extent. Though external support is very critical in the sustainability of borehole water projects, some donors pursue their own goals and forget to empower the communities to own and maintain the projects after closure. They rarely link the beneficiaries to local service providers for continued support and sustainability of the projects. Some projects are also imposed on the communities by donors and government agencies and therefore do not automatically get the blessings of the beneficiaries.

Research Gaps

Inadequate access to clean water consumes time, increase prevalence rates of waterborne diseases and increase costs of accessing healthcare. This ultimately impacts the economy of an area. In Kenya, most water projects implemented in the rural areas to address water accessibility and scarcity are non-operational. The failure rate for most water development projects in Africa lie anywhere between 30 to 60%. According to existing studies, 55% of all the rural water supply projects in Tanzania, Uganda and Kenya are non-operational. Various factors have attributed to this failure: lack of demand of the project by the beneficiary community, high recurrent costs, neglect of the water facilities especially on operation and maintenance, use of inappropriate technology, locating of water points far from the community and lack of proper training. Further, community involvement; type of technology, distance, governance structures and training have been found greatly impact community borehole water projects. Some boreholes have been dug where there is no electricity supply making investments counterproductive. About 35% of the water projects implemented in Kenya fail due to poor management of the initiation, planning, execution and closure phases. In Kitui County, 60% of the implemented water projects have been badly implemented while others have not been implemented though they were allocated funds (NTP, 2012).

METHODOLOGY

Research Design

This study employed a descriptive survey research design. Descriptive survey design focuses attention on the formulation of objectives, design of data collection instruments, collection of data, processing and analyzing data and reporting findings (Mugenda & Mugenda, 2003). A descriptive survey involves administering questionnaires to individuals by mail, telephone or in person.

Target Population

The study was conducted in Kyuso sub-county in Kitui County. Borehole Water projects in this district serve a population of around 9800 people from 50 community boreholes. Therefore, this study targeted 9800 respondents (community members, water management committee and key informants) from the community, NGOs, National and County governments and other stakeholders.

Sample Frame

According to Silverman (2005), the sampling frame should be large to allow the researcher to make inferences of the entire population. The sample frame for this study comprised of 9800 people from 50 community borehole projects. 0.1% or (12) represents the key informants.

Table 1: Sampling Frame

Category	Frequency	Percentage
Community Members	7733	79.0
Water management Committee	2055	20.9
Total	**9788**	**99.9**

Sample Size and Sampling Procedure

The choice of a sample size is vital so as to avoid wastage by not being too large and to give confidence to the results of the study by not being too small (Kothari, 2004). Nassiuma (2000) formula was used to calculate the sample size.

$$n = \frac{NC^2}{C^2 + (N-1)e^2}$$

Where n = sample size; N = population size; C = coefficient of variation which is 50% and *e* = error margin which is 0.05.

Substituting these values in the equation, estimated sample size (n) was:

$$n = \frac{9800\ (0.5)^2}{0.5^2 + (9800-1)0.05^2}$$

$$n = 98.9$$

$$n = 99$$

Table 2: Sampling Size Distribution

Category	Frequency	Sample Size
Community Members	7733	69
Water management Committee	2055	18
Total	**9788**	**87**

The key informants formed 0.1% or 12 and so the sample size is 87 + 12 = 99. The 87 community members were included in the sample size proportionately. A sample size of 87 community members was randomly selected from 50 community boreholes in Kyuso sub-county while the 12 key informants were purposively selected from National and County governments, NGOs and other stakeholders in the water sector.

Data Collection Instruments

Research instruments are the tools used to collect data. A semi-structured questionnaire was administered to the 99 respondents. The questionnaire had five sections consisting of questions on demographic characteristics, community participation, community training, water management committees, maintenance costs and sustainability.

Data Collection Procedure

Data collection as defined by Kombo et al. (2002) is the process of gathering specific information aimed at proving or refuting some facts. A permit for data collection was obtained preceded with a letter introducing the researcher. A drop and pick later method was used while face to face interviews were conducted with the key informants.

Pilot Testing

Prior to conducting the main research, a pilot study was conducted to test reliability and validity of the research instrument. Validity is the accuracy and meaningfulness of inferences, which are based on the research results (Mugenda and Mugenda 2003). Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials

(Creswell, 2003). A sample size of 10% of the sampled population is considered adequate for descriptive study (Mugenda & Mugenda, 2003). The reliability of the research instrument was calculated using Cronbach's correlation coefficient. A correlation coefficient greater or equal to 0.7 is acceptable (George & Mallery, 2003).

