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ASSESSING SUSTAINABILITY OF RURAL WATER PROJECTS IN NAIVASHA, KENYA, CASE STUDY: MARAIGUSHU WATER PROJECT

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ABSTRACT

As the world hurried to achieve the millennium Development Goal number 7 which aimed at halving the population accessing safe and improved drinking water, many water development projects were undertaken in the developing countries and indeed in Kenya. Now that these target has been attained, the challenge remains to ensure that these projects benefits are sustained and that they continue to offer the benefits of clean water services to the communities served without compromising future generation's ability to enjoy such benefits. The first step towards sustained access to safe water services is to draw an understanding of the current situation, by identifying and addressing the gaps in service delivery and the institutional capacity. Maraigushu water project is a case example of rural water projects that has been in existence for almost two decades and continues to provide services to the community. For over twenty years, this project has been managed by the community. Since its inception, no systematic assessment has been conducted to establish its sustainability. The researcher undertook this research with the goal of assessing the water project sustainability. The study employed a mixed method comprising of a household survey. Water committee members were interviewed for key project information, documents reviewed and physical assessment of the water project conducted. Data was analyzed using Stata 10. With reference to the conceptual framework underpinning the relevance of the study, through the use of ordinal logistic regression, it has been possible to demonstrate the extent to which "Sustainability" as the dependent variable is related to "Community participation", "Management factor" and "Technical factor". In most cases, it is observed that the relationship between the independent variables and the dependent variable exist at 95% level of confidence. The management factors were observed to deserve in improvement in order to further enhance this project's sustainability.

KEYWORDS: Sustainability, Water Project, Community Management and Participation. Maraigushu

1. BACKGROUND

In the context of striving to achieve the Millennium Development Goal (MDG) 7 on environmental sustainability, tens of thousands of water projects have been developed. This might seem a positive development: one of a key target of the MDG was to halve the proportion of people without sustainable access to safe water and basic sanitation by 2015.

Now that this goal has been achieved according to the United Nations Development Millennium Development goal Report (UN, 2013). The challenge will be to ensure that projects implemented to achieve these goals are indeed sustainable and that the beneficiaries indeed will continue to rip the benefits even into the future.

In Africa, the world's second-driest continent, the availability and access to water is more crucial to existence than it is almost anywhere else on Earth. Poverty is widespread and although it is rapidly urbanizing, the majority of its population is still rural-based and dependent on agriculture" (UNEP, 2010). In sub-Saharan Africa, 40% of the population has no reliable access to safe water.

Kenya, a sub-Saharan African nation with statistics that mirror the UNEP baseline, is among the water-scarce countries in the world. Unsurprisingly, water heavily impacts major sectors of Kenya's economy (Worldbank, 2004). Lack of adequate quality water is therefore a significant obstacle to development" (World Resources Institute, 2007). Increased investment in rural water supply development in the last decade by both Government and development partners has not resulted in the desired levels of anticipated service. In spite of efforts to increase access, many rural water supplies completed have either stopped operating or are not operating optimally. Many of the dysfunctional water sources are operated and managed by community-based organizations such as Community Water and Sanitation (WASH) Committees, Water User Associations (WUA) or Women groups.

The role of the communities in the operation, maintenance and management of rural water supplies was first described in Sessional Paper No. 1 of 1999 on National Policy for Water Resources Management and Development (1999). The paper defines the involvement of communities in project development in all stages of a project life-cycle including planning, implementation and operation and maintenance in light of the changing economic conditions and increasing burden to government. The paper further recommends institutional steps to be taken to facilitate the role of the communities in the operation and maintenance of rural water supplies. Increasing the participation of the communities in project development and management was intended to create a sense of ownership of the projects by communities.

In line with the recommendations of the Sessional Paper No. 1 of 1999, operation, management and maintenance of rural water supplies has largely been transferred to beneficiary communities over the years. However, the sustainability of these community based and managed water supplies remains a challenge to progress in the Water Sector and has implications for the attainment of the Water Sector objectives, the Millennium Development Goals (MDG) and VISION 2030 among other policy instruments. This has further implications for the socio-economic development of the affected populations.

To underscore the importance of access to safe water, The Bill of Rights under article 43 of the Constitution of Kenya (COK) 2010 states that access to safe water and safe sanitation is a right. The draft NWP 2012 further aligns the sector with the new Constitution based on the guiding principles - right to water with pro-poor orientation, participatory approach to water development and management and good governance practices at all levels. The Policy Objectives of the draft further include "progressively achieving universal rights to water supply and sanitation for all by 2030 in the rural and urban areas" (NWP 2012). However, in

spite of the new policy, legislative frameworks and increased sector investments in rural water development, access to safe drinking water still remains low. This is partly attributed to the poor sustainability of existing community operated and managed rural water supplies rather than lack of development of new sources.

1.1 Maraigushu rural water project

In 1986, the Catholic Diocese of Nakuru, on realizing that there was shortage, malfunction and inadequate distribution of existing water supplies as one of the biggest problems confronting the people in the diocese, initiated a water program department whose activities included; Spring water protection, Gravity flow schemes and roof catchment storage tanks; In 1990 drilling programme was initiated charged with responsibility of providing water through sinking boreholes in selected parishes. Maraguishu was a beneficiary of this phase where by a bore hole was dug in Maraigushu center in 1996 under the leadership of St. Peters Catholic Church which after project implementation, the project was handed over to the rural community for management. The Water program also consisted of Nakuru defouridation Company-NDC (Water Quality) established in 1998 to research, develop and implement an appropriate technology that would remove fluoride from water while ensuring full water quality and environmental conservation. The objective was to improve the living conditions of the people in the rural and urban areas by providing them with safe and clean water for domestic and agricultural use.

1.2 Statement of the Problem

Projects are designed and implemented to meet specific goals and achieve desired change. (PMI, 2013) describes a project as a set of coordinated activities with a specific start and finish time, pursuing a specific goal with constraints on time, scope and resources. Some projects such as water projects, require that their services be sustained over time to ensure continued flow of outputs and hence achievement of the desired change which could be social, cultural or economic. Implementation of most projects may be successful but their sustainability may remain a challenge. Large number of projects implemented at huge costs often tend to experience difficulties with sustainability. Major donors, such as the World Bank and the bilateral aid agencies have been expressing concerns on this matter (WorldBank, 2003). According to several recently conducted studies, while the trend with implementation is showing significant improvement, the trend with post implementation sustainability is rather disappointing - increasingly, less projects are being sustained. This means that while huge expenditures are being incurred by these countries in implementing projects, poor sustainability is depriving them from the returns expected of these investments.

Sustainability of rural water supply (RWS) projects, and of the benefits they deliver, has been an overriding concern of the water sector. This concern is well founded. Every year, many millions of dollars are invested by national governments and international and local donor agencies alike in water project implementation. Despite ever increasing attempts to tackle the problem, many water projects fail to maintain the flow of expected benefits over their intended lifetimes. Although there are few, systematic studies of this problem, many practitioners estimate that at any given moment a significant proportion of rural water supply systems in developing countries may be inoperable or abandoned completely. (UN, 2010)

In recent years there has been an increasing focus on, and understanding of, the design and implementation phases of RWS projects as part of efforts to make projects more successful and work more efficiently. Research has been undertaken to try to understand the linkages between project implementation and sustainability (Sara and Katz, 1997). With the likelihood that Kenya will surpass its MDG goal by the end of this year, the challenge must shift to ensuring that the investment and benefits of safe access to drinking water are sustained for the life of these projects without compromising future generation's ability to sustain them.

The Government of Kenya (GOK) has been committed to fostering on-going water sector reforms, aimed at water projects achieving both technical and infrastructural viability. According to the National Water Services Strategy (NWSS) (2007 -2015) "Kenya faces enormous challenges in providing sustainable access to safe water which is estimated at around 60% in urban and 40% in rural settings. Missing baseline data and sustainable information systems hinder obtaining a clear nationwide picture and thus, coverage can only be estimated. Therefore, sustainable access to safe water and basic sanitation is still declining in terms of quality and quantity" Some of the reasons explained for lack of sustainability include: old infrastructure, inadequate management and maintenance of existing infrastructure, insufficient sustainability, investments options fast tracking access to the detriment of sustainable investment and informal service provision operating outside a framework of basic standards and regulation. (Ministry of Water and Irrigation, 2007)

Studies conducted by scholars and authors such as (Binder, 2008), (Narayan, 1995), (Yacoob & Walker, 1991)and (Dungumaro & Madulu, 2003)point out to common definitions, indicators and measures of sustainability that can guide service management of resources in a manner that ensures benefits for both current and future generations. They indicate the importance of community participation and proper project organization management skills for successful sustainable development projects. Further, they point out that community participation is low in developing countries. The biggest challenge however is that there is gap in terms of locally conducted studies to assess sustainability of community water projects in Kenya, (Ministry of Water and Irrigation, 2007) indicating a local knowledge gap on water projects' sustainability issues.

Studies conducted on water project sustainability such as (Ngetich, 2009) showed that most water projects did not function to the full capacity and recommended further studies to be done on the influence of project location on sustainability of water projects. Habtamu, (2012) established that most water project decline in performance shortly after external support is withdrawn and recommended that further studies be done on factors that influence sustainability of such projects in other rural parts of other countries in Africa in order to bring a generalization of the findings. This study therefore was designed to assess sustainability of Maraigushu water project as it relates to community participation, management and technical factors.

The water project is a case example of rural water projects that has been in existence under the Maraigushu rural community management for close to two decades and continues to provide services to the community. It was observed that the project have not optimally delivered as intended thereby exposing the community to waterborne related risks. Prior to this study, no study had been conducted including post project implementation evaluation to determine how sustainable the project is. This motivated the researcher to carry out an assessment of the sustainability of the project.

1.3 General Objective

The objective of the study is to assess sustainability of Maraigushu rural community water project.

1.3.1 Specific objective

The study will is guided by the following specific objectives,

i. To determine the extent to which community participation affects sustainability of the rural water project.
ii. To assess the extent to which community project management influences sustainability of the rural water projects.
iii. To assess the impact of the technical factors on sustainability of the water project.

1.3.2 Research Questions

1. To what extent does community participation affect sustainability of the rural water project?
2. To what extent does community management influence sustainability of rural water project?
3. How do the project technical factors impact sustainability of the rural water project?

1.4 Justification of the study

The Water Sector in its Annual Water Sector Conference 2011 adopted sustainability as one of its four thematic areas for achieving sector objectives. Improved understanding of what actors influence sustainability will assist the Water Sector to achieve sector goals in improving access to sustainable safe water for Kenyans living in the rural areas. The sector has grappled with challenges arising from poor sustainability of rural community managed water projects which have affected service delivery particularly in rural Kenya.

The study also contributes to the knowledge that assists the sector to develop strategies for enhancing already existing projects and lessons for upcoming projects. The findings also assist in the design and formulation of future sector projects and contribute into subsequent stages of the research process and inform the content of the field study in addition to serving as a tool, or reference source, for those working on the planning and design of RWS projects and contribute to sector knowledge more broadly.

