FACTORS INFLUENCING SUSTAINABILITY OF RURAL WATER PROJECTS IN ISIOLO COUNTY, KENYA

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ABSTRACT

Sustainability of rural water projects continues to remain a challenge for both donors and the county governments with the value for investment involved being hard to realize. Report from Isiolo County Water Office shows that about 75% of water projects developed in Chumvyelle 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. The study established the factors influencing sustainability of rural water project based in Chumvyelle, Isiolo County, Kenya. The study was guided by the following specific objectives: to determine influence of community participation on sustainability of rural water projects in Isiolo County; to examine the influence of management skills on sustainability of rural water projects in Isiolo County; to assess the influence of information technology on sustainability of rural water project in Isiolo County; to establish the influence of cultural practices of the community on sustainability of rural water project in Isiolo County. The study adopted descriptive survey research design. The target population of the study comprised of 230. Stratified random sampling was applied to select the sample size of the study. A sample population of 67 was arrived at by calculating the target population of 230 with a 95% confidence level and an error of 0.05 using the below formula taken from Kothari (2014). The researcher collected data using questionnaires. The analysis of the collected data was done using SPSS (25.0) software. The data was edited, coded and classified so as to present the results of the data analysis in a systematic and clear way. Quantitative data collected was analyzed by the use of descriptive statistics and presented through percentages, means, standard deviations and frequencies. The data was presented in Tables. The study found that community participation largely affects the sustainability of rural water projects. The study further revealed that community involvement in water projects ensures that proposed development better target people's needs. The study found that that community members are involved in decision making process of water projects in their county. The study concludes that community participation had the greatest influence on sustainability of rural water projects in Isiolo County, Kenya followed by cultural practices, then management skills while information systems had the least influence on the sustainability of rural water projects in Isiolo County, Kenya. The study recommends that project designers should make a provision for community participation right from the start of the project. The study further recommends that skilled water management committees are important to attaining sustainability of rural water projects. The study also recommends that training of residents on water sustainability and maintenance of water sources should be reinforced.

Key Words: *sustainability, rural water projects, Isiolo County, Kenya*

INTRODUCTION

Water is a natural resource that is necessary for sustenance of life, ecological systems and a key resource to social and economic development. Efficient water management will not only contribute sustainability long term economic growing but also poverty reduction, health and security (Ghaffour, Missimer and Amy, 2013). Globally there are more than 1 billion people that are unable to access, on daily basis, a reliable source of clean, fresh water. Sustainability of improved water supplies has positive impact such as increased economic growth, increased health and reducing poverty at the community. Governments, non-governmental organizations, local and international organizations from all over the world have implemented water projects to promote safe rural water supply projects to promote safe rural water supply (Wang, Song, Watkins, OngXue, Yang and Shi, 2015).

However, in most projects areas, there is lack of sustainability of water supply systems as most of the communities don't own the projects (Harvey and Reed, 2006). In developing countries national and regional governments, local and international NGOs' and other concerned organizations invest large sums every year for implementation of rural water supply projects. However, construction of rural water projects does not help if they fail after a short time. In order to make the investment in rural water supplies more effective, failure rates of these systems should be reduced. According to Gebrehiwet (2006), this can be accomplished by better integration of people who receive the water and project suppliers in decision concerning planning construction and management of water supply systems.

In Kenya it's a common phenomenon to observe non -functional water systems just a few years after implementation e.g. lack of adequate protection such as fencing of water pans, vandalism of solar pumping systems from boreholes, non-operational shallow well hand pumps and wind mills. The main issue in water supply is gauging the willingness of community members to manage their water sources and infrastructure through contribution of time and resources to the protection, operation and maintenance of rural water supply is a key action towards achieving sustainability of water supply infrastructure (Gleitsmann, 2005). According to Harvey and Reeds (2007) community involvement strongly influences the sustainability of rural water projects.

The study was informed by the Resource based view theory and the Stakeholder theory. The stakeholder theory was originally detailed by (Freeman, 1984). The resource-based view theory was formulated by Barney (1991). The theory postulates that organizational resources need to be inimitable, valuable, not easily substituted and rare so as to enhance strategic competitive advantage of firms against competitors. If organizations are serious about prosperity, they need to be innovative so that they can remain relevant in the dynamic business environments. Since water is one of the resources, it requires formulation of sustainable resources. The stakeholder theory is one of the management theories and ethics that address morals and values in managing an organization. According to the stakeholder theory, corporate governance is primarily concerned with how effective different governance systems are in promoting long term

investment and commitment amongst the various stakeholders, (Williamson, 1985). Water is a resource and sustainability of such projects is based on the interaction of the stakeholders.

Access to safe drinking water and sanitation is a global concern, especially as a Millennium Development Goal, and in recent years, it has been increasingly addressed as one of the basic human rights of nations (UNDP, 2014). Clean water is a necessity for all humans. However, more than 1 billion people around the world have no access to clean drinking water. This problem is particularly acute in rural areas and small communities, where water collection may require hours of physical effort, water sources may be contaminated, or must be purchased at rates too expensive to allow for proper health and hygiene.

The escalating water crisis constitutes a major threat for global progress towards sustainable development in the new millennium. There is growing recognition that the urgent and deepening crisis in water stewardship worldwide is a particularly acute problem in countries of In spite of many years of humanitarian aid and development, it remains a major challenge to ensure access to water for all people. The sustainability rate on water projects in developing countries is alarmingly low, due to a lack of resources, capabilities and spare parts for service and maintenance (Hazelton, 2015). However, in most rural areas of the developing world, safe drinking water from an improved source and sanitation services remain unacceptably lacking (WHO-UNICEF 2014). Despite the importance of these issues in the political agenda, water policies in many countries do not promote the creation of appropriate institutions to manage water needs and enhance supply and maintenance capabilities (Saleth and Dinar, 2013).

