

# **FACTORS INFLUENCING PERFORMANCE OF WATER PROJECTS IN ARID AND SEMI ARID AREAS. A CASE OF EWASO NG'IRO NORTH BOREHOLE PROJECTS, ISILO COUNTY, KENYA**

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## **ABSTRACT**

Most of the water projects in Kenya have been performing dismally with most becoming un-operational or requiring rehabilitation. In Kenya, it is quite a common phenomenon to observe non-functional water projects that are not operational in most parts of the country. However, if the current trends of poor performance of water projects are allowed to continue, rural water facilities will be completely non-functional which significantly lowers the effective coverage. The purpose of this study was to establish the factors influencing performance of water projects in arid and semi-arid areas with reference to Ewaso Ng'iro North Borehole Projects, Isiolo County, Kenya. The study was guided by the following objectives; to determine how community participation, water infrastructure, project management and maintenance funds affect performance of Ewaso Ng'iro North borehole projects in Isiolo County. The study was grounded on the community participation theory, institutional theory and resource based view theory. The study adopted a descriptive research design. The target population composed of employees in different management levels of the 12 development agencies including the NGOs, CBOs and RBOs and government officials from the Ministry of Water and Irrigation. A sample population of 162 is arrived at by calculating the target population of 281 with a 95% confidence level and an error of 0.05 using the below formula taken from Kothari (2004). The study selected the respondents using stratified proportionate random sampling technique. The researcher used a semi structured questionnaire and focus group discussion as the primary data collection

tool. The researcher administered the questionnaire individually to all respondents from the government agencies. Data was analyzed using Statistical Package for Social Sciences (SPSS Version 24.0). Descriptive statistics such as frequencies, percentages, mean score and standard deviation was estimated for all the quantitative variables and information presented in form of tables. Inferential data analysis was done using multiple regression analysis. Multiple regression analysis was used to establish the relations between the independent and dependent variables. The study aimed at determining how community participation affect performance of Ewaso Ng'iro North borehole projects in Isiolo County and found that it greatly affects the performance of Ewaso Ng'iro North Borehole Projects in Isiolo County. Further the study found that maintenance funds greatly influences performance of Ewaso Ng'iro North borehole projects in Isiolo County. The study concluded that community participation had the greatest effect on the performance of water projects in Ewaso Ng'iro north borehole projects, followed by project management then water infrastructure while maintenance funds had the least effect to the performance of water projects in Ewaso Ng'iro north borehole projects. From the findings and conclusions the study recommends that; The Isiolo County Government and stakeholders should allocate funding towards the development of water infrastructure especially in construction of new pipeline extensions and constructing of new water points in Ewaso Ng'iro North and the use of solar energy as an option to replace the diesel generators or a hybrid system should be explored. More local technicians should be

trained on operation and maintenance of generators and hand pumps. The water management committees should be trained on financial management and record keeping. This should be done by the Ministry of Environment, Water and Natural resources.

## INTRODUCTION

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

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

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

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

**Key Words:** performance, water projects, arid and semi arid areas, Ewaso Ng’iro North, borehole projects, Isiolo County, Kenya

lack of ownership, limited community education, and limited sustainability of community management structures, such as water use committees (WUCs).

Besides, water supply projects have been strongly criticized for their planning approaches, which have focused excessively on physical construction and increasing coverage targets, but largely ignored what happens at the water sources after construction (Lockwood, 2014). For the last few decades, literature in the water supply sector has shown that sustainability of rural water supply structures has become positively associated with small-scale initiatives, which maintain public participation. Thus, the key to sustainability is to meaningfully involve the users in the planning, implementation, operation, protection and maintenance of water supply systems according to their needs and potentials (Davis & Liyer, 2012).

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

Despite many years of development efforts, access to safe water supplies and sanitation services (WSS) in the world continues to be extremely marginal. Over 1.2 billion people worldwide; the majorities living in developing nations, particularly in sub-Saharan Africa, 300 million of which 80% live in rural areas still do not have access to clean water facilities (Prokopy, 2015). In Africa, the number of people in rural areas without an improved water supply is six times higher than in urban populations (Baur & Woodhouse, 2009).

A focal issue in the water supply and sanitation sector in developing countries is gauging the willingness of individuals to manage their water sources through the contribution of time and resources (Schouten & Moriarty, 2013). The rationale is that contributing more time and resources to the protection and maintenance of rural water supply sources is a positive action that may potentially improve the sustainability of water supply infrastructures (Gleitsmann, 2015). Harvey and Reed (2013) strongly argue that community involvement, even at the lower intensities of participation, is a “perquisite for sustainability”. The participation of communities based on their willingness to contribute increases effectiveness, efficiency, empowerment, equity, coverage and the overall sustainability of water supply projects (Narayan, 2010). Similar findings were presented by Kumar (2012), particularly mentioning that a demand-responsive approach (DRA) significantly increases the sustainability of water supply projects.

To foster participation in projects, community members' contributions might take the form of money, labour, material, equipment, or participation in project-related decision-making and meetings (Bhandari & Grant 2009). Moreover, Harvey and Reed (2013) described forms of contribution such as the expression of demand for water, selection of the technology and area, financial contributions, provision of labor and materials, and selection of management systems.