1.5 Limitations of the Study

Best and Kahn (2000) observed that limitations are those conditions beyond the control of the researcher that may place restrictions on the conclusion of the study and their application to other institutions. Just as projects are said to be "unique" PMI, (2013) due to unique settings, cultural and environmental conditions which uniquely affect projects implementation differently. The context of each project must be considered. Therefore these study findings may not be generalizable to other areas, however, the underlying theoretical assumptions and methodology of this study should inform similar future studies.

2. LITERATURE REVIEW

2.1 Theoretical Review

This section presents two theoretical reviews that guide the understanding of community involvement in management of community rural projects leading to achievement of sustainable benefits. Two supporting theories; the Community Management Model and the Sustainability theory are discussed.

2.1.1 Community Management Model

The Community management (CM) of rural Water Supply projects (RWS) projects is now in its second decade as a leading paradigm for water supply development and management. (WHO, 2010). CM approaches did not appear spontaneously, nor do they exist in a vacuum. They emerged from a history of trial and error in the rural water supply sector and are linked to, and affected by, development in many other sectors particularly those related to more general rural development. The rural water supply and sanitation sector itself gradually emerged in the two decades prior to the 1980s International Drinking Water Supply and Sanitation Decade (IDWSSD). During the IDWSSD the concepts of community participation and the promotion of appropriate technologies became established as part of efforts to meet the optimistic targets of "water for all". Although the IDWSSD failed to meet these targets, the concept of community participation was extended to include operation and maintenance and, most importantly, cost-sharing of water supply systems. This idea marked an important step towards basing the provision of services on *demand*, rather than the conventional supply driven model, and complemented efforts to create ownership of services on the part of communities (Nicol, 2000).

During the 1980s and 1990s a variety of different actors, with very different agendas signed up to community management concepts: Although different organizations propose slightly varying definitions of community management, many share the same elements a number of common principles identified include; **Participation**: for effective CM to be in place, a cross-section of the community must participate in the development process; there must be broad community support for the implementation of CM models. Community participation must continue indefinitely; **Control**: the community must be in direct or indirect control over the operation and management of its own water supply system, where control is understood to mean the ability to make strategic decisions about the process, from the design phase to long-term operation and management O&M; **Ownership**: although formal legal ownership of physical infrastructure is highly desirable, it may not always be possible in existing legal frameworks. Of equal importance is the perception of ownership by the user community; **Cost sharing**: closely linked to the question of ownership, is the need for some element of contribution to the recurrent costs of running and maintaining the system depending on individual circumstances, contributions need not always be financial in nature.

Three broad objectives of the CM model include: Empowerment: for many organizations, one of the underlying aims of CM is broader community empowerment and self-improvement. Water supply projects are often seen as the entry point into building up capacity more community owned development.

Efficiency: CM also serves a utilitarian function and is viewed as a means of increasing the efficiency of service delivery. By leveraging the resources of literally millions of communities around the world, through the use of human capacity, volunteer time and material inputs.

Sustainability: lastly, and most importantly, the aim of CM is to guarantee the sustainability of RWS services. The principal argument in this case is that by being in control of the process of service delivery, communities will have a vested interest in seeing that the service, and its commensurate benefits, continues indefinitely.

2.1.2 Sustainability theory and concepts

The concept of sustainability gained wider use after the World Commission on Environment and Development published a report titled “Our common future” (Brundtland,1987) which defined sustainability as “development which meets the needs of current generations without compromising the ability of future generations to meet their own needs”. According to IFAD strategic framework 2007 -2010 (IFAD, 2007) sustainability amount to: Ensuring that the institutions supported through projects and the benefits realized are maintained and continue after the end of the project. This definition acknowledges that assessment of sustainability entails determining whether the results of the project will be sustained in the medium or even longer term after the project has been handed over to the beneficiaries.

The term sustainability integrates social, environmental and economic responsibilities.

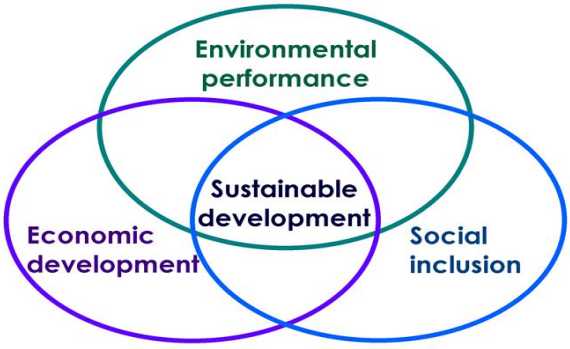

Figure 1 - The triple bottom line concept of sustainability (Adams, 2006)

The social dimensions of managing water projects may involve things like village-level coordination, compromise, financial management and decision-making. Increasingly, local people are being required to pay into a community fund for every liter of water they use. This roles into the economic development aspect where by a village committee is set up, a bank account opened, and a custodian appointed to collect fees. The committee is effectively charged with running water project to ensure sustainable supply to the people in the locality.

Sustainability dimensions

Several dimensions of project sustainability have been considered depending on the nature of the sector or project. Each of these dimensions has the capacity to influence project sustainability in one or way or another. The Sustainability Planning and Monitoring guide on Methodology for Participatory Assessment (MPA) for Community-Driven Development Programs (2000) described the following five dimensions applicable for assessment of water projects sustainability.

Technical sustainability. This refers to the reliable and correct functioning of the technology and, for water supplies, the delivery of enough water of an acceptable quality. Equity aspects relate to the technology meeting the demands of all user groups. Requirements for technical sustainability include: a technically good design, which is adhered to in construction and operation, and first-rate workmanship and materials.

Financial sustainability. Systems can only function if financial resources meet at least the costs of operation, maintenance, and common repairs. Equity elements relate to who pays for all this and how fairly payments are shared between and within households.

Institutional sustainability. To keep systems operational, accessible and widely used, communities need institutions. Institutions have cultural characteristics, agreed and valued procedures and rules for operation, and varying capacities for management and accountability. Equity considerations require looking at the extent of voice of all the user groups, especially the poor and the women, in organizations.

Social sustainability. Users will only sustain services that satisfy their expectations. This means services which they can easily access, that are in accordance with their socio-cultural preferences and practices, and services that they consider worth the cost they incur to obtain them. It also include looking at how fairly the burdens and benefits from the services are shared across different socio-economic, gender, and ethnic groups that manage and control the services.

Environmental sustainability. Water resources face multiple threats. Over-extraction and contamination of water sources industrialization and waste disposal threaten reliable and safe drinking water supplies. Water supplies and sanitation facilities themselves threaten the environment through the unsafe disposal of wastewater and human and solid waste. In dry areas, lack of drainage of wastewater has created new risks of insect breeding that have brought outbreaks of diseases such as malaria, dengue, and filariasis. It also incorporates fair sharing of responsibility among users for the protection of their environment and water resources.

2.1.3 Significance of theoretical framework

The theory of sustainability brings out three aspects as common elements in its definition namely: the limits of available resources; the interdependence of human activities both in the present and future generations; and, issues of equity in distribution of a benefit (goods or services). The concept has also been extended to incorporate institutional or management sustainability which brings in the theory of community management model. This model is the most widespread institutional model used to manage rural development project including water supplies in Africa. The assumption is that community participation leads to ownership and control over management and operation of their development projects leading to sustained community water service going at a level satisfactory to most users and environmentally sound without explicit exclusion of particular user groups.

2.2 Empirical Review

2.2.1 Sustainability in Rural Water Supply Projects

There is a broad range of definitions of sustainability in RWS projects used in reports, field surveys and books on the topic. The literature is full with definitions and with most of them being similar and often times referring to common sources as their starting point. However some differences exist with some being quite significant in emphasis. How we define sustainability is of course important in setting the parameters, which are then used for measuring it and in understanding the determinant factors which may contribute to, or work against, the likelihood of sustainability.

As Hodgkin (1994) noted "One of the problems for objective quantification of sustainability is the fact that the adjective "sustainable" has strong normative connotations". That is to say, that different people, or different groups of people (users of water, donors, national governments, local private sector companies, research institutions etc.) will have different perceptions of sustainability based on the relative value of achieving the various goals" (Hodgkin, 1994,). Therefore, each organization may choose to look at sustainability from a different perspective and attach significance to different aspects; these can include a focus on technical performance, Management, empowerment, social equity or the environment to name just a few.

When sustainability first entered the vocabulary of the water supply and sanitation sector, it was primarily associated with financial aspects of service delivery and the need to make projects self-sufficient, even in low-income communities, by highlighting the need for users to contribute to cost-sharing (Black, 1998). This definitional problem can be clearly illustrated by considering the ultimate goal of providing RWS services. For many, although not all, donor agencies the perceived benefit of projects will be a subsequent positive impact on the broader welfare of beneficiary community. Therefore, the logical definition of sustainability from the perspective of these institutions may be one that includes sustained health impacts. However, for many rural households, the perceived benefit of a project may simply be the continued convenience of having (running) water nearby, or within, the household. Hence, their definition may be closer to one that simply describes sustainability as: "whether or not something continues to work over time" (Abrams, 1998); meaning in this case, whether or not water continues to flow over time.

Of course, Abrams's definition of sustainability is a one-dimensional, and does not tell us about the quality or quantity of the benefit, nor does it tell us about how the benefit is used and distributed. As stated above, numerous examples of the definition of sustainability exist in the literature and many authors start out by citing the various definitions of sustainability as developed by Bamberger and others over a number of years. These have at their core, the concept of the capacity of a RWS project to continue delivering a flow of benefits for a long period of time after project inputs have ceased (Hodgkin, 1994). This definition resonates with another, frequently cited version based on the work of the Organization for Economic Cooperation and Development,(OECD) which describes a development project as being sustainable, "when it is capable of supplying an appropriate level of benefits during an extensive time period after the withdrawal of all forms of support from the external agency" (OECD/DAC ,1998)

Many authors go on to build from this basic definition, noting that the concern in terms of sustainability is not so much to do with the "project" per se, but rather the water supply system itself and the service it provides (Sara and Katz, 1997; Carter et al 1999). One significant exception to this is a recent Water, Engineering and Development Center (WEDC) study of sustainable hand pump projects in Africa, specifically designed to focus on the level of the project and includes aspects such as effectiveness, efficiency and replicability as part of defining a project's sustainability (Harvey et al, 2002).

With the growing importance of the community management model for RWS, sustainability has also been defined in terms of the capacity of the community itself to maintain the service (WSP, 2000; IRC, 2001).

Community participation and sustainability of rural water projects

Participation plays a great role as a foundation of community development projects including water services in developing world. According to (Awortwi & (Netherlands), 1999), participation is aimed at inculcating a sense of self-reliance and ownership to create equity in resource distribution. This argument is also in tandem with (Berner & Phillips, 2005) s preposition that; 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 (Saith, 1992), "Participation" encompasses purposeful interaction among different stakeholders including international actors, national politicians and local government leaders who make decisions together with private sector contractors and the targeted beneficiaries who form part of this relationship. In his view, conflict is expected since each group has different interest, requiring some conflict resolution skills to manage them (ibid.).