Inadequate access to water for drinking, cooking, bathing and cleaning gives rise to social problems associated with poverty. Indeed, a shortage of water is an acute form of deprivation by any standards. It threatens health and physical well-being and affects gender relations and population patterns. The financial hardship that it both reflects and reinforces has severe repercussions on household livelihoods and family relationships. Effects on health are perhaps the most obvious. It has been estimated that 13 million children under 5 years of age die each year from poor sanitation and other diseases linked to poverty (Redclift, 2014). ‘Dirty water and dirty air are major causes of diarrhoea and respiratory infections, the two biggest killers of poor children’ (World Bank, 2015).

Gleitsmann (2015) suggested that ownership of water supply project is dependent upon the degree to which the technology corresponds to the needs of the users and the users’ ability and willingness to maintain and protect it over time. According to Harvey and Reed (2013), low sustainability rates are related to community issues such as limited demand, perceived lack of ownership, limited community education, and limited sustainability of community management structures, such as water use committees (WUCs).

Besides, water supply projects have been strongly criticized for their planning approaches, which have focused excessively on physical construction and increasing coverage targets, but largely

ignored what happens at the water sources after construction (Lockwood, 2014). For the last few decades, literature in the water supply sector has shown that sustainability of rural water supply structures has become positively associated with small-scale initiatives, which maintain public participation. Thus, the key to sustainability is to meaningfully involve the users in the planning, implementation, operation, protection and maintenance of water supply systems according to their needs and potentials (Davis and Liyer, 2012).

Many developed governments and donor agencies have made substantial investments in projects to improve supplies of water in poor rural areas. In addition to funding, external agencies can bring in technical and managerial skills and open up access to credit. They often carry political influence and may provide charismatic leadership to stimulate project development (Aggarwal, 2014).

Access to clean drinking water has progressed enough to reach the MDG target, 780 million people remain without access to clean drinking water. Only 61% of the population in Sub-Saharan Africa has access to improved water supply sources. People lack proper services because systems fail, often because not enough is invested to appropriately build and maintain them, and also because of the stress that urbanization places on the existing infrastructure. In the past decade, Africa's population grew at an annual average of 2.5 percent, and the urban and slum population grew at almost double that rate (World Bank, 2015).

For a long time, measures taken by governments to address service coverage gaps have concentrated on building new infrastructure with little attention given to improving efficiency and productivity of water utilities. Estimates of finance requirements for water and sanitation expansion point to large funding gaps and prospects of private sector investments appear bleak. These realities have compelled major players in the water sector to seek alternative approaches to improving water service coverage. As noted by World Bank (2015), water utilities in Africa differ greatly in terms of size, organizational culture and operating environments. They share one major challenge of expanding access to appropriate levels of services to their growing urban populations as can be seen clearly in the context of the MDGs where Africa lags far behind other regions. It is now widely acknowledged that the inefficiencies of African water utilities are a major cause of poor access to water services.

In many systems, as much as a third of production is lost through physical and commercial losses and revenues are insufficient to cover operating costs let alone expand service coverage. In addition to the non-revenue water (NRW) challenge, most utilities are currently struggling to cover even their operating costs. In all regions, less than half of the utilities can be considered financially viable and, for many. Thus, it is becoming clear that the real potential in the African water sector lies in increasing efficiency in the existing systems - for example by reducing wastage, improving service quality and securing cash flows (Hukka and Katko, 2004).

Financial sustainability matters are driven by countries' Companies Codes, Securities and Exchange Commissions, the stock exchange listing requirements, regulations and rules and other country-specific regulatory agencies. However, though financial sustainability in Africa is off on a good start, insufficient empirical research limit the basis for comparison of the continent's financial sustainability experiences and outcomes with other continents (Ndung'u, 2014). National and regional governments, local and international NGOs invest large sums every year for the implementation of water supply projects (Gebrehiwot, 2014). However, construction of water projects does not help if they fail after a short time. In order to make the investment in water supplies more effective, failure rates of these systems should be reduced. According to Gebrehiwot (2014), this can be accomplished by better integration of people who receive the water and water project suppliers in decisions concerning planning construction and management of water supply systems.

Water is the backbone for all known forms of life and therefore it is important to ensure adequate supply in the right quantity and quality. The Government of Kenya recognizes that for the country to meet its poverty-reduction strategies and achieve the MDGs, water has to be made available, accessible and affordable, especially to the poor. This is based on the fact that all the eight MDGs are directly or indirectly related to access to water. The Kenyan water sector has for a long time been characterized by inefficiencies, lack of investments, poor management and confusing array of legal and institutional frameworks. In addition, the exponential growth of Kenya's urban centers has put increasing pressure on utilities to extend services to new areas. To address these challenges and as part of a global trend, the Government of Kenya introduced far reaching reforms in the water sector to restructure and improve sector sustainability (Owour and Foeken, 2009).

A major aspect of these reforms was ensuring financial viability of water service providers (WSP). However, most WSPs are financially unsustainable. WSPs are faced with weak management structures, processes and systems and poor systems of revenue collection. Therefore, in order to ensure the sustainability of WSPs, it was vital to investigate the interrelationship and importance of factors impacting corporate sustainability, paying greater attention to financial viability of a WSP (GoK, 2015).

In 2002, major reforms were introduced in the water sector in Kenya. The reforms were carried out to address the policy, regulation and service provision weaknesses experienced in the sector (Owour and Foeken, 2009). The reforms were occasioned by the fact that despite many interventions, close to half of the Kenyan population did not have access to clean water (United Nations-Water, 2014). This entailed separating policy functions from regulation and services delivery.