Data Processing and Analysis

The collected data was checked for errors, edited, coded and analyzed using SPSS (Version 23) for both descriptive and inferential analyses. Regression analysis was conducted to test if the strength of the relationship between the independent variables and the dependent variable were statistically significant.

The model tested is as shown below:

$Yi = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$

Where,

Y1Rrepresents Sustainability of community borehole projects; X_1 Represents Community participation; X_2 Represents Water management committees; X_3 Represents Community training; X_4 Represents Maintenance costs and ε Representing the error term. β 1, β 2, and β 3 are the net change in Y. The findings were presented using frequency distribution tables

ANALYSIS AND FINDINGS

Reliability Test Results

A pilot study was conducted to test the reliability and validity of the questionnaire using a sample size of 10 respondents, (10% of the study sample). The response rate was 100%. The Cronbach's Alpha Test was then conducted and all the four variables gave Cronbach's Alpha values which were greater than 0.7. Field (2005) observes that a Cronbach's $\alpha > 0.7$ implies that the instrument provides a good measure. These results of the pilot test were not included in the final data analysis.

Table 3: Reliability Test Results

Variable	N Test Items	Cronbach's Alpha Value
Community Participation	5	.838
Community Training	5	.825
Maintenance Costs	5	.842
Water Management Committees	5	.827

Response Rate

The study targeted a sample size of 99 participants out of which 75 were completely well filled and consequently were used for data analysis. This yielded a response rate of 75.8%. Cooper and Schindler (2003) also argues that a response rate exceeding 30% of the total sample size provides enough data that can be used to generalize the characteristics of a study problem as expressed by the opinions of few respondents in the target population. This also meets the acceptable response rate of 40%, as suggested by Sekaran (2000).

Demographic Characteristics of the Respondents

Gender Distribution of the Participants

The study established that there were more male participants (66.7%) than female participants (33.3%) participated in Kyuso community borehole projects as illustrated in Table 4.

Table 4: Gender Distribution of the Respondents

Gender	**Frequency**	**Percent (%)**
Male	50	66.7
Female	25	33.3
Total	**75**	**100.0**

Age Categories of the Participants

The study sought to determine the age categories of the participants and from the findings in Table 5, majority (46.7%) were aged 35 years and above followed by those aged between 31 and 35 years respectively. Those aged between 20 and 30 years (17.3%), mainly the youth or young people have not adequately participated in the community borehole projects probably due to attending college or seeking employment in urban centres.

Table 5: Age of the Participants

Age	**Frequency**	**Percent (%)**
20-25 years	6	8.0
26-30 years	7	9.3
31-35 years	27	36.0
Above 35 years	35	46.7
Total	**75**	**100.0**

Education Level of the Participants

From the study it was established that majority of the participants attained secondary school education level (57.3%) as indicated in Table 6. This was followed by those who had attained primary school education (24%), college (12%) and university (6.7%). Majority were adequately educated to understand and answer the questions appropriately.

Table 6: Education Levels of the Participants

Level	Frequency	Percent (%)
Primary	18	24.0
Secondary	43	57.3
College	9	12.0
University	5	6.7
Total	**75**	**100.0**

Roles of Participants in Community Borehole Projects

The study further sought to establish the roles the participants played in the community borehole water projects in Kyuso sub-county. From the findings in Table 7, community members (53.3%) were the majority followed by water management committee members (21.3%), project managers (10.7%) while the National and County government officials were the least at 5% and 6% respectively.

Table 7: Roles of Participants in Community Borehole Projects

Department	Frequency	Percent (%)
Community member	40	53.3
Project Manager	8	10.7
Water management community member	16	21.3
National government official	5	6.7
County government official	6	8.0
Total	**75**	**100.0**

Participants' Working Experience with Community borehole projects

During the current study, participants were asked to indicate their working experience with the community borehole water projects in Kyuso sub-county as shown in Table 8. The study established that majority (37.3%) of the participants had worked between 5 to 10 years followed by those who had worked for over 10 years. This implies that majority of the participants had sufficient experience in the community borehole projects.