The central role that women play in the collection, management and use of water, as well as with the general sanitation of the household is well documented. Furthermore, there is ample evidence to indicate that a more active involvement of women can optimize the results and impacts of RWSS projects (Mukherjee & van Wijk, 2003). Therefore, it is not surprising that the continued involvement of women, after project implementation, is identified as one important determinant of sustainability. However, the extent to which women continue to be meaningfully involved in management of RWS project benefits in the long-term, can also be influenced by external factors. It is often the case, especially in cultures where the role of women is strictly limited, that once the interventions of project staff comes to an end (usually shortly following the construction of facilities), any gains in women's involvement falls back, or is given only token recognition.

Several researchers point to motivation as one of the keys to sustained project benefits. (IFAD, 2009). It is only common sense that motivation or willingness to contribute to the maintenance of a system is based on a perceived benefit. In the case of a communal water supply system, motivation and willingness must be generated on both an individual and collective basis, amongst both individual household users who pay a tariff and community members who volunteer time and are involved in system management. Taking a broader perspective, external actors may also be motivated to contribute towards supporting community-managed RWSS; local governments may perceive a political benefit, the private sector a profit motive and central government may see sustainable service provision as part of their broader development agenda. For whatever reason, and from whichever perspective, motivation is clearly a critical factor in post-project sustainability.

Similarly, an adequate degree of social cohesion within a community is now considered by many to be a fundamental factor in sustainability. The collective willingness to maintain a water supply system, is a reflection of social cohesion, and is dependent on the concept of community identity. Ironically, as some researchers suggest, this very community "spirit" may be directly threatened by the development process itself, including the provision of improved services such as RWSS, which breaks apart community loyalties and traditional obligatory relationships (Carter, Tyrell, & Howsam, 1999).

The community participation to rural water management approach has faced various criticisms from various scholars like (Bastian and Bastian 1996; Cleaver 1999; Mosse 1994). While some focused on the technical limitations of the methodological applications such as Participatory Rural Appraisal (PRA), others are troubled with theoretical, conceptual and the political economy weaknesses of CPM (Cooke and Kothari 2001). They add that, most decisions of development projects in several third world countries are taken with minimal consultation of the local people in that, even efforts to engage them in participatory planning do not reflect their choices (ibid.).

On the other hand, 'critical modernist' scholars such as Hickey and Mohan maintain that, the success of participatory approaches may be possible where they are undertaken as part of a wider radical political project (Hickey and Mohan 2005, p. 237) and how power operates and translate itself (Cooke & Kothari, 2001; Mosse, 1994)

While participatory approaches are limited in many respects, nevertheless their perception of the role of structure and agency in the dynamics of participatory development and the radical social change is worth mentioning (Cleaver 1999). Hence in view of the above critical perspectives, some scholars are in support of encouraging private sector participation as an option to achieve efficiency and effectiveness in service delivery. This for example is revealed by studies on water service delivery experience and revenue generation in Dhaka in Indonesia (Haq 2006).

2.2.2 Community Management and Sustainability of water project

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) It aims at defining more citizen control and ownership in order to create a more accountable and transparent and sustainable management mechanism. The rationale for effective community empowerment is building capacity of community members in making choices that they can be in position to negotiate with other actors (Awortwi, 1999) an effective community management mechanism is one that enhances community empowerment through active community leadership taking a center stage in order to promote rural water supply sustainability. The emphasis here is community empowerment as Narayan puts it, "empowerment is 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).

Community Organization constitutes a platform within which community actors/organizers operate as an intersection for coordinating local efforts in development interventions. This emanates from the belief that in many communities, the poor are disempowered and they require to be organized in their own right to participate in development interventions (Constantino-David 1995). It is inadequate to assume that, the poor people in the community have enough time that can be utilized in development programs. However, it is generally agreeable that, community members have the muscle to undertake collective action when faced with difficulties rather than without problems due to resource constraint and incapacity (Awortwi 1999; Berner and Phillips).

Effectiveness of organization requires some basic competencies in the area of knowledge, attitudes and skills. In most cases, these competencies are lacking in community organizations as highlighted by (Korten 1989, in Munguti 2008). This is also confirmed by Constantino-David (1995). One such essential competence is the financial management of the post project implementation phase, as cited in Binder (2008). Budgeting, accounting and proper financial records and transparency for community water supply systems is important for ensuring sustainability and proper maintenance. Financial feasibility during project planning is critical to ensuring project sustenance without continued external support. Projects should therefore include long term benefits during planning.

Similarly, the leadership of community based organizations in many sub Saharan African countries in particular tend to divert resources meant for the poor for their selfish interests such as elected politicians who develop strong patronage linkages to maintain their power positions (De Wit and Berner 2009). This raises a danger to service provision since the official administrative structures may be paralyzed, especially where the local elites get closely linked to elected leaders like members of parliament, leaving out the powerless categories exploited (Lavalle et al. 2005; De Wit 1996 as in De Wit and Berner 2009).

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 (WorldBank, 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. Other issues of conflict relate to:- water conflict between the rich and the poor in the community, the need to involve all groups in conflict management, the need for clear and transparent roles and regulations, the rules of outside agencies such as donors and the government, and the need to monitor system (Bretty, 2003).

The ministry of water and irrigation n 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.

2.2.3 Technical factors

Simply, in terms of keeping the physical infrastructure working, adequate availability and supply of spare parts and maintenance skills and tools is obviously of primary importance to long-term sustainability. Supply chains are now recognized as one of the "key determinants of sustainability" (Davis and Iyer 2002), especially where the technology used in the construction of water infrastructure is imported, which is often the case with water projects in Africa. Technical skills for repairs and maintenance and upgrading need to be transferred to the community long before the project handover in order to ensure sustainability.

Another important factor concerns the provision of follow-up support to rural communities in the long-term. This is increasingly recognized as a critical factor in sustainability (Lockwood, 2002) and the IRC (Schouten and Moriarty, 2003). In order to guarantee the sustainability of RWSS projects and the associated benefits, it is necessary to provide support and guidance which addresses a range of issues.

The final, factor considered for post-project sustainability is a rather obvious, but one that nonetheless tends to get overlooked: the sustainability of the water source itself. Obviously, deterioration of source water quantity will be of major concern in areas of low rainfall, or poor groundwater re-charge, where there is greater sensitivity to over-extraction. But even in relatively water-abundant regions of the world, the source can fail to satisfy demand, either due to population expansion or abuse of the supply for non-domestic purposes. Water quality may also suffer from contamination from agricultural by-products or chemicals. In either case, care must be taken in the design of projects to determine the likely sustainability of the source over a long period of time. For example, water saving designs and the construction of recharge mechanisms, such as check dams and infiltration structures, in the watershed area of the projects which are to be maintained for up to five years following project completion (India, PAD 2003).

2.4 Conceptual Framework

Independent Variable **Dependent Variable**

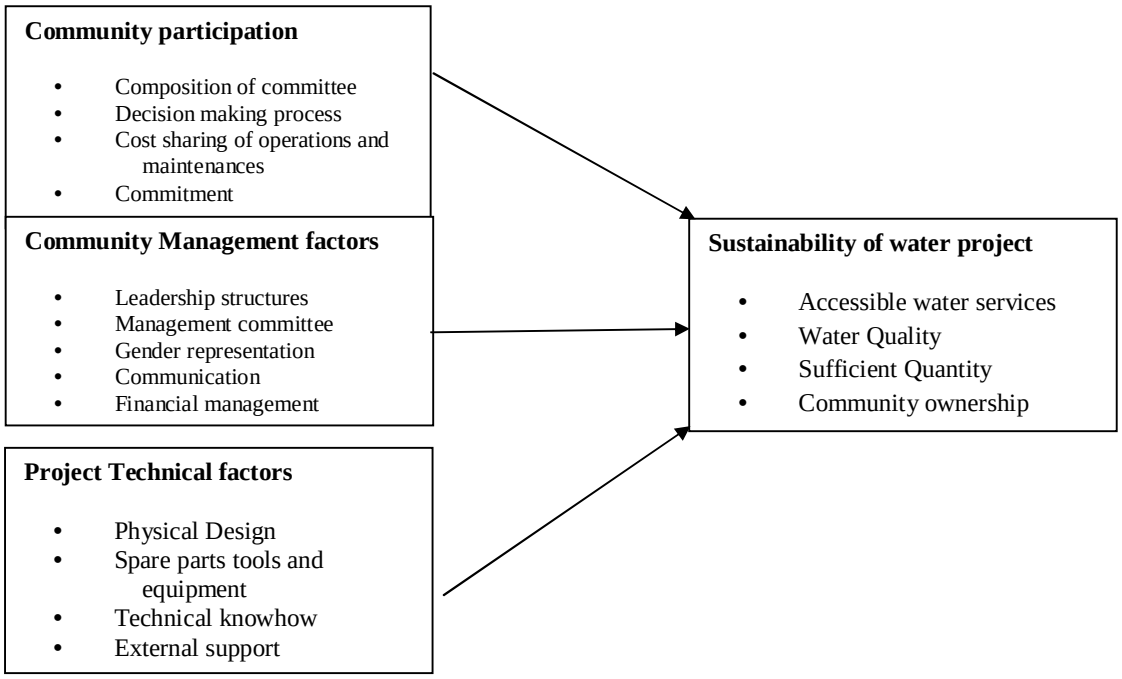

Figure 2 – Conceptual framework

2.5 Summary

From the literature reviewed, a number of frequently cited factors emerged which literature show that they have an impact on sustainability of rural water supply projects. These factors were grouped and discussed as three main independent variables that can be used to assess sustainability in relation to RWS projects and depicted in the conceptual framework in Figure 2 (conceptual framework) above.

2.6 Research Gaps

This chapter has given literature reviewed from existing secondary sources according to the variables of the research, theoretical reviews and the conceptual framework which formed a basis of the study. In the literature reviewed many researchers have highlighted on the influence of community participation, and community project management practices. Project management strategies identified are financial management, community organization and planning and leadership, willingness of community members to sustain their projects through contributions towards operations and maintenances, technical skilled water operators and leadership. It has been indicated that where strategies were not applied, contribute greatly to lack of sustainable projects.

Community participation involves capabilities and willingness of communities to take charge, influence and determine the nature of project during its life cycle to ensure long lasting impacts. The identified indicators in the literature review of community participation are community participation in decision making, community contribution, representation, responsibility, social factors and informed choice. It has also shown that the level of involvement of communities in water projects activities is still low in most developing countries especially in rural areas.

Technical capacity development is important through specialized training and education of project managers, community members and the entire project team. The review has also indicated some of the methodologies that have been used to carry out assessment of sustainability studies, and their pros and cons. The literature reviewed also shows that there is knowledge gap of studies done locally to investigate the post project implementation assessment sustainability of community managed indicating that there is a local

knowledge gap on water projects' sustainability issues in Kenya. Maraigushu water project that have is one such project that has not had a post implementation assessment of its sustainability carried out prompting the researcher to carry out this needed assessment in Naivasha East Constituency.

3. METHODOLOGY

3.1 Introduction

This chapter describes research methodology that was adopted by the researcher. It precisely focuses on method used in gathering information, presentation of data collected and discusses reliability and validity of tools used.