Before formation of water private companies, service provision under the local authorities was fraught with frequent shortages and wastage, high unaccounted-for-later, illegal connections, mismanagement of funds from water bills, non-reading of meters, and nonpayment of water,

among others (World Bank, 2015). All these compromised the financial situation of water utilities. According to the Water Act of 2002, WSPs in Kenya is private entity companies, which are autonomous, managed independently and run professionally. WSPs act as agents of Water Service Boards (WSBs). The Water Act 2002 vests in the WSBs the legal ownership of water and sewerage assets utilized by WSPs. Additionally; WSBs have the authority to regulate water tariffs set by WSPs. Reforms in the water service provision as contained in the Water Act of 2002 were to be guided by the principles of decentralization (provision of services at the local level);financial and operational autonomy of the WSPs; institutionalization of financing of water services (through the establishment of Water Services Trust Fund); as well as financial sustainability. The water reforms in Kenya resonated with similar institutional reforms in the water sector across the developing countries, driven by the Millennium Development Goals targets of ensuring increased access to adequate and quality water (Government of Republic of South Africa, 2002).

At the national level, the challenge of financial sustainability poses a major challenge to the water service providers. A study of water service providers in Tanathi Water Services Board found out that only four of 15 WSPs were able to meet their financial obligations (Tanathi Water Services Board, 2009). In addition, most of the WSPs had weak management structures, processes and systems, had poor systems of revenue collection, and they were un-clustered therefore facing diseconomies of scale (Republic of Kenya, 2014).

According to WHO/UNICEF (2000), rural water coverage in Africa was 47% in 2000, compared to 44% in 1990, leaving 256 million people unserved. In Kenya, the WSS situation is poor for majority of people: approximately 57% of households using water from sources considered unsafe. Sustainable access to safe waters around 60% in the urban setting with as low as 20% coverage in the urban poor settlements where half of the urban population lives. In the rural setting, sustainable access to safe water is estimated at 40%. WSS service in urban poor informal settlements is mainly the domain of unregulated small-scale providers whose tariffs range between 5 to 20 times more than the formal tariff applied to a metered utility supply.

Water Supply Project in Isiolo County

Isiolo County is one of the thirteen counties of eastern province of Kenya and it borders Marsabit district to the north Garissa to the south west and Wajir district to the east. It also borders Tana River, Meru North and Meru Central to the south and Laikipia and Samburu districts to the West. The district covers an area of 25,605 square kilometres and is divided into 6 administrative divisions namely Central, Garbatulla, Sericho, Merti, Oldonyiro and Kinna. There are 22 locations and 44 sub-locations. The district has 2 constituencies; Isiolo North and Isiolo South. Isiolo is inhabited by among other groups the Borana, the Somali, Turkana, the Samburu and the Meru. This makes the district one of the most cosmopolitan districts in Kenya. The 2009 census put the population of the district at 143,000 people. The Central division is densely populated

due to its well-developed infrastructure and being a common rural centre with a total population of 52,280 people. People in other areas tend to settle around watering points. Nearly three quarters of the county total population lives below the poverty line.

There are four perennial rivers in the district namely EwasoNyiro which originate from Mt. Kenya and Aberdare Ranges, Kinna, Isiolo River and Bisanadi which originate from Nyambene Hills. Boreholes, rivers and pans are the main sources of water. Distances of access to water for domestic use has improved by an average of 5km one way. Livestock access distances to water sources also improved. There are 59 water points in Isiolo County most of which are either not operational or requires rehabilitation. Isiolo County lies on semi-arid area. It has little rainfall which is less than 500mm annually and is unreliable. People have to get alternative to supplement the little amount received through the rainfall. The problem that need to be addressed include means of living with the changing environment, proper management, financial systems, ensuring proper monitoring and evaluation of the water supply project. Knowledge of the factors, which influence sustainability of water supply projects, can create a positive impact to sustainability of the water supply projects. The study established the factors, which influence sustainability of water projects in central division of Isiolo North County.

STATEMENT OF THE PROBLEM

Lack of proper management of water projects greatly influence sustainable delivery of water resources to the rural populations in (Kakumba 2010). Earlier studies provide figures of operational failure rates in water projects from individual African countries ranging from 30% to 60% (Lockwood 2014). It is estimated that 55% of all rural water supplies/projects in Kenya, Tanzania and Uganda are not functioning (Baumann, 2009), and despite the frequency with which it appears in development discourse, the reality of sustainability remains elusive. The widespread failures in water supplies have been attributed to a number of flaws in the project; the intervention was not desired by the community, the capital and/or recurrent costs are too high for the community, lack of ownership results in neglect of maintenance and repairs, the promised benefits don't materialize, education programmes are too short and trained members of the community move away or lose interest (Carter, Tyrrel and Howsam, 2011). Community participation has not been well incorporated in establishment and management of water projects in Isiolo County. Although Ministry of Water and Irrigation in collaboration with both international and local organizations, is actively involved at the grassroots level to improve the situation, clean water supply coverage is still in its infancy in many parts of the country. It is estimated that more than 60% of the Kenyan population do not have access to clean water despite the fact that much of the country have reliable water sources and adequate rainfall. The situation is worse in rural areas, occupied by the majority of the population. The ongoing efforts, which are measured based on the sustainability in achieving short term objectives need to be re-engineered to raise their output by 2000% to meet the water and sanitation Millennium Development Goals (MDGs) by 2015 (MWI, 2011). In Isiolo County, there is poor management