Table 8: Participants' Working Experience with Community borehole projects

Duration	Frequency	Percent (%)
Less than 1 year	17	22.7
1-5 years	10	13.3
5-10 years	28	37.3
Above 10 years	20	26.7
Total	**75**	**100.0**

Descriptive Analyses

Influence of Community Participation

In order to determine the participation of the community in borehole water projects, the first statement was that community members participate in the identification of borehole water needs at community level. As shown in Table 9, the mean score for responses was 3.30 indicating that a majority of the participants were neutral in their responses to the statement. The standard deviation indicates that a majority of responses did not vary from the mean by more than 1.044. The second statement sought to determine whether community members participate in community borehole water project planning phases and activities needed to complete the projects. A mean of 3.12 suggests that a majority of the participants were neutral with the statement. A standard deviation of indicates that the responses did not vary from the mean score by more than 1.338. The third statement asked respondents whether the community members participate in the implementation of the borehole water projects in various activities including provision of labor, attending community meetings, work scheduling and budgeting. A mean score of 3.77 implies that majority of the respondents were in agreement with the statement with a standard deviation of 1.230.

The fourth statement sought to establish whether community participation in borehole water projects promotes sustainability of the projects. Majority of the participants were strongly

in agreement with a mean score of 4.45 and standard deviation of 0.925. The fifth statement sought to determine if the borehole water projects gave priority for the participation of the community and other stakeholders. The majority of the participants were in agreement with a mean score of 4.10 and standard deviation of 0.872. The study also asked the participants to list other ways the community and other stakeholders could be integrated into the borehole water projects in Kyuso. Majority indicated that regular empowerment workshops on stakeholder analysis and integration, election of water management committees from public barazas and involving local administration to motivate members.

The study further conducted a qualitative analysis on participants' responses to find out why most community members do not participate in the planning and implementation of borehole water projects in Kyuso sub-county. The participants indicated that ignorance, politics and bad leadership, corruption, lack of technical skills, poor planning of meetings and lack of appreciation in integrating community members as the core problems. These findings are consistent with UNDP-WSP (2006) that one of the pre-implementation factors for water projects is demand responsive approach. Post-implementation factors are technical support, community satisfaction, institutional and financial management, training and willingness to sustain the water project.

Table 9: Influence of Community Participation

	Statement	N	Min	Max	Mean	Std. Deviation
i.	Community members participate in the identification of borehole water needs discussions at community level	75	1	5	3.30	1.044
ii.	Community members participate in community borehole water project planning phases and activities needed to complete the projects	75	1	4	3.12	1.338
iii.	Community members participate in the implementation of the borehole water projects in various activities including provision of labor, attending community meetings, work scheduling and budgeting.	75	1	5	3.77	1.230
iv.	Community participation in borehole water projects promotes sustainability of the projects	75	2	5	4.45	.925
v.	The borehole water projects gives priority for the participation of the community and other stakeholders.	75	2	5	4.10	.870

Influence of Community Training

The study analyzed the role of community training in the sustainability of community water borehole projects, the first statement sought to find out if the community is always trained on the management and maintenance of borehole water projects in Kyuso.

From the findings in Table 10, the mean score was 3.29 and standard deviation of 1.189 implied the respondents were neutral on the statement. The second statement sought to establish if community training plays a critical role the sustainability of borehole water projects. A mean score of 4.23 and standard deviation of 0.990 indicates that the participants were in agreement. Third statement sought to find out if the community was empowered on how to conserve water boreholes and ensure sustainability of the projects. The mean score of the responses was 3.81 and the standard deviation was 1.195. The fourth statement sought to establish whether borehole water projects regularly conducted trainings for new community members to ensure continued of skills. A mean score of 3.23 and standard deviation of 1.117 indicate that the participants were neutral. The fifth statement sought to determine if trained community members on sustainability of borehole water projects continued sharing skills among themselves. The findings indicate a mean of 3.65 implying the participants were in agreement with the statement. In addition, the study sought to establish the mechanism through which the borehole water projects could integrate the surrounding communities in the particular sustainability efforts.

The participants suggested that creating awareness to the community on the importance of sustaining borehole water supply, sourcing labor from the community for the drilling projects, piping water to the nearest points and selling to the community at a fee and partnering with the surrounding communities to share benefits of continuous supply of water. They also indicated that paying dividends to the community members as the investors in the borehole water projects will instill a sense of ownership and provide a platform for sustaining the borehole water projects.