3.2 Research Design

The study employed a mixed method comprising of a household survey interview document review and physical site assessment. Structured survey questionnaire was administrated to the community beneficiaries of the water project. Interviews and discussions with water committee members, personal observation and assessment of the physical water project and review of documents was conducted.

3.3 Target Population

As defined by Grinnell and Williams (1990), population is the totality of persons or objects with which a study is concerned. Maraigushu community water project beneficiaries were the primary data source in the study.

3.4 Sample size and sampling technique

A sample size of 351 samples was selected from a population estimated at 4,964 from the 2009 National census. The formula for determining sample size provided by Krejcie and Morgan (1970) was used in sample size calculation: According to the same report, the average household size is 4.27. This was divided by the sample giving a minimum of 82.2 (~**83 households to be interviewed)**

$$S = \frac{X^2 NP(1-P)}{d^2(N-1) + X^2 P(1-P)}$$

Where

S = required sample size.
X^2= the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841) for 0.95 confidence level
N = the population size.
P = the population proportion (assumed to be .50 since this would provide the maximum sample size).
d = the degree of accuracy as reflected by the amount of error that can be tolerated in the fluctuation of a sample proportion p about the population proportion P- the value of d being .05 in the calculations for entries in the table, (Appendix iii) Respondents were selected using purposive sampling. Respondents in this non-probability sampling were selected on the basis of their accessibility or by the purposive personal judgment of the researcher.

3.5 Sampling Procedures

This study used purposive sampling. Purposive Sampling is a non-probability sampling technique whereby the researcher selects participants on the strength of their experience of the phenomenon under study (Fenny *et al.*, 2001). It is also called judgmental or deliberate sampling. The choice of the sample elements depends exclusively on the discretion of the researcher/investigator (Milanzi, 2009). Purposive sampling was used to choose from community/beneficiaries, and local leaders as it was believed that they possessed relevant information for this study. Purposive sampling was also preferred because it would suit for both quantitative and qualitative methodology (Kombo & Tromp, 2006).

3.6 Data Collection Tools / Techniques

The most commonly used data collection tools in researches consist of self-administered surveys or questionnaires, personal interviews and/or focus groups. This study employed questionnaires and interviews as primary data collection methods documentary review was also used to collect secondary data. The questionnaires were pilot tested to determine their suitability to both the committee members and households. Two types of questionnaires– one set for the management committee, local leaders and Donor representative and another set for households.

3.6.1 Questionnaires

Saunders *et al.* (1996,) defined questionnaire as a method of collecting data where respondents are asked to respond to the same set of questions in a predetermined order. The general advantage of the Questionnaire method is that it allowed collection of a large amount of data from sizeable population in a highly economical way, (Kothari, 1990) Questionnaire method has the following advantages: time and money saving, if the research covers large area. According to Cockburn and Mackenzie (2000), "The main attraction of questionnaires is the relative ease of gathering a large set of responses. The questionnaire consisted of a section on demographic information on age and gender and education level.

The environmental assessment section of the questionnaire was a modified adoption of a Monitoring checklist for water points by The Global Water Initiative (Sahel Consulting, 2012)

3.6.2 Interviews

An interview is a purposeful discussion between two or more people, Saunders *et al*. (1996). This was used by the researcher to obtain data directly from the respondents. The researcher administered some structured, semi-structured and unstructured questions to interrogate committee management team and selected local leaders. This approach aimed to capture the project management aspects of the independent variable and provide participants with an opportunity to give more spontaneous, in-depth accounts of their information.

3.6.3 Document Reviews

In order to obtain more information on the technical and management factors, document review was conducted mainly focusing on historical information on the project at project office and to review the financial records management aspects. This helped the researcher in cross- checking the consistence of information obtained through the questionnaires.

3.7 Data Reliability and Validity

3.7.1 Reliability

Reliability is the extent to which results of a study are consistent over time and there is an accurate representation of the total population under study (Golafshani, 2003). Reliability analysis aims at finding out the extent to which a measurement procedure produces the same result when the process is repeated over and over again under the same conditions (Toke et al., 2012). Reliability was assessed using the split half technique and questionnaires administered to a small group of respondents. The questionnaire items were assigned arbitrary scores and data entered into computer software for Statistical Package for Social Sciences. Data was analyzed using Spearman Brown prophecy formula and a correlation coefficient of 0.87 was obtained indicating that the instruments had internal consistency.

3.7.2 Validity

Validity determines whether the research items truly measured what they were intended to measure or how factual the research results are (Golafshani, 2003). To test the extent to which the sample was representative of the population, research supervisor opinion was sought.

3.8 Data Analysis and Presentation

A qualitative and quantitative data analysis is used to analyze the research data. This followed a systematic process starting with editing of all the data obtained from the field. Every questionnaire was checked to ensure it was complete and correctly filled. This was followed by coding of all data to allow for analysis using STATA 10.

Descriptive information is used to portray the sets of categories formed from the data and are described in frequency distribution and percentages and graphically presented. To examine and measure the relationship between the dependent variable and independent variables, an ordered logistic regression model is used. The choice was motivated by the nature of the dependent variables considered which have more than two categories and the values of each category indeed has a meaningful sequential order. In the following lines, the model is briefly described.

Suppose the response variable Y has K categories, say $\kappa = 0,1,2,\ldots,K-1$, then there are K-1 ways to dichotomize the outcome, precisely $Y \geq 1 \; vsY < 1; Y \geq 2 \; vsY < 2; \cdots; Y \geq K-1 \; vsY < K-1.$ Having categorized the response variable Y, it then follows that the odds that $Y \geq \kappa$ is equal to the probability of $Y \geq \kappa$ divided by the probability of $Y < \kappa$, where $\kappa = 0,1,2,\ldots,K-1$

This can formally be written as $odds(k) = \dfrac{P(Y \geq k)}{P(Y < k)}$, where the *odds($k_1$)* and *odds($k_2$)* have, by assumption, the same ratio for all independent variables combinations. In relation with the independent variable vector, X, the probability of a given observation for ordered logit is given by $P(Y \geq \kappa \mid X) = \dfrac{1}{1+\exp[-\alpha_\kappa + X\beta]}$, where $\kappa = 0,1,2,\ldots,K-1$. Note that in this model, an underlying score is estimated as a linear function of the independent variables and a set of cutpoints. In this respect, the probability of observing the outcome, Yi corresponds to the probability that the estimated linear function, plus a random error, is within the range of the cutpoints estimated for the outcome, i.e. $P(Y_j = i) = \Pr(\kappa_{i-1} < \beta_1 x_{1j} + \beta_2 x_{2,} + \ldots + \beta_k x_{kj} + u_j \leq \kappa_i)$ where u_j is assumed to be logistically distributed on ordered logit. In either case, the coefficients $\beta_1, \beta_2, \ldots, \beta_k$ alongside the cutpoints $\kappa_1, \kappa_2, \ldots, \kappa_{k-1}$ are estimated, where k is the number of possible outcomes. Since the interpretation of the ordered logit estimates does not depend on the ancillary parameters that are used to differentiate the adjacent levels, for simplicity and clarity in discussions of the results, interpretation of the probabilities derived from the latter were not considered in this work, the interpretation of the outcomes of the model used solely focused on the estimates of the parameters, $\beta_1, \beta_2, \ldots, \beta_k$ in the model. To test for their simultaneous statistical significance, the Wald test is performed and this is confirmed if Prob > chi^2 < 0.05 for a 5% level of significance, where chi^2 stands for Chi square test.

Table 1 displays an operationalization of the variables, selection and identification and how they were matched with questions in the questionnaire to allow for analysis.

Table 1 Operationalization of the variables

VARIABLE	ASPECTS OF MEASUREMENT	Associated Survey Question
$D = \{y_1, y_2, y_3, y_4\}$ **Sustainability**	y_1 = Accessible Water	Is Sustainable, ExtnSustainability
	y_2 = Quality of water	Water quality
	y_3 = Quantity of Water	Sufficient Quantitiy
	y_4 = Community Ownership	Membership
$I_1 = \{X_{11}, X_{12}, X_{13}, X_{14}\}$ **Community Participation**	X_{11} = Composition of Committee	membership
	X_{12} = Decision making	Involved in planning
	X_{13} = Cost sharing of maintenance	Income, sanction repair charges
	X_{14} = Commitment	PartProject, Contrimportant, Commitment, PartEnhanced Sus
$I_2 = \{X_{21}, X_{22}, X_{23}, X_{24}, X_{25}\}$ **Management factor**	X_{21} =Leadership structure	ParticipatorRules, Rateleasdership
	X_{22} Management committee	CommitteePre, ConveneMeeting, Rate Mngt
	X_{23} Gender representation	Gen
	X_{24} = Communication	MtdofCommunication
	X_{25} = financial management	IncomeManagWell
$I_3 = \{X_{31}, X_{32}, X_{33}\}$ **Technical factor**	X_{31} Physical design	Failure, AccessRules, Functionality"
	X_{32} Technical know-how	Skills, RepairPrs
	X_{33} External support	RespforUpKeep, InchargeMainten

Table 1 depicts how the variables were matched to the survey questions.

3.9 Ethical consideration

Prior to using the research instruments, the researcher obtained approval from the supervisor at Jomo Kenyatta University of Agriculture and Technology. The researcher then visited the study area and met with the area authorities to explain the intended study and to seek for permission. An official permit from the local was ill also be sought permitting the study to be carried out. The permit letter was read to the community members specifically the beneficiaries of the water project under study. All participants were assured of the confidentially of information they provided and an informed consent was verbally sought from all respondents. No personal Identifying Information (PII) was collected.

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4. RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

The main objective of the study is to assess sustainability of rural water project in Maraigushu ward of Naivasha East constituency of Nakuru County. This chapter starts by presenting descriptive analysis of the data which includes the respondent's demographics characteristics and response rate followed by a selected graphical presentation of the proportion of respondent. The observed project environment assessment by the researcher is also presented. This is followed by in-depth statistical analysis and discussion of the results where the relationship between the dependent and independent variables according to each study question is highlighted.

4.2 Descriptive findings

4.2.1 Questionnaire Return Rate

As depicted in table 2 below, the survey targeted 83 households' respondents. The response rate was over 77%. A total of 64 participants responded to the questionnaires. Data from the respondents in this study are presented in descriptive and inferential statistics.