of water which led to financial difficulties, the inability of water utilities to attract and retain skilled manpower, high levels of unaccounted-for-water and low revenue collection, including corruption, among others (Government of Kenya, 2014). Service delivery functions were further separated into asset holding (ownership) and investment; and direct water and sewerage services provision (Owour and Foeken, 2009). The key weakness identified in the service provision of water was the financing mechanism in the sector (World Bank, 2015). Most of the water projects in Isiolo County have been performing dismally with most becoming un-operational or requiring rehabilitation. It is quite a common phenomenon to observe non-functional water projects that are not operational in most parts of the country (MWI, 2011). However, if the current trends of poor sustainability of water projects are allowed to continue, rural water facilities will be completely non-functional which significantly lowers the effective coverage. This is manifested in some water project such as Isiolo water supply; LMD Borehole being nonoperational after very few years of operation while even those in operation are either silted up or require rehabilitation. Currently, there seem to be low level sustainability of water projects in Isiolo County in Kenya, resulting from low levels of ownership at community level especially in the Ewaso Nyiro North Borehole Projects. And yet participation alone without effective community organization and leadership to carry out operation and maintenance and other mobilization activities of rural water supply may not work. Similar study by Donge for example reveal that, non-functionality of water sources could be resulting from lack of maintenance, irresponsibility of users and 'free-riding',all of which cause management failures (Donge, 2013). Ali (2015) looked at determinants of community ownership of water projects in central division, Isiolo County. Management of water points is an important aspect of sustainable delivery of water resources to the rural populations in Isiolo County. Currently, there seem to be low level of community participation of rural water supply in Kenya, leading to low levels of ownership at community level. Rimberia (2012) studied on the determinants of water projects sustainability in Kieni East Division, Nyeri County. The sustainability rate on water projects in developing countries is alarmingly low, due to a lack of resources, capabilities and spare parts for service and maintenance. Kemuma (2015) assessed the determinants of financial sustainability in water resources management authority in the Kenyan water sector. None of these studies have established the factors influencing sustainability of rural water project in Chumvyelle, Isiolo County, Kenya. Therefore, this study bridged the existing knowledge gap.

PURPOSE OF STUDY

The purpose of this study was to establish factors influencing sustainability of rural water project in Chumvyelle, Isiolo County, Kenya.

OBJECTIVES OF THE STUDY

1. To determine the influence of community participation on sustainability of rural water projects in Isiolo County.

2. To examine the influence of management skills on sustainability of rural water projects in Isiolo County.
3. To assess the influence of information technology on sustainability of rural water project in Isiolo County.
4. To establish the influence of cultural practices on the community on sustainability of rural water project in Isiolo County.

LITERATURE REVIEW

Sustainability of Rural Water Projects

In the year 2010, the Academic Advisory Committee for the Office of Sustainability at the University of Alberta defined sustainability being "the process of living within the limits of available physical, natural and social resources in ways that allow the living systems in which humans are embedded to thrive in perpetuity." Therefore, sustainability of water projects would involve making use of the available natural resources to ensure security, financial independency and attaining basic necessities to achieve the set objectives for the future and our future generations. This requires good management (Konde, 2016).

The Brundtland Report of the World Commission on Environment and Development (WCED 1987) viewed sustainability as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. According to the WCED (1987), sustainable development is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations. Sustainable development is a normative concept that embodies standards of judgment and behavior to be respected as the human community the society seeks to satisfy its needs of survival and well-being

Isiolo County lies on semi-arid area. It has little rainfall which is less than 500mm annually and is unreliable. People have to get alternative to supplement the little amount received through the rainfall. The problem that need to be addressed include means of living with the changing environment, proper management, financial systems, ensuring proper monitoring and evaluation of the water supply project. Knowledge of the factors, which influence sustainability of water supply projects, can create a positive impact to sustainability of the water supply projects. The study established the factors, which influence sustainability of water projects in central division of Isiolo North Count

Community Participation and Sustainability of Rural Water Projects

Community participation is a principle that has been drafted in the constitution of Kenya (2010). Participation should be embraced in all public affairs and be promoted by non-state Actors and

the state acting in public interest. Participation seeks and facilitates the involvement of those potentially affected by or interested in a decision. The affected must be involved in decision making process. Community participation implies that, the community contribution will influence the decision. According to Van (2008), water projects have greater impact when women are involved. World Bank Survey has shown that women's participation was strongly associated with water project effectiveness. The women are involved in roles such as decision making, capacity building, mobilizing political will etc.

Community participation is essential in all projects implemented in a community. Communities should be involved in all stages of the project, from the planning through to the building and managing of systems. Engaging the community in its own development ensures that the proposed development will better target people's needs as per what would really suit them, incorporate local knowledge of the project, create grassroots capacity to undertake other projects and maintain facilities, distribute benefits equitably and help lower costs of the project. To achieve outcomes through participation, considerable investment in time and resources by parties facilitating and engaging in the process are required. Often pressure for delivery of outputs may compromise the process since the development progress is measured not only by developers of the projects but also by public opinion formers and by the speed in which tangible results are produced or how effective the project influences the lives of the community.

Faunt (2012) also noted that involvement of the community is crucial for sustainability of water supply projects. Furthermore community participation and support increases project efficiency; therefore it is recommended that there should be consultation with the community during all stages of the project planning starting from identification until the project is complete and used by the community members or beneficiary involvement in the management of project implementation or cooperation to ensure sustainability (Harvey and Reed, 2007). Various models of how communities participate in development projects are described by, Faunt (2012) while looking at groundwater depletion and sustainability of irrigation in the US High Plains and Central Valley, some of these models include the full range and depth of community participation which could be 100%, from simple consultation by the community elite to the full and active participation of a representative of a cross-section of a village or set of villages.