The participants indicated that trainings should be conducted regularly, holding barazas and discussing with the chiefs, churches, water clinics and schools on sustainability of borehole projects, ensuring good leadership in the projects, provision of workshops or seminars and ensuring a focused management committees for accountability and progress.

Table 10: Influence of Community Training

	Statement	N	Min	Max	Mean	Std. Deviation
i.	The community is always trained on the management and maintenance of borehole water projects in Kyuso.	75	1	5	3.29	1.189
ii.	Community training plays a critical role the sustainability of borehole water projects	75	1	5	4.23	.990
iii.	The community is empowered on how to conserve water boreholes and ensure sustainability of the projects	75	1	5	3.81	1.195
iv.	The borehole water projects regularly conduct trainings for new community members to ensure continued of skills	75	2	5	3.23	1.117
v.	Trained community members on sustainability of borehole water projects continues sharing skills among themselves	75	2	5	3.65	1.082

Influence of Maintenance Costs

The study analyzed the impact of maintenance costs on the sustainability of the community borehole projects in Kyuso sub-county. The participants were asked whether the community makes monetary contributions towards maintenance and operations of the water borehole projects. The responses mean score was 4.00 and standard deviation of 0.894 as illustrated in Table 11. Moreover, the study sought to determine if all stakeholders agree to pay borehole water use fee agreed upon for maintenance. The mean score of 3.77 indicate the majority of the participants were in agreement on their responses to the statement. The findings are consistent with those of Angel (2009) who indicated that in water providing organizations financial resources are required to put into place new infrastructure, rehabilitate existing infrastructure and to maintain service quality over time.

The third statement sought to establish whether paying for the maintenance of water boreholes is prioritized by the NGOs, government and other investors. A mean score of 3.71 and standard deviation of 1.296 indicated the participants were in agreement. The fourth statement asked participants whether paying for the maintenance of borehole water projects leads to sustainability. The mean response score of 4.48 indicates that majority of the participants were strongly in agreement with the statement. A standard deviation of 0.570 implies the participants were cohesive in their responses to the statement.

The fifth statement sought to establish if it is important for borehole water users to pay water use fee as it makes them feel they own the project. A mean score of 4.55 indicates that the participants were strongly in agreement with the statement on paying for water use fees. The study asked the participants on ways the community could raise funds to sustain the borehole water projects and majority suggested charging water use fees or paying water tariffs, contribution from community members, seeking the support of the NGOs, and fundraising through organizing mini-fundraisers (harambees). The study also asked the participants to suggest ways NGOs, governments (National and County), investors and private borehole owners could ensure the beneficiary community maintains the water projects. They suggested prioritized training of beneficiary communities, making regular follow ups of the water committees trained, involving the beneficiaries and other stakeholders in all the project activities. Further, ensuring strong water management committees are in place, correct use of boreholes, putting in place rules and regulations to be followed by management committees, providing financial assistance and advocating on the use of cheap but effective and efficient technology e.g. solar system to pump water.

Table 11: Influence of Maintenance Costs

	Statement	N	Min	Max	Mean	Std. Deviation
i	The community makes monetary contributions towards maintenance and operations of the water borehole projects	75	1	5	4.00	.894
ii	All stakeholders agree to pay borehole water use fee agreed upon for maintenance	75	1	5	3.77	1.023
iii	Paying for the maintenance of water boreholes is prioritized by the NGOs, government and other investors	75	1	5	3.71	1.296
iv	Paying for the maintenance of borehole water projects leads to sustainability	75	2	5	4.48	.570
v	It is important for borehole water users to pay water use fee as it makes them feel they own the project	75	1	5	4.55	.810

Influence of Water Management Committees

The study sought to establish the influence of water management committees on the sustainability of community borehole projects in Kyuso sub-county in Table 12. The first statement sought to determine if the community and other stakeholders' participation often ensures there is functioning and complete borehole water supply. The mean score was 3.81

with a standard deviation of 0.833 indicating the participants were in agreement. The second statement sought to establish whether NGOs, government and other investors help maintain borehole water projects for continuous supply. Majority agreed with a mean score of 3.81 and a standard deviation of 0.792. The third statement asked the respondents whether borehole water projects offers trainings on sustainability of water supply regularly.