4.2.2 General Respondents

Table 2 Questionnaire Return Rate

Respondents	**Target**	**Returned**	**Percentage**
	83	64	77%

4.2.3 Demographic and Gender Distribution

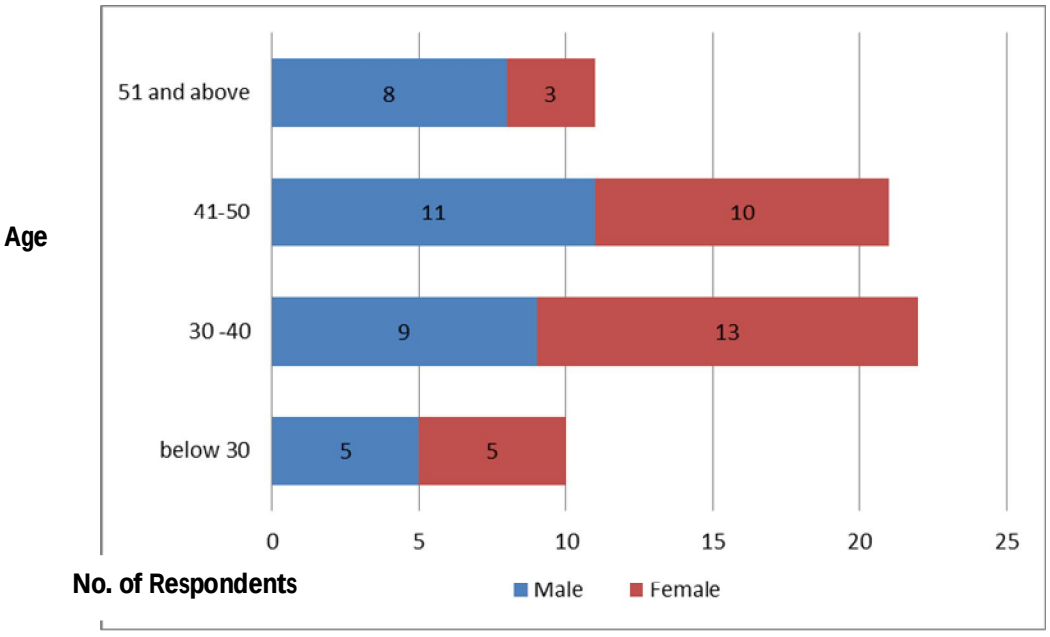

Figure 3 Respondents age and gender distribution

The survey data represented 52% female respondents and 48% male respondents with majority of the women being within the age bracket of 30 -40. The respondent gender distribution was important since according to research, the benefit of women's participation in projects implementation of rural water supplies have long been argued, with the main aspect in relation to sustainability being that women are often concerned about the operation of their water supply and are motivated to do something about it because it directly affects them (Harvey & Reed, 2004).

4.2.4 Project environment

To assess the physical and environmental sustainability of the project, the researcher visited the project site in order to have first-hand information on the general technical assessment of the physical conditions of the water project. Technical issues relating to the design and construction of a rural water project are most obvious indications of the water project infrastructure sustainability. The factors presented in table 3 below were identified through examinations of the project and interviews with the committee members.

Although the project environment fared well on the assessed questions, there are elements that require addressing. For instance, the borehole is located less than two meters from a public road which in the long time can lead to degradation of the infrastructure. Physical assessment measures overall functionality of the water project and the construction quality, a good score shows that the water is free from contamination, from latrines, manure pits and flooding. Although overall construction quality was not evaluated by a technical person, the researcher observed that the borehole had no indications of leakages but that the area can be prone to overflowing of flooding water from the roadside during heavy rain seasons.

Table 3 – Project Environment assessment

		Yes	No
1.	Is there a latrine within 30 m of the borehole?		√
2.	Is there a manure pit or a rubbish dump within 30m of the borehole?		√
3.	Is there an ani al enclosure within 30 m of he borehole?	√	
4.	Are there any chemicals (petrol, waste oil, solvent) on or around the water point (within 50m)?	√	
5.	Is the borehole in an area liable to flooding?		√
6.	Is there a guard for the generator?		√
7.	Is there a person in charg of daily cleaning/inspecting?	√	
8.	Is there a person in charge of monitoring the state of the water network (water tank, valves, taps, pipes, etc.)?	√	
9.	Is the water point in a poor condition (pump in a bad condi ion, cracks on the concrete loor, etc.)?		√

4.3 Part I, measuring the effect of technical factor on Sustainability variables

In order to establish the extent of the relationship between the dependent and independent variables as operationalized in Table 1 Operationalization of the variables, the researcher conducted ordered logistic regression analysis using STATA 10. Each of the indicators of sustainability, i.e., "accessible water, quality and quantity of water services and the project ownership" were run in the model against elements of the independent variables. Table 4 below refers to the analysis outcome observed for the measures that were found to be statistically significant.

As depicted below, the probability of chi square was found to be Prob > chi^2 = 0.0002 < 0.05, for Access to water services, revealing that there is indeed exists a relationship. The explanatory variable "InchargeMaintenance" was found to be statistically significance, with P>|z|=0.000 < 0.05.

Table 4 Regression coefficients for technical factors against measures of dependent variable under sustainability

		Income	Functionality/Access	Technical knowhow	Incharge Maintenance
Access	Coef	0.462	-0.465	1.050	-2.416
Prob > chi^2 =0.0002<0.05	P>z	0.938	0.279	0.086	0.000
Quality	Coef	2.236	0.295	-0.884	0.412
Prob > chi^2 =0.0001<0.05	P>z	0.000	0.460	0.048	0.437
Quantity	Coef	1.436	1.170	-0.242	0.496
Prob> chi^2=0.0001<0.05	P>z	0.002	0.004	0.569	0.366
Ownership	Coef	-	-0.746	0.446	-0.790
Prob>chi^2=0.0319<0.05	P>z	-	0.090	0.326	0.110

The results indicate that having a person who is charged with ensuring that the infrastructure is maintained play a key role in sustainability of the water project. For any breakdown of equipment's, which would compromise sustainability of the project, the person in charge ascertains that repair is done in time and adequately. The ordered logit regression equation is given by $S = \beta X = 0.0462465 - 0.46495007X_{32} + 1.050381X_{33} - 2.415551X_{34}$. Focusing on the variable found to be statistically significant, it is clear that an increase by a unit in "InchargeMain" affects an increase in the expected log odds of being in a higher **Technical factors** category in terms of "Sustainability", by 2.41 units while keeping all other variables constant. When the Wald test is carried out, it reveals that all the explanatory variables conjointly are indeed statistically significant, having Prob > chi^2 = 0.0014.

Similarly running the ordered logit regression model on the other components of the response variable $y_2 \in D$ which denotes the **Quality of water** and the set of explanatory variables, $\{ X_{31}, X_{32}, X_{33} \} \subseteq I$ The Prob > chi^2 = **0.0001.** The resulting ordered logit regression equation is given by $S = \beta X = 2.236224X_{31} + 0.2945963X_{32} - 0.8843506X_{33} + 0.4124045X_{34}$. In this case, the variables "Income" and "RepairPrsn" are found to be statistically significant.

Examining the extent of the relationship between the response variable $y_3 \in D$ which denotes the **Quantity of water**, the Prob > chi^2 = 0.0001, which leads to rejection of the null hypothesis, at 0.01 level of significance indicating that not all the coefficients in the ordered logit regression equation, that is $S = \beta X = 1.435988X_{31} + 1.169679X_{32} - 0.2421423X_{33} + 0.495584X_{34}$ are all zeros. An increase in "Income" and in "Functionality" variables of a unit respectively affect an increase in the expected log odds of being in a higher **Technical factors** category in terms of "Quantity", by 1.435988 and 1.169679 units respectively while keeping all other variables constant.

The regression coefficients when "Membership" is the dependent variable under sustainability reveals the Prob>chi^2=0.0319<0.05, the relationship between Sustainability and Technical factors is real and measured by the size of the ordered log-odds (logit) regression coefficients in the last row of Table 4 The variables "AccessRules" and "RespforUpKeep" are found to be statistically significant, at 10% level of significance. Conjointly, all the explanatory variables, "X31=AccessRules", "X32=RepairPrsn" and "X33=RespforUpkeep", are simultaneously significant at slightly below 10%. This is confirmed by the Wald test score where p-value is Prob > chi^2 = 0.0688. Thus the model is adequate at 10% level of significance.

What the above results reveal is that technical issues relating to the design and construction of a rural water project are apparent determinants of water project sustainability. Poor construction, quality may lead to failure of the system before its project end of life. Basing the technical factor aspects with the Sara and Karts (2008) indicators for a sustainable project, no design flaws were observed, and the survey respondents indicated confidence that a skilled repair person and in charge of maintenance ensure that the community does not go without the commodity. Considering that this project has been in-existence for a long time, the technical aspects of its sustainability can therefore be said to be indeed sustainable.

4.4 Part II, measuring the extent to which Community participation affects sustainability

Respondents were asked to indicate who had participated in the planning and implementation of the water projects. All the respondents confirmed that the community had participated. The highest percentage of respondents (77%) confirmed that the project had been implemented by the donors confirming that indeed the project was spearheaded by the Catholic Diocese of Nakuru.

Table 5- Community Participation – Responsible for who were involved in the water project planning

	Freq.	Percent	Cum.
Administrative offices	4	6.25	6.25
Donors	45	70.31	76.56
The community	15	23.44	100.00
Total	**64**	**100.00**	

Responding to the question whether community participation was important for sustainability of their water projects, majority of the respondents at 82% responded affirmatively and only 7% were of the opinion that participation had low impact on sustainability. The researcher established that the water management was composed of both men and women with a woman taking the traditional treasurer position. Although the proportion of women to men was found to be 2:7, this is a good indicator of gender involvement which is related to sustainability. One thing that was noted however that is the committee is set up on voluntary basis and as such there are no real incentives to motivate the committee members beyond their commitment to their community.

Respondents indicated that the water charges were fair at 100% and that the quantities supplied were sufficient which from the conceptual framework was used as a measure for willingness to cost share in the upkeep of the project.

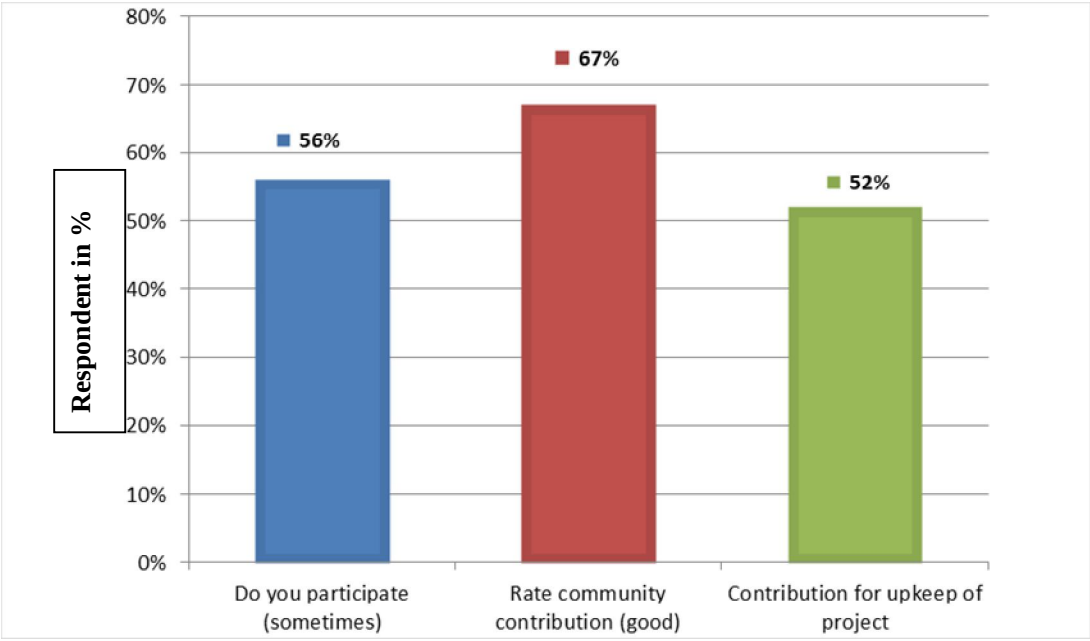

Figure 4 - Respondents indicators of community project ownership

A community's perception of who owns the water project is essential to ensuring that the community will maintain the water system according to Sara & Katz, (2007). However it is crucial to note that it is not possible to quantify communal ownership. The findings from this study reveal an indication of a positive ownership which stems from the community's perception of benefits obtained. The figure above shows that the perception of ownership is rated above average in using the three questions/responses depicted above.