Mutonga (2015) in the factors influencing sustainability of donor funded community water projects: a case of Kitui central constituency, Kitui County, Kenya. The study established that most of the community members were not involved in the implementation of the community projects in all the phases and that there was a strong positive correlation between community participation and sustainability of donor funded community projects. Secondly, the community capacity building was not fully undertaken prior to the implementation of the water projects and as a result the community lacked appropriate skills for management, lacked information of policy guidelines on the management of water projects and there was poor planning by the management team. There is a strong positive correlation between community management and sustainability of donor funded community projects. Finally the study established that the most of the

community financial records are never audited. There is also a strong positive correlation between community financial management and sustainability of donor funded community projects.

Ofuoku (2011) sought to examine the effect of community participation on sustainability of rural water projects in Nigeria. Purposive sampling was used in selecting communities, while systematic sampling was used in selecting respondents for the study. The findings of the study indicated significantly relationship between participation and sustainability of water projects (r-cal = 0.652 and r-critical = 0.632).

Sei (2016) looked at the factors influencing community participation in rural water project development. The study adopted descriptive survey design with a target population of 550 households. SPSS was sued to analyze data. The study recommends that the local community social economic status should be strengthened, community should be empowered with the right skills and knowledge to enable them effectively participated in development projects.

Haq, Hassan and Ahmad (2014) investigated community participation and sustainability of water supply program in Pakistan. Survey was carried out from the heads of the households of two villages, District Faisalabad with a sample of 100 respondents. The researcher used Chi-square test to check the association between the variables of the study. The study established that community involvement in planning, execution, operation and maintenance largely contributes towards sustenance of water supply programs in rural area. The study further established that empowerment of local people in operation and maintenance tasks of development projects enhance ownership of these projects, in turn sustainability.

Management Skills and Sustainability of Rural Water Project

Management involves organization of resources available to achieve a certain goal. Resources include human resources, natural resources and financial resources. It is common practice for village water scheme to be managed by a village committee. The creation of such a committee is to enable the community to have a sense of ownership and to ensure its ongoing operation and maintenance (Harvey and Reeds, 2006). According to UNICEF (1999) and USAID (2009) if the operation and maintenance program of a water project is designed by the community, the program will function much better empowerment of the community than when the program is designed by outsiders. Empowerment of the community involved in the management, lead to the positive participation in the sustainability.

Said and Osman (2013) had an overview on management patterns in community, private and hybrid management in rural water supply. This was an empirical study and the findings indicated that proper management of water supply profoundly influences the sustainability of water supply system. The study found out that all over the developing countries most of rural water supply is managed by the community itself.

Tadesse, Bosona and Gebresenbet (2013) studied the rural water supply management and sustainability in Ethiopia. Four sample water schemes were selected and totally 148 (63 were female) representative households were selected for answering the questionnaires. Key informant interviews and group discussions were also conducted. The study established that community participation in planning and implementation was very good while monitoring mechanism of operation and management as well as community participation on choice of technology was poor.

Information Systems and Sustainability of Rural Water Project

According to (Gebrehiroot 2006) water projects are more or less demand responsive to the degree that beneficiaries make choices and carry out resources in support of the choices. The stakeholders have a sense of ownership and will definitely stand with their project hence protect it. According to Alexia and Haysam (2006) in the event of failure in water supply the community does not make any attempt at repairs as it is not perceived to be their responsibility. The ministry of water and irrigation in Kenya has made efforts to enlighten the community on the importance of their participation in the water issues. According to CPC (2007) CPC is an approach developed to enhance the capacity of the community to apply for implement manage and maintain their own water.

Large-scale information systems can provide timely information to stakeholders on such core issues as the level of services delivered and the sustainability of those who provide the service. ICT can provide access to data management tools in rural areas and improve the quality of monitoring information. Finally, ICT can improve the efficiency of monitoring by speeding up data collection, management and analysis, reducing distances required to travel, and shortening the time between failure of a water service and corrective action. The barrier to ICT is decreasing as the cost of Internet access, phones, computers, and software is falling dramatically.

Information technology plays an important in sustainability of water projects. Nhu (2013) evaluated systems for rural water supply and sanitation systems using a case study of Mekong Delta Rural Water Supply and Sanitation Project (AUSAID Project). The study established that rural water supply activity is more likely to be sustainable with active participation of community members, especially women.

In Tanzania, Tonya (2015) assessed the implications of water supply technology on the sustainability of rural water supply. The study adopted cross-sectional research design. 24 projects were surveyed across the study area and 136 respondents were interviewed. The study established a very strong negative correlation coefficient (r = -91.99%) between the information systems and sustainability of the project. The study recommended that transparency should be well observed at community level thereby sharing with the beneficiaries on all the technological options, their advantages and disadvantages, and wherever possible to consider and respect

technologies in which the communities have experience so as to enhance sustainability of the particular rural water supply projects.

Cultural Practices of the Community and Sustainability of Rural Water Projects

Culture broadly defines the whole complex of distinctive, spiritual, material, intellectual and emotional features that characterize a society or social groups. It includes not only the arts and letters but also modes of life, the fundamental rights of the human being, value systems, traditions and beliefs (UNESCO, 1995). Culture is what we inherit from past generations and what we pass onto future generation. Community sustainability is creating a more just and equitable community through encouraging social and cultural diversity (Roseland et al., 2005). It also requires the community to define sustainability from its own values and perspective. This involves community participation and a collective decision-making process that meets the social, cultural, environmental, and economic needs of the community.

THEORETICAL REVIEW

Resource Based View

The Resource Based View Theory was formulated by Barney (1991). The theory postulates that organizational resources need to be inimitable, valuable, not easily substituted and rare so as to enhance strategic competitive advantage of firms against competitors. If organizations are serious about prosperity, they need to be innovative so that they can remain relevant in the dynamic business environments. Barney (1991) further hypothesized that the ownership of unique organizational resources has a positive influence on firm sustainability. The RBVT`s of the opinion that firm`s competitive advantage emanate as a result of ownership of key resources. Therefore, internally owned resources by firms serve to be the key source of competitive advantage in that they warrant superior sustainability (Barney, 1991). The possession of rare and valuable organizational resources leads to competitive advantage where the resources are non-substitutable. In essence, a firm with superior competitive advantage will enjoy improved sustainability over its competitors.