The majority were neutral with a mean of 3.26. The fought statement sought to ascertain whether the community collects enough borehole maintenance fees to ensure sustainability of water supply. Majority were neutral with mean score of 3.06 and standard deviation of 1.036. The fifth statement asked the participants whether stable water management committees foster sustainability of borehole water projects. They were in agreement with mean of 4.42 and standard deviation of 0.807. The study determined how water management committees could be strengthened to ensure they are empowered and capable of ensuring sustainability. The participants suggested inclusion of women into water management committees, holding refresher trainings, and field trips for benchmarking, training on leadership management, advocacy and financial management and provision of support by the community and the government. The main challenges the projects face are: insufficient support, inadequate training, power breakdown due to mechanical problems, long queues caused by low water pressure, inadequate institutional development, leadership wrangles, lack of technical and skilled manpower, reduction in water yield during droughts and famines, some community members refusal to pay water use fees, embezzlement of funds and lack of sufficient funds to cater for the required equipment.

Table 12: Influence of Water Management Committees

Statement	N	Min	Max	Mean	Std. Deviation
i. The community and other stakeholders' participation often ensures there is functioning and complete borehole water supply	75	1	5	3.81	.833
ii. The NGOs, government and other investors help maintain borehole water projects for continuous supply	75	1	5	3.81	.792
iii. The borehole water projects offers trainings on sustainability of water supply regularly	75	1	5	3.26	.893
iv. The community collects enough borehole maintenance fees to ensure sustainability of water supply.	75	2	5	3.06	1.036
v. Stable water management committees fosters sustainability of borehole water projects	75	2	5	4.42	.807

Sustainability of Community Borehole Water Projects

The participants were asked whether the participants whether all borehole water projects in Kyuso have water management committees in Table 13. Majority agreed with a mean of 3.94 and a standard deviation of 0.574. The second statement sought to ascertain whether water management committees are very important in the sustainability of borehole water projects. Majority strongly agreed with a mean of 4.71 and standard deviation of 0.461. The third statement sought to establish whether water management committees represented all the key stakeholders in the borehole water projects. The mean score was 3.90 with a standard deviation of 0.700 implying the participants were in agreement. The fourth statement asked the participants whether the involvement of women in the water management committees enhanced leadership and sustainability. Majority strongly agreed with a mean score of 4.48. with a standard deviation of 0.508 indicating that the participants were strongly in agreement with the statement. The findings were congruent to those of Okemwa and Wanyoike (2015) who established a strong positive significant relationship between the involvement of women and the sustainability of water projects.

The findings further supports Osagi (2001) who said that perceptions, interests, needs and priorities of women must be taken into consideration not only as a matter of social justice but because they are necessary to enrich development processes. Further, the study sought to establish whether water management committees led the beneficiaries in maintenance and sustainability of the borehole water projects. The majority agreed with a mean of 4.42. The study established that the main problems facing the sustainability of bore water projects in Kysuo were mismanagement of collected funds, bad leadership, poor borehole maintenance by the community, lack of sufficient maintenance fees, insufficient training and capacity building, lack of financial commitment by the community, breakdown of borehole pumps or equipment and power fluctuations.

Table 13: Sustainability of Community Borehole Water Projects

	Statement	N	Min	Max	Mean	Std. Deviation
i.	All borehole water projects in Kyuso have water management committees.	75	1	5	3.94	.574
ii.	Water management committees are very important in the sustainability of borehole water projects	75	2	5	4.71	.461
iii.	Water management committees represents all the key stakeholders in the borehole water projects	75	1	5	3.90	.700

iv.	Involvement of women in the water management committees enhance leadership and sustainability	75	2	5	4.48	.508
v.	Water management committees leads the beneficiaries in maintenance and sustainability of the borehole water projects	75	2	5	4.42	.502

Inferential Analysis

Correlation between Community Participation and Sustainability

Correlation analysis was done to investigate the existence and nature of relationship between community participation and the sustainability of community borehole water projects. From the correlation analysis in Table 14, it was noted that there was a strong significant positive correlation (r = 0.902) between community participation and sustainability of borehole water projects. The findings are congruent to those of Okemwa (2015) who posited that not all community members participate in integrated water resource management practices because they lack awareness. This further support Oakley and Marsden (2007) that stakeholders' support brings together individuals, families, or communities who assume responsibility for their own welfare and develop a capacity to contribute to their own community's development.