The ordered logistic regression analysis results presented in Table 6 below revealed that all the indicators of water services sustainability, that is accessibility aliased "Issustainable", "Quality", "Quantity" and "Ownership" indeed have a relationship, with Prob>chi^2 = >0.050 which are Prob > chi2 = 0.0002, Prob > chi2= 0.0048, Prob > chi2 = 0.0014 and Prob > chi2 = 0.0000 respectfully. These results alone shows that there is, indeed, a real relationship between the Sustainability and community participation. The wald test is used to investigate whether simultaneously all coefficients are zeros which reveals that the model used is statistically significant, since Prob > chi^2 = 0.0014 < 0.05, the null hypothesis is rejected at 0.05 level of significance.

Table 6 extent of Community participation variables on Sustainability

		Membership	Involvedpl~g	PartiProject	Income	PartEnhance
Is Sustainable	Coef	1.8322	0.527	-1.195	-0.258	0.678
Prob > chi2 = 0.0002	P>z	0.044	0.237	0.000	0.642	0.144
Quality	Coef	-2.874	1.421	0.412	1.668	-
						-
Prob > chi2= 0.0048	P>z	0.005	0.036	0.274	0.025	
Quantity	Coef	-0.203	0.615	0.167	1.232	1.343
Prob > chi2 = 0.0014	P>z	0.851	0.184	0.564	0.016	0.003
Ownership	Coef	1.796	2.805	-	0.679	-2.267
Prob > chi2 = 0.0000	P>z	0.033	0.002	-	0.420	0.000

Referring to the dependent variable Quality with Prob > chi^2 = 0.0048, there is sufficient evidence, at 0.05 level of confidence, to reject the null hypothesis in favor of the alternative. Not all β are zeros. The corresponding logit regression equation is given by

$S = \beta X = -2.873929X_{11} + 1.420557X_{12} + 0.4119185X_{13} + 1.668127X_{14}$. When tested simultaneously for significance, the model used is statistically significant With Prob > chi^2 = 0.0145 < 0.05, the null hypothesis is rejected at 0.05 level of significance, which implies existing relationship between the Sustainability and community participation.

Focusing on the relationship between the response variable $y_3 \in D$ which denotes the **quantity of water** and the set of explanatory variables, $\{ X_{11}, X_{12}, X_{13}, X_{14}, X_{15} \} \subseteq I$, described earlier, in this case X_{15} represents participation enhancing sustainability. The explanatory variables "Income"and "PartEnhancedSus" were the only predictors found to be statistically significant. These two explanatory variables were statistically significant with each scoring P >|z| = 0.016 and P >|z| = 0.003 respectively, which are both less than 0.05. The Wald test reveals that all the explanatory variables are simultaneously statistically significant, given that Prob > chi^2=0.0079 which is less than 0.05. Consequently, not all coefficients in the model are zeros. The subsequent logit regression equation is then given by

$S = \beta X = -0.203089X_{11} + 0.6148221X_{12} + 0.1674182X_{13} + 1.231504X_{14} + 1.343241X_{15}$

Ownership since the Prob>chi^2=0.0000<0.05, the relationship between Sustainability and community participation is real and measured by the size of the ordered log-odds (logit) regression coefficients in the second column. All the explanatory variables are found to be significant except "Income". Prob > chi^2 = 0.0000 < 0.05 leads to rejection of the null hypothesis in favor of the alternative hypothesis, at 0.05 level of confidence. Subsequent log odds logit regression equation is given by $S = \beta X = 1.796363X_{11} - 2.266578X_{12} + 0.6793891X_{13} + 2.804674X_{14}$.

To interpret these coefficients, it is understood that if the subject were to increase "Sanctions", "PartiEnhancedSus" and "Involvedplanning" by a unit respectively, the expected log-odds of being in a

higher **Community ownership** category would increase by 1.796363, 0.6793891 and 2.804674 unit respectively while keeping all other variables constant. The Wald test reveals that all together, the explanatory variables are statistically significant, given the Prob > chi^2 = 0.0020 < 0.05 score. This is a clear evidence that the explanatory variables considered in this case affect the response variable, which is still "Sustainability" measure under "Community ownership".

The results of this study concur with evidence from previous studies as advanced by Narayan (1994) that beneficiary participation is key to project effectiveness. Majority of respondents at 82% responded affirmatively to weather they thought that participation was important for sustainability of the water project and only 7% were of the opinion that participation had low impact on sustainability. Although the project was initiated and implemented by the donor, with over 15 years since it was handed over to community management, it was observed that the project was still in operational conditions.

The study established that for this water project, community participation entailed representation of opinions in decision making processes and that women were fairly represented in water management committee indicating compliance with the gender equity principle on gender representation which guarantees a fair and equal participation by both men and women in decision making processes, operations and maintenances. The findings also concur with past findings by OECD (2002) who established that a strong sense of local ownership and genuine participation by both men and women are critical to successful and sustainable project benefits.

4.5 Part III, measuring the influence of Management factors on Sustainability

Community organization can be achieved either through organized community water committee or through traditional leader who have authority to give support to development efforts. Maraigushu water project has an organized water committee that manages the water supply services. Among other things the committee ensures that water usage is managed, fees are collected, presence of a maintenance and upkeep person and that spare parts are available. The respondent's responses on the various management elements under assessment are displayed below.

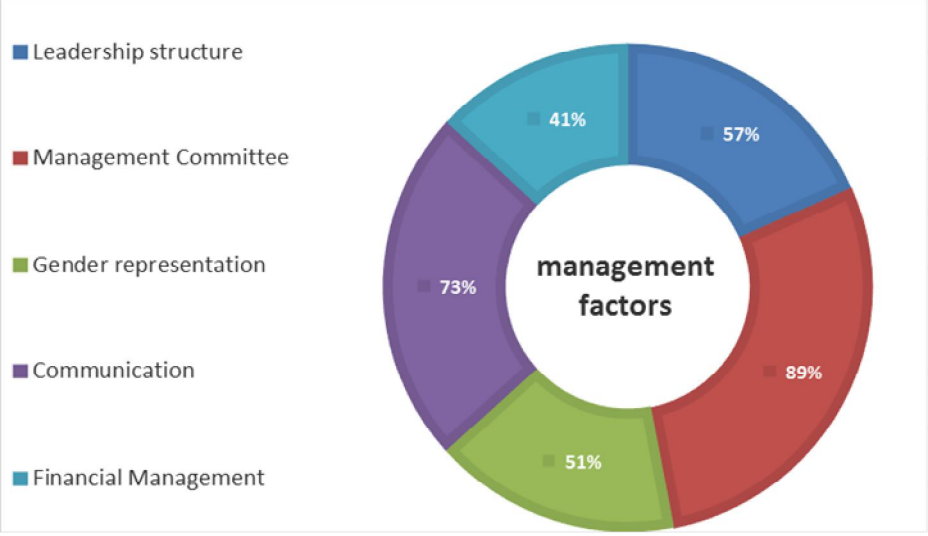

Figure 5 - Combination of aspects of Management factors

The figure above represents a combination of project management aspects that were assessed and their respective response. According to (Batchelor, McKemey, & Scott, 2000) community management usually relies on the availability of a water committee which is responsible for all the management issues related to the water supply. Membership of such committee should be gender sensitive. Research has also shown that good governance is positively correlated with a sustained water supply (IRC, 2002).

Table 7- Community management components

	%positive responses	**Description**
Leadership structure	57%	Rating on Leadership = Good
Management Committee	89%	Presence of management committee
Gender representation	51%	Similar gender roles =Yes
Communication	73%	Convenient Communication methods
Financial Management	41%	Are the project income managed well =Yes

From the direct interview with the committee and leaders members, the researcher observed that the community water management committee carried out their work on voluntary basis, the project has only one salaried person according to all 9 committee members interviewed. The roles of this employee include maintaining the project site pumping the water on daily basis and in charge of water sales. Efforts to cover for the operations and maintenance cost were all left in the hands of the management committee. Lack of clear information available on the expenses incurred by the committee on behalf of the community water project was reported as lacking by 69% of the respondents. 58% of the respondents reported that they did not think that the income from water sales and other funds were managed well, suggesting that there may be some challenges to the financial sustainability of the project.

Financial records review by the researcher at the project office revealed that there was poor records keeping, the committee did not generate any savings to cover future operations charges. Although there is a designated committee treasurer, a closer examination of financial management practices in the field revealed that there was no clear information available on the expenses incurred by the committee on behalf of the community water project.

Gender representation in the management committee and general community perception on gender roles was assessed in order to determine how the community perceives gender equity. Data collected revealed that there was good gender representation in the committee where two out of the nine committee members were women. The study respondents answering to the question "Do men and women perform the same roles in the community water project" closely tallied at 51% yes and 49% no implying a good practice for responding to gender and equity for the improvement of sustainability

Here, the effect of Management factors on Sustainability is considered. The analysis is focused on the relationship between the response variable $y_1 \in D$ which denotes the Accessible water service and the set of explanatory variables, $\{ X_{11}, X_{12}, X_{13}, X_{14}, X_{15}, X_{16} \} \subseteq I$.

Table 8 Influence of management factor on Sustainability indicator "Accessible water"

		Committee Presence	Gender	Communication	Finance/Income
Access	Coef	-0.903	1.611	-0.616	0.992
Prob > chi2= 0.0323	P>z	0.327	0.010	0.305	0.298

From results in Table 8 above, with Prob>chi2 = 0.0323 < 0.05, the null hypothesis is rejected at 0.05 level of significance, in favor of the alternative. Not all β in the resulting regression equation

$$S = \beta X = -0.9029508X_{21} + 1.610697X_{22} - 0.6156329X_{23} + 0.9919587X_{14}$$

are zeros. "GenderRole" is found to be the only statistically significant component. The Wald test reveals that all together, the explanatory variables are simultaneously statistically significant at 0.1 level, given that the Prob > chi^2 = 0.0707 < 0.1 score.

Considering Quality element of the dependent variable. With Prob > chi^2 = 0.0007, there is sufficient evidence to reject the null hypothesis, at 0.001 level of confidence, in favor or the alternative, that is not all β are zero. Both "PartEnhancedSus" and "RateMngt" are found to be statistically significant. From the subsequent log-odds logit regression equation deduced, i.e.