Wright, Dunford and Snell (2001), further argues that firms needs to deploy resources to enable them attain strategic competitive advantage. Firms undertake to identify the various types of resources that lead to higher returns and profitability. Firms seek complementary resources so that they can be able to create synergies in the competitive business environment. The presence of any discrepancies in terms of owned resources explains the differences in the organizational sustainability of different firms. The resource-based view is founded on the notion that better firm sustainability is attributed to internal affairs and not necessarily the industry where the firm operates in (Dowell andHart 2010). This theory strongly promotes the proposal thatboth human and financial resources are indeed important factors that have an effect on business

sustainabilityand growth. The ownership of enough resources enables smooth execution of firm strategies hence increasing in chances of swift implementation. This will enhance firm capabilities to realize full expansion potential (Ramanathan, Nachiappan andNath, 2010). The resource-based view applies to the study at hand since this study shall undertake to examine the influence of project resource management on sustainability of water supply services. Sustainability cannot be achieved where imperative resources are scarce. This is due to the reason that this scarcity impedes ability to continue working towards the attainment of a common goal.

Stakeholders Theory

Stakeholder theory is a theory of organizational management and business ethics that addresses morals and values in managing an organization. It was originally detailed by (Freeman, 1984) and identifies and models the groups which are stakeholders of a corporations and both describes and recommends methods by which management can give due regard to the interests of those groups. In the traditional view of the firm, the stakeholders of a company as the owners of the company, and the firm has a binding fiduciary to put their needs first, to increase value for them. However, stakeholder theory argues that there are other parties involved, including governmental bodies, political groups, trade associations, trade unions, communities, financiers, suppliers, employees, and customers. Sometimes even competitors are counted as stakeholders - their status being derived from their capacity to affect the firm and its other morally legitimate stakeholders (Gesteland, 2005).

According to the stakeholder theory, corporate governance is primarily concerned with how effective different governance systems are in promoting long term investment and commitment amongst the various stakeholders, (Williamson, 1985). Kester (1992), for example, states that "the central problem of governance is to devise specialized systems of incentives, safeguards, and dispute resolution processes that will promote the continuity of business relationships that are efficient in the presence of self-interested opportunism". Blair (1995) also argued that corporate governance should be regarded as the set of institutional arrangements for governing the relationships among all of the stakeholders that contribute firm specific assets. Companies stakeholders argue that, companies owe a duty to all those affected by their behavior. This calls for even directors to be accountable and responsible to a wide range of stakeholders far beyond companies‟ current company law responsibility to shareholders.

This theory is application to this study since it looks at avenues of corporate governance of projects in an effort of ensuring the benefits are spread to all people and they can enjoy the projects' benefits for a long time. Thus, in this case water projects should be well governed by the stakeholders who include: the investors, donors, NGOs, governmental agencies and individual and the communities; this will ensure satisfaction in the water use and eventually their sustainable of the water projects.

RESEARCH METHODOLOGY

Research Design

This study adopted a descriptive research design. A descriptive study is one in which information is collected without changing the environment. It should answer five basic questions: who, what, why, when and where (Creswell 2009). The design was deemed appropriate because of the observational nature of data that was collected from respondents in Isiolo County. Descriptive research portrays an accurate profile of people, events or situations therefore this study employed a descriptive research design where the respondents were the staff at the ministry of water at Isiolo, County government and the Communities in which water projects have been initiated.

Target Population

Bryman and Bell (2007) define population as a fine set of services, people, and group of things, households, elements or even events under investigation by the researcher. It is basically the specific group of individuals or items with which the researcher intends to generalize the research findings to. Ngechu (2004) further describes the target population as the group of objects, items or individuals from which study samples are taken for analysis and reporting. A target population is the researcher's population of interest. The population of the study included the 23 officials of the ministry of water in Isiolo county government, 35 community leaders and 128 beneficiaries' residing in the communities where the water projects had been initiated.

Sample Size and Sampling Procedure

Sampling is a deliberate choice of a number of people who are to provide the data from which a study would draw conclusions about some larger group whom these people represent (Zikmund, 2011). The sample size is a subset of the population that is taken to be representatives of the entire population (Onabanjo, 2010). A sampling frame is a list of population units/elements from which to select units/elements to be sampled (McDaniel and Gates, 2001). Denscombe (2003) emphasize that a good sampling frame should be relevant – meaning that: it should contain things directly linked to the research topic; be complete by covering all relevant items; and be precise and up to date. The sample size is a subset of the population that is taken to be representatives of the entire population (Kumar, 2011). A sample population of 67 was arrived at by calculating the target population of 230 with a 95% confidence level and an error of 0.05 using the below formula taken from Kothari (2014).

$$n = \frac{z^2.N.\partial_p^2}{(N-1)e^2 + z^2\partial_p^2}$$

Where: n = Size of the sample; N = Size of the population and given as 230; e = Acceptable error and given as 0.05; ∂p = The standard deviation of the population and given as 0.5

where not known; Z = Standard variate at a confidence level given as 1.96 at 95% confidence level.