Table 14: Correlation between Community Participation and Sustainability

		Community Participation
Sustainability of Community borehole water projects	Pearson Correlation	.902**
	Sig. (2-tailed)	.000
	N	75

**. Correlation is significant at the 0.01 level (2-tailed).

Correlation between Community Training and Sustainability

The study established a strong significant positive relationship (r=0.789) between community training and sustainability of borehole water projects in Table 15. These findings are consistent with those of Bor and Wanyoike (2015) who while studying the adoption of bone char technology in defluoridation of water found that creation of more awareness levels, reduction of the cost of acquisition and simplification of the complexity of use of the technology ultimately enhanced the adoption of the bone char technology. The findings emphasize the importance of training and building the capacity of community members to own projects.

Table 15: Correlation between Community Training and Sustainability

		Community Training
Sustainability of Community borehole water projects	Pearson Correlation	.789*
	Sig. (2-tailed)	.013
	N	75

*. Correlation is significant at the 0.01 level (2-tailed).

Correlation between Maintenance Costs and Sustainability

The study results indicate the existence of a strong significant and positive relationship (r = 0.795) between maintenance costs and sustainability of borehole projects as shown in Table 16. These findings are congruent to those of Kinyanjui and Wanyoike (2015) who established that there is a positive relationship between financial capacity and sustainability of peri-urban water projects. Therefore, the community and other stakeholders should ensure that financial resources are available to maintain the boreholes for continued supply of water by paying water use fees.

Table 16: Correlation between Maintenance Costs and Sustainability

		Maintenance Costs
Sustainability of Community borehole water projects	Pearson Correlation	.795*
	Sig. (2-tailed)	.011
	N	75

*. Correlation is significant at the 0.01 level (2-tailed).

Correlation between Water Management Committees and Sustainability

The study established a strong significant and positive relationship ($r_=$ 0.882) in Table 17 between water management committees and the sustainability of community borehole water projects. This finding is consistent with Ochelle (2012) who did a study on factors influencing sustainability of community water projects in Kenya (Mulala division, Makueni County) and recommended training of water management committee members on operation and maintenance to enhance sustainability. Training has a significant impact on both the water management committees and sustainability of community borehole projects.

Table 17: Correlation between Water Management Committees and Sustainability

		Water Management Committees
Sustainability of Community borehole water projects	Pearson Correlation	.882*
	Sig. (2-tailed)	.029
	N	75

*. Correlation is significant at the 0.01 level (2-tailed).

Regression Analysis

The researcher conducted a multiple regression analysis to analyze factors affecting sustainability of community borehole water projects in Kyuso sub-county, Kenya. The Regression model summary in Table 18 shows that the four predictor variables account for 76.9% of the total variation in the sustainability of community borehole projects because the 'R square' value is 0.769. Therefore, further research should be conducted to investigate the other factors constituting 23.1% which affect the sustainability of community borehole water projects in Kyuso sub-county.

Table 18. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.885[a]	0.783	0.769	2.015

a. Predictors: (Constant), Community participation, Community training, Maintenance costs and Water management committees.

ANOVA test was conducted to test the significance of the relationship between the independent and dependent variables by predicting the power of the model with that of an intercept only model (Faraway, 2002). The results in Table 19 show that the P-value of 0.001 was established from the ANOVA test. This reveals the existence of a statistically significant relationship between sustainability of community borehole projects and the four independent variables (Community participation, Community training, Maintenance costs and Water management committees).

Table 19. ANOVA for Model 1

Model		Sum of Squares	Df	Mean Squares	F	Sig.
1	Regression	79.103	3	26.368	144.879	0.001[b]
	Residual	12.924	71	0.182		
	Total	92.027	74			

a. Dependent variable: Sustainability of community borehole projects

b. Predictors: (Constant), Community participation, Community training, Maintenance costs and Water management committees

Multiple Regressions Analysis

Multiple regression analysis was conducted as shown in Table 4.16. Substituting the values in the equation: $Y= \beta_0+ \beta_1X_1+\beta_2X_2+ \beta_3X_3 + \beta_4X_4$

$Y= 1.452+ 0.812X_1+ 0.784X_2+ 0.790X_3 + 0.798X_4$

The beta values that were obtained were used to explain the regression equation. The regression model established that taking all factors into account (Community participation, Community training, Maintenance costs and Water management committees) at zero, the constant is 1.452 as presented in Table 20. The findings imply that taking all other independent variables at zero, a unit increase in community participation leads to a 0.812 increase in sustainability; a unit increase in community training leads to 0.784 increase in environmental sustainability, a unit increase in maintenance costs leads to 0.790 increase in sustainability and a unit increase in water management committees leads to 0.798 increase in sustainability.