$S = \beta X = 1.496331X_{21} - 0.4545582X_{22} - 1.353062X_{23} - 0.1709866X_{14}$, it follows that if a subject were to increase for instance "PartEnhancedSus" and "RateMngt" by a unit respectively, the expected log-odds of being in a higher **Management and organization** category in terms of "Quality", would increase by 1.4963317 and decrease by unit 1.353062 respectively while keeping all other variables constant in each case.

Table 9 Regression coefficients when "Quality" is the dependent variable under sustainability.

		Rate Management	PartEnhance	Rate Leaders	Communication
Quality	Coef	-1.353	1.496	-0.1710	-0.455
Prob > chi2= 0.0007	P>z	0.051	0.002	0.705	0.459

Only "PartEnhancedSus" is found to be statistically significant.

The Wald test shows that, all the explanatory variables are simultaneously statistically significant, given Prob > chi^2 = 0.0024. This is a strong result when it comes project sustainability. Active participation of members, using right channel to communicate with members and managerial quality in the leadership are key to sustainability. When considering $y_3 \in D$ aliased **Quantity** as the operational variable under "Sustainability", the dependent variable. ologit Quantity PartEnhancedSus MtdofCommunication RateMngt RateLeadership [fweight =RateLeadership]

Table 10 Regression coefficients when "Quantity" is the dependent variable under sustainability.

		PartEnhanc	MethodofComm	RateMngmt	RateLeader
Quantiy					
Prob > chi2= 0.0002	Coef	1.561	-0.440	-0.039	0.706
	P>z	0.000	0.404	0.942	0.065

With Prob > chi^2 = 0.0002 < 0.05, the model used is highly statistically significant. The null hypothesis is rejected at 0.05 level of significance. The explanatory variables "PartEnhancedSus" and "RateLeadership" are statistically significant. The subsequent log-odds logit regression equation is given by $S = \beta X = 1.560763X_{21} - 0.4404454X_{22} - 0.0394547X_{23} + 0.7064921X_{14}$

The standard interpretation of the coefficients follows. A unit increase in "PartEnhancedSus" affects an increase in the expected log-odds of being in a higher **Management factor** category in terms of "Quantity", by 1.560763 while keeping all other variables constant. Similar interpretation applies for each coefficient in the log-odds logit equation. However, taken together, the Wald test confirm that all coefficients together are statistically significant, hence adequacy of the model used.

This result again confirms that the institution of managing community-based project organization during and after implementation is a form of participation. Sara and Katz (1998) prove that a designated community organization which manage and oversee a system is necessary for success. Considering the next element of sustainability in the management factors, where $y_4 \in D$ aliased **Ownership** is the dependent variable table 4.13. The Prob > chi2 = 0.0486. This signifies that there is sufficient allows to reject the null hypothesis at 0.05 level of significance in favor of the alternative. The later state that not all β in the log-odds logit regression equation, $S = \beta X = -3.002627X_{21} - 0.2557544X_{22} - 1.93272X_{23}$

where X_{21}="GenderRoles", X_{22}="MtdofCommunication", X_{23}="IncomeManWell".

Table 11 Regression coefficients when "Ownership" is the dependent variable under sustainability

		MethodofComm	IncomeMngWell	GenderRoles
Ownership				
Prob > chi2= 0.0486	Coef	-0.256	-1.933	-3.003
	P>z	0.795	0.136	0.035

Only "GenderRoles" is found to be statistically significant. An increase unit in "GenderRoles" affects a decrease in the expected log-odds of being in a higher **Management factors** category in terms of "Membership", by 3.002627 units while keeping all other variables constant. However, taken simultaneously, the Wald test reveals that all the explanatory variables used in this case are conjointly statistically significant at 0.1 level, having Prob > chi^2 = 0.1996 score. When management factors are operationalized by "GenderRoles", MtdofCommunication" and IncomeMangWell", the influence on "Sustainability" is optimal, even though at 10% level. Combination of other factors could not produce

satisfactory results, as one would reject the null hypothesis only at a level that is greater than 0.05.

Committee memberships vary considerably but women participation is more and more being encouraged. Out of the 9 members of the committee only 2 were women. At 58%, more male than female 45% were to the opinion that women and men play similar roles with the local leaders supporting the opinion at 80% which would imply more local leadership support for gender equity. This finding relates to the definition of sustainability by Brikke (2000) who asserts that a community management for water project is institutionalized and incorporates gender perspective and partnerships.

In conclusion, it has been shown that there exist indeed a true relationship between the dependent and independent variables. Moreover the explanatory variables which significantly affect the dependent variable have been highlighted. But the most important factor that has been highlighted by this findings and which are corroborated by Weinberg (2008) is that community –based projects are complex and require multifaceted management skills. The PMBOK (2013) recommends that for project managers to manage projects successfully, they must manifest not only project management skills but also technical and expertise as required by each project.

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. SUMMARY

The use of an ordered logistic regression analysis in addition to descriptive data analysis was used to test and respond to the survey questions. The study findings have demonstrated and reported the independent variables in each category whose parameter estimates are statistically significant. Clearly, under measurements used for the independent variable "**Community participation**", "*Membership, Involvedplanning, PartiEnhancedSus*, *Sanctions, PartiProject* and *Income*" are the components which most affect the dependent variable, "**Sustainablility**" in its own measurements used. Here, the null hypothesis has been rejected at $\alpha = 0.05$, holding other factors constant.

Likewise, under the independent variable "**Management factor**", "*GenderRoles, CommitteePre* and *RateMgt*" are among the variables that mostly affect the dependent variable "**Sustainability**". In this case, the null hypothesis has been rejected at $\alpha = 0.1$. Finally, under the independent variable "**Technical factor**", the research demonstrated that the measurements "*InchargeMaint, RepairPrsn, Functionality, AccessRules, RespforUpkeep* and *Skills*" have effect upon the dependent variable, "**Sustainability**", each at its own level (see Coeff. values). In this case, the null hypothesis has been always rejected at $\alpha = 0.05$ level of confidence. It is however important at this point to emphasize that the above results are unique to this study this is in concurrence with the project management theory that no any two project can be similar and that there is no such a thing at a "one size fits all" approach.

The use of statistical testing for associations is helpful to managers to see whether certain clusters of factors, as well as individual factors, tend to occur together. This study findings have demonstrated that fact. This is useful for decision makers and good information for future water projects implementers as they consider if for instance better-sustained services also have also been in the best way used by all beneficiaries or there are some certain groups that are excluded.

These result implies that sustainability of the water project under study is certainly dependent on the set of independent variables considered and not only on a few of them.

5.2 CONCLUSIONS

With reference to the conceptual framework underpinning the relevance of the current study, with the use of ordered logistic regression statistical model, it has been possible to demonstrate the extent to which "*Sustainability*" as the dependent variable is related to "*Community participation*", "*Management factor*" and "*Technical factor*". In most cases, it is observed that the null hypothesis is rejected at $\alpha = 0.05$ level of significance, and only a few cases at $\alpha = 0.1$ level of significance.

The operation of the water infrastructure assessed was observed to be reasonably well assured of being sustainable considering the aspects of the physical conditions of the infrastructure. The study found that construction quality had major impact on sustainability. Although the data was qualitatively collected for this aspect. Evidence is that the project has withstand a number of years and it is still in operation.

The lack of accountability and transparency in the management of the project income by the committee may jeopardize the proper management of the project. Although presence of a committed water committee and level of beneficiary participation and ownership is strong, the longer-term maintenance of the project appears to be threatened due to weakness in the institutional capacity in management, most specifically the financial aspects of fee collection and savings to be generally low. This may have negative implications on the ability to ensure cost of long term maintenance, user charges and transparency in expenditure analysis.

The community participation aspect of the project as perceived by the survey respondent and confirmed by the inferential statistics at 95% confidence score emerged quit high which is a positive indicators that with little assistance in the management factors, this project stands to be indeed sustainable.

5.3 RECOMMENDATIONS

Findings from this research study show that although a lot has been achieved towards long term sustainability of this water project, much more still require to be done to further enhance sustainability of the benefits already being enjoyed and also to deal with the inherent weaknesses that have been identified. Danger looms if these gaps are not addressed which may compromise what has so far been achieved. Outlined below are some recommendations that the author suggest.

The importance of quality project implementation is fundamental to ensuring sustainability of as advanced by PMI, 2013. The maraigushu water project was implemented under high standards of quality, with the modern technology used to drill the borehole. This has enabled the technical and social preconditions for a sustainable project that has been in existence for close to two decades. This findings leads to a recommendation that project implementers should therefore not compromise on the quality of the infrastructure in the design of water projects.

Operations and management including financial management relate to the capacity of the community management structures. As indicated by poor rating and nonexistence of financial records and savings, the financial management aspect of this water project committee need to be improved through training in the handling of income and expenditure and better financial records management.

Incentives to the water committee member may give motivation to them but this may only be successful where payment systems and amounts are transparent and are clearly conveyed to and agreed by the community as a whole. The committees must also be accountable to the community.

5.4 FURTHER RESEARCH

More statistical testing for associations' surveys on sustainability of rural water projects should be carried out. This will help policy makers, managers and researchers in future to be able to see whether certain elements or cluster of factors, or individual factors work better together to enhance sustainability. Such information, supplemented with qualitative and exploratory perceptions of causality can better give insights for action.

Further, the researcher recommends that more sustainability assessment of post project implementation and project handover of water projects be conducted in other areas in Nakuru County and indeed Countrywide. This will avail baseline data which according to the Ministry of water and irrigation services 2007 report, missing baseline data and sustainable information systems hinder obtaining a clear nationwide picture of water project sustainability issues.