This research study used a stratified random sampling method to select and sample the respondents. Sampling ensures that inferences made from the sample data are not distorted by selection bias (Hildebrand, Ott and Gray, 2005). The heterogeneous group was represented by the population, homogenous groups were represented by the different management levels and a simple random sample was obtained from each group. Stratified random sampling enables populations to be segregated into several mutually exclusive strata. A stratified random sample facilitates different research and methodologies to be used in different strata, providing adequate data for analyzing the various subpopulations and hence increasing a sample's statistical efficiency (Cooper and Schindler, 2006).

Research Instruments

Primary data was obtained using self-administered questionnaires while secondary data was obtained using data collection sheet. Mugenda and Mugenda (2003) stated that questionnaires are among the commonly used instrument in social science research. The questionnaires comprised of open ended questions that adopted a five-point Likert scale ranging from 1 to 5 that gave the respondents an opportunity to express their feelings and behavior in relation to the research questions. Use of questionnaires was expected to ease the process of data collection as all the selected respondents were reached in time. The questions were divided into five areas where Section A covers demographic information and Section B covered the four independent variables (community participation, management skills, information systems and cultural practices) and the dependent variable. The open-ended questions was used so as to encourage the respondent to give an in-depth and felt response without feeling held back in illuminating of any information and the closed ended questions allowed respondent to respond from limited options that had been stated. According to Edwards (2014), the open ended or unstructured questions allow profound response from the respondents while the closed or structured questions are generally easier to evaluate. The questionnaires were used in an effort to conserve time and money as well as to facilitate an easier analysis as they are in immediate usable form

Data Collection Procedure

The researcher obtained an introduction letter from the university which was presented to each manager so as to be allowed to collect the necessary data from the respondents. The drop and pick method was preferred for questionnaire administration so as to give respondents enough time to give well thought out responses. The researcher booked appointment with respondent at least two days before visiting to administer questionnaires. The researcher personally administered the research instruments to the respondents and a research permit from University was used to show the study was used for academic purposes only. This enabled the researcher to

establish rapport, explain the purpose of the study and the meaning of items that may not be clear.

Data Analysis Techniques

Data analysis involves cleaning up collected research data before undertaking to deduce it so as to give meaningful interpretations and explanation (Kothari, 2004). The analysis commences immediately after collection of research data and ends during final interpretation of study results (Kothari, 2004). Collected data was compiled, sorted, edited, coded and analyzed using Statistical Package for Social Sciences (SPSS) Version 25.0 computer program to address the research objectives. The study used mean, frequencies and percentages in the analysis. Results was presented in tables and figures using percentages and frequencies to facilitate comparisons and further analysis. Inferential data analysis was done using multiple regression analysis. Multiple regression analysis was used to establish the relations between the independent and dependent variables and to test research hypotheses. Multiple regressions were used because it is the procedure that uses two or more independent variables to predict a dependent variable. Since there are four independent variables in this study the multiple regression model generally assumed the following equation;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Where: Y= Sustainability of rural water project in Isiolo County; β_0=constant; β_1, β_2, β_3 and β_4 = regression coefficients; $\mathbf{X_1}$= Community Participation; $\mathbf{X_2}$=Management Skills; $\mathbf{X_3}$= Information Systems; $\mathbf{X_4}$ = Cultural Practices; $\boldsymbol{\varepsilon}$ = error term

RESEARCH RESULTS

The study sought to determine the influence of community participation on sustainability of rural water projects in Isiolo County. The study found that community participation largely affects the sustainability of rural water projects. The study further revealed that community involvement in water projects ensures that proposed development better target people's needs. The study found that that community members are involved in decision making process of water projects in their county. The study established that community capacity building is fully undertaken prior to the implementation of the water projects in our county and that there are consultation with the community during all stages of the project planning.

The study also sought to examine the influence of management skills on sustainability of rural water projects in Isiolo County. The study found that management skills affect the sustainability of rural water projects greatly. The study further found that the county employs qualified team to management water projects and that the management carries out regular monitoring and evaluation of the water projects in our county. The study found that the management team

consults the village water committee in water projects and that proper management of water supply influences the sustainability of water supply system in the county

The study further sought to assess the influence of information technology on sustainability of rural water project in Isiolo County. The study found that information systems largely affect the sustainability of rural water projects. The study also found that management considers and respects technologies in which the communities have experience. The study found that information systems provide timely information to stakeholders and that IT provides access to data management tools in rural areas greatly. The study found that IT improves the efficiency of monitoring by shortening the time between failure of a water service and corrective action.

The study sought to establish the influence of cultural practices on the community on sustainability of rural water project in Isiolo County. The study found that cultural practices of the community greatly affect the sustainability of rural water projects. The study also revealed that a culture of cooperation in management of water projects is inherited from past onto future generations and that women and men are actively involved in management of water projects in their county. The study also found that there is collective decision-making process that meets needs of the community and that the community has defined sustainability from its own values and perspectives.

REGRESSION ANALYSIS

The researcher conducted a multiple regression analysis to test the relationship between the variables. This showed how the dependent variable is influenced by the independent variables.

Table 1: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.893	0.797	0.782	1.404

From the findings, the independent variables were statistically significant predicting the dependent variable since adjusted R square was 0.782. This implied that 78.2% variations in sustainability of rural water projects in Isiolo County, Kenya are explained by community participation, management skills, information systems and cultural practices. Other factors influencing sustainability of rural water projects in Isiolo County, Kenya that were not covered in this study accounted for 21.6% which form the basis for further studies.

Table 2: ANOVA Test

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	442.119	4	110.530	53.101	.000
	Residual	112.401	54	2.082		
	Total	554.52	58			

From the ANOVA Table, p-value was 0.000 and F-calculated was 53.101. Since p-value was less than 0.05 and the F-calculated was greater than F-critical (2.4472), then the regression relationship was significant in determining how community participation, management skills, and information systems and cultural practices influenced sustainability of rural water projects in Isiolo County, Kenya.