Table 20: Regression Coefficients

Model	Un-standardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	1.452	1.921		1.766	.0240
Community participation	0.812	0.322	0.360	3.305	.0231
Community training	0.784	0.412	0.281	3.274	.0234
Maintenance costs	0.790	0.325	0.294	3.321	.0250
Water Management committees	0.798	0.346	0.287	3.125	.0230

a. Dependent Variable: Sustainability of the community water borehole projects

SUMMARY OF THE FINDINGS

Influence of Community Participation

From the findings, community members did not adequately participate in the identification of borehole water needs discussions at community level and project planning phases and activities. The community members provided labor, attended community meetings, work scheduling and budgeting. The findings also aver that community participation promotes sustainability of the projects. The study established that the community and other stakeholders could be integrated into the borehole water projects through regular empowerment workshops, electing water management committees from public barazas and involving chiefs, training on water management issues and provision of certificates to motivate members. The study further established that most community members lack awareness, experience politics and bad leadership, corruption and lack of technical skills.

Influence of Community Training

The study found that the community was not always trained on the management and maintenance of borehole water projects though training play a critical role on sustainability of borehole water projects. The community was also empowered on how to conserve water boreholes to ensure sustainability of the projects. In addition, the borehole water projects did not regularly conduct trainings for new community members. Contrary to training and transferring skills to new members, the trained community members on the sustainability of borehole water projects continued sharing skills among themselves. Creation of awareness is important in sustaining borehole water supply by sourcing for local labor for piping water to the nearest points and selling to the community at a fee to raise maintenance costs. Payment of dividends to the community members as the investors in the borehole water projects will instill a sense of ownership and provide a platform for sustaining the borehole water projects. The community needs regularly trainings, holding barazas and discussing with the chiefs, churches, water clinics and schools on sustainability of borehole projects. Good leadership through focused management committees were suggested for to ensure accountability and progress of the water supply projects.

Influence of Maintenance Costs

The study established that the community makes monetary contributions towards maintenance and operations of the water borehole projects. Moreover, all stakeholders agree to pay borehole water use fee agreed upon for maintenance. The water tariffs are critical in ensuring new infrastructure, rehabilitation of existing infrastructure and quality maintenance are done for the

borehole equipment. The NGOs, government and other investors prioritized paying for the maintenance of water boreholes projects. The community members' support paying for the maintenance of borehole water projects for sustainability purposes. However, the challenge lie in ensuring all the community members benefitting from the borehole water supply projects actually pay the water use fees. It is important for borehole water users to pay water use fee as it makes them feel they own the project. The community could raise funds to sustain the borehole water projects through charging water use fees or water tariffs, contribution from community members, seeking the support of the NGOs, and fundraising through organizing mini-fundraisers.

The NGOs, governments (National and County), investors and private borehole owners could ensure the beneficiary community maintains the water projects by prioritizing training of beneficiary communities and encouraging use of cheap but effective and efficient technologies like solar power to pump water.

Influence of Water Management Committees

The study established that the community and other stakeholders' participation often ensures functioning and complete borehole water supply. The NGOs, government and other investors also help to maintain borehole water projects for continuous supply. The borehole water projects did not offer adequate training on sustainability of water supply regularly. The study also ascertained that the community collects enough borehole maintenance fees as prerequisite for the sustainability of water supply. Furthermore, water management committees foster sustainability of borehole water projects. Water management committees could be strengthened and empowered by involving key stakeholders, inclusion of women, holding refresher trainings and field trips for benchmarking, training on leadership management, advocacy and financial management and provision support by the community and the government. The water management committees face challenges in their work ranging from insufficient support, inadequate training, power and mechanical problems, long queues, inadequate institutional development, leadership wrangles, lack of technical and skilled manpower, reduction in water yield during droughts and famines, some community members refusal to pay water use fees, embezzlement of funds and lack of sufficient funds.