REFERENCES

1. Abrams, L. (1999). *Understanding sustainability of local water services.* Retrieved June 1, 2015, from http://wn.apc.org/afwater/Sustainability.htm
2. Adams, C., & McNicholas, P. (2007). Making a difference. Sustainability reporting, accountability andorganisation change. *Accounting, Auditing & Accountability*, 382-402.
3. Adams, J. R., & Barndt, S. E. (1993). *Behavioral Implications of the Project Life Cycle," in Project Management Handbook, ed. David I. Cleland and William R. King.* NewYork: Van Nostrand Reinhold Co.
4. Adams, M. W. (2006). *The future of Sustainability: Te-thinking Environment and Development in the Twenty-first Century.* UK: IUCN-The World Conservation Union.
5. Antonio, G. (2005). *The European response to the challenges of water and sanitation in.*
6. Asantewaa, P. (2013). *Assessing the Status of Water Point Sources Case Study: Ejisu-Juaben Municipality.* Doctoral Dissertation.
7. Awortwi, N., & (Netherlands), &. I. (1999). *The riddle of community development: Factors influencing organisation, participation and self-management in 29 African and Latin American communities. .* The Hague, Netherlands:: Institute of Social Studies.
8. Bastian, S., & Bastian, N. (1996). *Assessing Participation: A Debate from South Asia. .* Konark Publisher.
9. Batchelor, S., McKemey, K., & Scott, N. (2000). *Strategies for Resettlement of Drought Prone Populations (Project Technical Report).* UK: Gamos Ltd Reading.
10. Bebbington, J., Brown, J., & Frame, B. (2007). Accounting technologies and sustainability assessment models. *Ecological Economics*, 224-236.
11. Berner, E., & Phillips, B. (2005). Left to their Own Devices? Community Self-Help between Alternative Development and Neo-Liberalism. *Community Development Journal*, 17.
12. Binder, D. (2008). *Sustainability of Water Service Delivery in Rural Environment: Past Approaches and the Way Forward*. Emerging Markets Group, Ltd.
13. Bretty, E. (2003). Participation and Accountability in Development Management. T. *The Journal of Development Studies*, 40 (2), 1 -29.
14. Brikké, F. (2002). *Operation and Maintenance of Rural Water Supply and Sanitation Systems: A Training Package for Managers and Planners. .* Geneva: WHO.
15. Brundtland, G. (1987). *Our common future: .* World Commission on Environment.
16. Carter, R., Tyrell, S., & Howsam, P. (1999). the Impact and Sustainability of Community Water Supply and Sanitaion Program in Developing Countries. *Water and Environment Journal*, 13 (4), 292-296.
17. Center, I. W. (2000). *The Sustainability Planning and Monitoring guide on Methodology for Participatory Assessment (MPA) for community-Driven Development Programs.* WorldBank.
18. Cleaver, F. (1999). Paradoxes of Participation: Questioning Participatory Approaches to Development. *Journal of International Development, 11*(4), 597-612.
19. Cleland, D. I. (1994). *Project Management: Strategic Design and Implementation 2nd ed. Singapore: .* McGraw-Hill, Inc.
20. Cleland, D. I., & Kezner, H. (1985). *A Project Management Dictionary of Terms* . New York: Van Nostrand Reinhold Company.
21. Cleland, D. I., & King, W. R. (1988). New York: : Van Nostrand Reinhold,.

22. Cooke, B., & Kothari, U. (2001). *Participation: The New Tyranny?* Zed Books.
23. Davis, R. C. (1951). *The Fundamental of Top Management.* New York: Harper.
24. de Wit, A. (1988). Measurement of Project Success. *Project management*, 164-70.
25. De Wit, J., & Berner, E. (2009). Progressive Patronage? Municipalities, NGOs, CBOs and the Limits to Slum Dwellers. *Empowerment Development and Change*, 40(5): 927-947.
26. DHS. (n.d.). *DEMOGRAPHIC AND HEALTH SURVEY*. Retrieved June 3, 2015, from DHS program: http://dhsprogram.com/Publications/Publication-Search.cfm?ctry_id=20&country=Kenya
27. Dungumaro, E., & Madulu, N. (2003). Public participation in integrated water Resources Management:the case of Tanzania/. *Physics and Chemistry of the Earth*, 1009 -1014.
28. EC. (2006). Luxembourg: Office for Official Publications of the.
29. Gary, C. (2002). *Gravity-fed water supply in Ethiopia: Community management and financial* .
30. Gichuri, W. (1999). Case study on the Kabuku Water Project in Kenya. Paper presented at a. *Regional workshop on Financing Community Water Supply and Sanitaion* (p. Papar ID 02015208). Mpumalanga: Republic of South Africa.
31. Gleick, P. H. (2004). The Millennium Development Goals for water: Crucial objectives, inadequate commitments. *The World's Water*, 1-15.
32. Golafshani, N. (2003). Understanding Reliability and Validity in Qualitative Research. . *Science and Education*, 597-607.
33. Habtamu Addis, B. (2012). *Factors Affecting the Sustainability of Rural Water Supply Systems. The Case of Mecha Woreda Amhara Region, Ethiopia.* Unpublished Thesis of Cornell University.
34. Harvey, & Reed. (2007). *Guidelines for Sustainable Hand pump*. Retrieved May 26, 2015, from http://www.unicef.org/wes/mdfreport/definition.php
35. Harvey, P., & Reed, B. (2004). *Rural Water Supply in Africa: Building blocks for Handpump Sustainability.* Loughbough University.
36. Hickey, S., & Mohan, G. (2005). Relocating Participation within a Radical Politics of Development. *Development and Change, 36*(2), 237-262.
37. Holddren, J. G. (1995). *The meaning of sustainability: biogeophysical aspects.* Washington D.C: World Bank.
38. IEA. (2007). *A rapid assessment of Kenya's water, sanitation and.* Institute of Economic Affairs .
39. IFAD. (2007). *Strategic Framework.* Rome.
40. IFAD. (2009). *Sustainability of rural development projects: Best practices and Lessons learned bt IFAD in Asia.* Tango International.
41. Institute, W. R. (2007). *Nature's Benefits in Kenya: An Atlas of Ecosystems and Human Well-Being.* Retrieved 6 18, 2015, from http://pdf.wri.org/kenya_atlas_fulltext_150.pdf
42. IRC. (2010). *How to sustain development goals for WASH.* http://www.ircwash.org/projects/triple-s: IRC.
43. Kakumba, U. (2010). 'Local Government Citizen Participation and Rural Development: Reflections on Uganda's Decentralization System. *International Review of Administrative Sciences* , 76(1): 171. .

44. Kenya. Ministry of Water Resources-Ke. (1999). *Sessional paper no. 1 of 1999 on national policy on water resources management policy and development.* Nairobi: Kenya, Ministry of Water Resources.
45. Khan, A. M. (2000, December). *MandE NEWS*. Retrieved June 15, 2015, from MandE: http://www.mande.co.uk/docs/khan.htm
46. Kothari, C. (1990). *Research Methodology: Methods and Techniques.* Wishwa Prakachan.
47. Mimrose, D. G. (2011). Assessment of sustainability of community water supply projects in Kandy District. *Tropical Agricultural Research*, 51-60.
48. Ministry of Devolution and Planning. (2013). *MILLENNIUM DEVELOPMENT GOALS: Status Report 2013.* Nairobi: GOK.
49. Ministry of Water and Irrigation. (2007). *The National Water Services Strategy (2007 -2015).* Nairobi: GOK.
50. Mosse, D. (1994). Authority, Gender and Knowledge: Theoretical Reflections on the Practice of Participatory Rural Appraisal. *Development and Change, 25*(3), 497-526.
51. Mukherjee, N., & van Wijk, C. (2003). *Sustainability Planning and Monitoring in Community Water Supply and Sanitaion*. The World Bank.
52. Mwangi, M. W. (2014). *Determinants of sustainability of community water projects in Kieni east District, Nyeri County.* Doctoral dissertation.
53. Narayan, D. (1995). Participatory evaluation: tools for managing change in water sanitation. *World Bank Technical Paper*, p. 207.
54. Ngetich, R. C. (2009). *Assessment of Factors Influencing Projects Sustainability; the Case of Community Water Projects in Keekonyokie Central Location of Kajiado North District, Kenya.* . Unpublished Thesis of University of Nairobi.
55. Norgaard, R. B. (1994). *Development Betrayed–The End of Progress and a Co-evolutionary Revisioning of the Future,*. New York: Routledge.
56. NWP. (2012). Retrieved June 3, 2015, from http://siteresources.worldbank.org/INTAFRICA/Resources/257994-1335471959878/draft-water-bill-2012.pdf
57. Peter, G., & Nkambule, S. E. (2012). Factors affecting sustainability of rural water schemes in Swaziland. *Physics and Chemistry of the Earth, Parts A/B/C*(50), 196-204.
58. PMBOK. (2013). *A Guide to the Project Management Body of Knowledge.* Newtown Square, Pennyslavania: Project Management Institute.
59. PMI. (2008). *A Guide to the Project Management Body of Knowledge 5th ed*. Upper Darby, PA: Project Management Institute.
60. PMI. (2013). *A Guide to The Project Management Body of Knowledge (PMBOK* GUIDE) 5th edition.* Pennsylavania - USA: Project Management Institute Inc.
61. Pretty, J. &. (2001). Social capital and the environment. . *World Development*, 209.
62. Rossi, P., & Freeman, H. (1999). *Evaluation: A Systematic Approach*. . New Delhi: SAGE.
63. Sahel Consulting. (2012). *GWI Technical Series: Hardware Quality for Sustainable Water & Sanitation.* The Global Water Initiative.
64. Saith, A. (1992). *The Rural Non-Farm Economy: Processes and Policies.* . International Labour Organisation. .
65. Sara, J., & Katz, T. (1998). *Making Rural Water Supply Sustainable: report on theimpact of project rules.* UNDP World Bank Water and Sanitation Program.

66. Saunders, M., & Lewis, P. T. (1996). *Research Methods for Business Students, 4th edition,* . Prentice Hall.
67. Schouten, T. M. (2003). *Community water, community management: from system to servive in rural areas.* London: ITDG Publishing.
68. Soley, F., & Thøgersen, J. (2003). Monitoring and evaluation system for rural water supply. *29th WEDC International Conference,* blz 296-298.
69. Taylor, B. (2009). *Addressing the Sustainability Crises: Lessons from research on managing rural water project.* WaterAId Tanzania.
70. Turner, R. J. (1993). *The Handbook of Project-Based Management: Improving the Processes for Achieving Strategic Objectives* . London: McGraw-Hill.
71. UN. (2010). Goal 7 Ensure Environmental Sustainability Fact Sheet. *UN Department of Public Information.*
72. UN. (2013, May 2015). *The Millennium Development Goals and beyond 2015*. Retrieved from http://www.un.org/millenniumgoals/pdf/Goal_7_fs.pdf: http://www.un.org/millenniumgoals/pdf/Goal_7_fs.pdf
73. UNDP. (1999). *Monitoring Sustainability: The VIPWay- a ground level experience. South Asia.* India: UNDP- World Bank Water and Sanitation Program .
74. UNDP. (2006). *Beyond scarcity: power, poverty and the global water crisis.* Human Development Report.
75. UNEP. (2010). *Africa Water Atlas.* UNEP .NET.
76. UNICEF. (2012-2015). *UNICEF*. Retrieved May 19, 2015, from Monitoring and Statistics: http://www.unicef.org/statistics/index_24302.html
77. WHO. (2000). *Operation and Maintenance of Rural Water Supply and Sanitation Systems, A training mannual for managers and planners.* IRC International Water & Sanitation Center, WHO.
78. WHO/UNICEF. (2010). *WHO /UNICEF JMP for Water Supply and Sanitation*. *New York.* Retrieved May 20, 2015, from JMP for Water Supply and Sanitation: WHO /UNICEF JMP for Water Supply and Sanitation. New York. [Online] Available: http://www.who.int/water_sanitation_health/monitoring/jmp2000.pdf. Retrieved May 20, 2012.
79. WorldBank. (2003). *Rural Water Projects: Lessons from OED evaluation, Operations Evaluation Department working paper.* World Bank.
80. Worldbank. (2004). *Towards a Water-Secure Kenya: Water Resources Sector Memorandum.*
81. Yacoob, M., & Walker, J. (1991). Community management in water supply and sanitationproject: cost and implications. *Water SRT-Agua,* 30-34.
82. Yin, R. K. (1984). *Case Study Research: Design and Methods.* Newbury Park, CA: Sage.