Table 3: Regression Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.912	0.182		6.962	.000
Community participation	0.812	0.196	0.714	4.143	.000
Management skills	0.712	0.208	0.611	3.423	.001
Information systems	0.568	0.208	0.462	2.731	.007
Cultural practices	0.771	0.312	0.672	2.471	.015

The established model for the study was:

$$Y= 0.912 + 0.812X_1 + 0.712X_2 + 0.568X_3 + 0.771X_4$$

Where: Y= Sustainability of rural water projects in Isiolo County, Kenya; X_1= Community participation; X_2= Management skills; X_3= Information systems; X_4= Cultural practices

The regression equation above has established that taking (community participation, management skills, information systems and cultural practices), sustainability of rural water projects in Isiolo County, Kenya will be 0.912. The findings presented also show that increase in the community participation leads to 0.812 increase in the score of sustainability of rural water projects in Isiolo County, Kenya if all other variables are held constant.

Further it was found that if management skills increases, there is a 0.712 increase in performances of rural road maintenance projects in Igembe South Sub County, Meru County, Kenya. Further, the findings show that a unit increases in the scores of managements support would leads to 0.568 increase in the scores of performance of the rural road maintenance projects in Igembe South Sub County, Meru County, Kenya. The study also found that a unit increases in the scores of cultural practices would lead to a 0.771 increase in the scores of performances of rural road maintenance projects in Igembe South Sub County, Meru County, Kenya.

Overall, community participation had the greatest influence on sustainability of rural water projects in Isiolo County, Kenya followed by cultural practices, then management skills while information systems had the least influence on the sustainability of rural water projects in Isiolo County, Kenya. All the variables were significant since their p-values were less than 0.05.

CONCLUSIONS

The study concluded that community participation influence sustainability of rural water projects in Isiolo County positively and significantly. The study deduced that community involvement in water projects ensures that proposed development better target people's needs. The study also found that that community members are involved in decision making process of water projects in their county. The study revealed that community capacity building is fully undertaken prior to the implementation of the water projects in our county.

The study further concluded that management skills influence sustainability of rural water projects in Isiolo County positively and significantly. The study deduced that the county employs qualified team to management water projects and that the management carries out regular monitoring and evaluation of the water projects in our county. The study established that the management team consults the village water committee in water projects and that proper management of water supply influences the sustainability of water supply system in the county.

The study further found that information technology influence the sustainability of rural water project in Isiolo County significantly. The study deduced that management considers and respects technologies in which the communities have experience. The study found that information systems provide timely information to stakeholders and that IT provides access to data management tools in rural areas greatly. The study found that IT improves the efficiency of monitoring by shortening the time between failure of a water service and corrective action.

The study also concluded that cultural practices on the community influence sustainability of rural water project in Isiolo County significantly. The study also revealed that a culture of cooperation in management of water projects is inherited from past onto future generations and that women and men are actively involved in management of water projects in their county. The study also found that there is collective decision-making process that meets needs of the community and that the community has defined sustainability from its own values and perspectives.

RECOMMENDATIONS

The study recommends that project designers should make a provision for community participation right from the start of the project. This includes making funding available for the community processes including social mobilization, organization and training of the communities. The sector should put in place an enabling environment that includes legal and framework policy for accountability necessary for achieving sustainability. Selecting appropriate technology is a primary concern of every project manager, for without technology safe sources cannot be exploited. Increasing community participation in project design and implementation is

associated with sustainability of rural water projects in Kenya. Increased community participation increases sense of ownership of projects among the community members.

The study also recommends that project designers must take into account all parameters mitigating selection of technology including need for innovations, source characteristics, demand and adequacy of source and cost of operation and maintenance before making choices. Such factors as affordability, access to spare parts and quality of water are also important factors that influence long term sustainability of facilities.

The study further recommends that skilled water management committees are important to attaining sustainability of rural water projects. The skills help in making decisions, coordinating and responding to challenges skills of water committees should therefore be increased including setting an educational description on academic level. Motivating water committees should be considered as a way of retaining people with skills to volunteer .such incentives could include participation in exchange programmes visits.

The study also recommends that training of residents on water sustainability and maintenance of water sources should be reinforced. As per the study findings, most of the residents have no formal education. This implies that the professionals are needed to help the community learn essentials of water source maintenance. Furthermore, training may never be conducive for the residents due to lack of formal education. It is thus recommended that the policy makers should come up with a friendly water sustainability and maintenance curriculum and affordable fees to encourage adequate training of the residents.

It is also recommended for government to promote spare parts stockiest or private sector engage on Private Public Partnerships models that may involve provision of spare parts among other services to reduce on mechanical or technical challenges that could be faced by service teams or management committees.

The study also recommends that county government to conduct life cycle cost analysis to help in setting realistic tariffs from which revenues can be collected would help raise money for major or expensive parts. This would help in awareness raising link between cost of establishing a water infrastructure and cost of both minor and major replacements.

Capacity building trainings to enhance management committee skills and competencies need to be periodically done by the county governments and a monitoring system instituted for tracking, assessing and reporting on progress in improvement of management capabilities. This should be followed by development of remuneration packages for a lean but competent professional staff that will ensure improvements in water collection and better customer service levels.

County governments and other partners implementing rural community water projects in the counties in pastoralist areas should develop user friendly technologies for water supplies such as

solar powered systems owing to the long hours of sunshine in these areas. This should then be followed by sponsoring community youth to take up technician's course trainings in diagnostic, repair and maintenance of the applied water technologies.

Positive cultural practices such as the ones that discourage water wastages and encourage alternative dispute settlements using elders should be and embedded in formal county water regulations and by –laws. The laws should also encourage women participation in water management committees by making it mandatory for reserved key positions to be allocated to women.

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