CONCLUSIONS OF THE STUDY

The study concludes that the community members' did not adequately participate in identification of water needs and project planning phases and activities needed to complete the projects. However, they participated in implementation of various project activities including

provision of labor, attending community meetings, work scheduling and budgeting for the borehole water projects. Community participation promotes sustainability of the projects and participation of the community and other stakeholders was given priority. The stakeholders' integration can be achieved through regular empowerment workshops, electing credible water management, training on water management issues, provision of certificates to motivate members and participation in feasibility studies. Lack of awareness, politics and bad leadership, corruption, lack of technical skills, poor planning of meetings and lack of appreciation in integrating community members hinders community participation in the borehole water projects. On community training, the study concludes that training on the management and maintenance of borehole water projects was not conducted all the time. Community training plays a critical role in the sustainability of borehole water projects. The community was empowered to conserve borehole projects. The new community members were not trained for continued transfer of skills in borehole water management. The trained community members on the sustainability of borehole water projects continued sharing skills among themselves. The surrounding communities can be integrated into the borehole water projects through creation of awareness, sourcing labor from the community, piping water to the nearest points for selling at a fee and partnering with the surrounding communities to share benefits of continuous supply of water. Enhancement of community training can be achieved through regularly trainings and holding public meetings and discussions. Water management committees should ensure there is accountability and progress of the water supply projects.

Moreover, the community makes monetary contributions towards maintenance and operations of the water borehole projects as all stakeholders agree to pay borehole water use fee for maintenance. The NGOs, government and other investors prioritize paying for the maintenance of water boreholes project maintenance. The community members are in support of paying for the maintenance of borehole water projects for sustainability purposes. Paying water use fees fosters project ownership. The participation of the community and other stakeholders' ensures functioning and reliable borehole water supply. The private sector and government help maintain borehole water projects for continuous supply. The projects have not offered adequate training on sustainability of regular water supply and the community does not collect enough borehole maintenance fees. Water management committees can be strengthened and empowered by involving women, holding refresher trainings and field trips for benchmarking, training on leadership management, advocacy and financial management. The water management committees experience insufficient support from the community, inadequate training, power breakdown due to mechanical problems, long queues caused by low water pressure, inadequate institutional development, leadership wrangles, lack of technical and

skilled manpower, reduction in water yield during droughts and famines, some community members refusal to pay water use fees and embezzlement of funds.

RECOMMENDATIONS OF THE STUDY

The study recommends that the community members' should be adequately involved in identification of water needs and project planning phases and activities. The study further recommends that community members and other stakeholders should continue to be involved in all the borehole water project implementation activities. There should be regular empowerment of workshops, training on water management issues and technical skills, creation of awareness, motivation of community to participate in the water projects. Training on the management and maintenance of borehole water projects should be conducted regularly. The new community members should be trained for continued transfer of skills in borehole water management. The surrounding communities should be integrated into the borehole water projects through creation of awareness, sourcing labor from the community, piping water to the nearest points for selling at a fee and partnering with the surrounding communities to share benefits of continuous supply of water. The borehole water projects should ensure there is good leadership for accountability and progress of the water supply projects.

The NGOs, government and other investors should continue prioritizing paying for the maintenance of water boreholes project maintenance. The beneficiary communities should be trained and involved in regular follow ups in all project phases. Provision of financial assistance and advocating for the use of cheap, effective and efficient technologies like solar power to pump water should be pursued. The community should put in a place a strategy to ensure the members pay water use fees sufficient for borehole maintenance fees. Water management committees should involve women, hold refresher trainings and field trips for benchmarking, training on leadership management, advocacy and financial management. The water management committees should seek sufficient support from the community and plan how to address mechanical problems, long queues caused by low water pressure, inadequate institutional development, leadership wrangles, and lack of technical and skilled manpower and embezzlement of funds.

LIMITATIONS OF THE STUDY

The study covered 50 community borehole projects in Kyuso sub-county. As a result, sustainability was studied basing on community participation, community training, maintenance costs and water management committees. Some respondents were reluctant to give confidential information which was vital for the study because of fear of victimization from

community water management officials. The researcher assured the employees that information given would be treated with confidentiality and would not use the information for other purposes but for the research. Some respondents were slow in filling and returning the questionnaires. This prompted the researcher to constantly remind them where most of them responded positively while some of them did not respond at all.

SUGGESTIONS FOR FURTHER STUDIES

The study recommends that further training should be conducted on the effect of water management committee leadership structure and the impact on sustainability of borehole water projects in Kenya. Also, further a comparative study should be conducted on the impacts of community conflicts and the sustainability of borehole water projects in Kenya.

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