Ultimately, improved planning procedures which fully consider the value and demand placed on different levels of service by the community are a necessity for the ownership of rural water projects (Mbata, 2014). However, in spite of the ever-increasing importance placed on the role of participation in development efforts, there have been few quantitative studies to demonstrate the proposition that participation measurably increases development outcomes (Prokopy, 2015).

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

The African continent poses the most difficult challenge for achieving the water and sanitation MDG targets. The MDGs for water supply and sanitation services require a doubling of the pace of expansion of coverage in water supply in urban areas and a tripling for sanitation. Recent projections show that following the 'business as usual' trends, Sub-Saharan Africa would only reach the MDG targets for water services by 2040, and those for sanitation by 2076 (United Nations Development Programme (UNDP, 2014)).

For a long time, measures taken by governments to address service coverage gaps have concentrated on building new infrastructure with little attention given to improving efficiency and productivity of water utilities. Estimates of finance requirements for water and sanitation expansion point to large funding gaps and prospects of private sector investments appear bleak. These realities have compelled major players in the water sector to seek alternative approaches to improving water service coverage.

As noted by World Bank (2015), water utilities in Africa differ greatly in terms of size, organizational culture and operating environments. They share one major challenge of expanding access to appropriate levels of services to their growing urban populations as can be seen clearly in the context of the MDGs where Africa lags far behind other regions. It is now widely acknowledged that the inefficiencies of African water utilities are a major cause of poor access to water services.

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

In the 1990s, many governments sought to implement policy, regulatory and institutional reforms of urban water supply and sanitation (WSS) services, often with support from international financial institutions. Reforms were badly needed: millions of people lacked access to piped water and sanitation services; and for millions of others, service was often poor. Deteriorated infrastructure, fast urban growth, and large investment needs coexisted with poorly run utilities, artificially low tariffs, and scarce fiscal resources. Water sector reforms emphasize the need for consumers' protection and their access to efficient, adequate, affordable and sustainable services, whilst ensuring the financial sustainability of service provider (Hukka & Katko, 2004).

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

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

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

In 2002, major reforms were introduced in the water sector in Kenya. The reforms were carried out to address the policy, regulation and service provision weaknesses experienced in the sector (Owour & Foeken, 2009). The reforms were occasioned by the fact that despite

many interventions, close to half of the Kenyan population did not have access to clean water (United Nations-Water, 2014). This entailed separating policy functions from regulation and services delivery.

Service delivery functions were further separated into asset holding (ownership) and investment; and direct water and sewerage services provision (Owour & Foeken, 2009). The key weakness identified in the service provision of water was the financing mechanism in the sector (World Bank, 2015). Specifically, there was poor management of water which led to financial difficulties, the inability of water utilities to attract and retain skilled manpower, high levels of unaccounted-for-water and low revenue collection, including corruption, among others (Government of Kenya, 2014).

Before formation of water private companies, service provision under the local authorities was fraught with frequent shortages and wastage, high unaccounted-for-later, illegal connections, mismanagement of funds from water bills, non-reading of meters, and nonpayment of water, among others (World Bank, 2015). All these compromised the financial situation of water utilities. According to the Water Act of 2002, WSPs in Kenya is private entity companies, which are autonomous, managed independently and run professionally. WSPs act as agents of Water Service Boards (WSBs). The Water Act 2002 vests in the WSBs the legal ownership of water and sewerage assets utilized by WSPs. Additionally; WSBs have the authority to regulate water tariffs set by WSPs. Reforms in the water service provision as contained in the Water Act of 2002 were to be guided by the principles of decentralization (provision of services at the local level);financial and operational autonomy of the WSPs; institutionalization of financing of water services (through the establishment of Water Services Trust Fund); as well as financial sustainability.

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

At Independence in 1963 Kenya's population was 7 million. It is now approaching 40 million and like many other African countries, Kenya faces serious difficulties in trying to help its people meet the need for water that is reasonably convenient, and above all safe (Onjala, 2012). Much of the country is arid or semi-arid. Most rural people are poor. There is lack of enough fresh water resources which has led to water-borne disease, poor hygiene and lack of sanitation facilities. The increased population growth rate has over-stretched the available fresh water resources leading to water scarcity (Onjala, 2012).

In Kenya, just like in other parts of Africa, water is scarce in some parts of the country forcing women and children to trek long distances to fetch water. The exact groundwater potential of the country is unknown, but it has been estimated to be approximately 2.6 billion m<sup>3</sup> (ADF, 2015). Despite this abundance, many Kenyan people have suffered from a lack of

access to safe drinking water for centuries. The eastern part of Kenya is one of the areas where lack of clean water has led to the education of the girl child being compromised and the health of the community at stake due to water borne diseases. In the blue print Vision 2030 under the economic pillar are the Flagship projects for Tourism to spur development. The specific strategies for realizing the goals will involve: an aggressive strategy to develop resort cities in three key locations that includes Isiolo Town. The development of the resort city and increase in human population will require more water. For sustainability and to reduce stress, there is need to sustain rural/community water supplies.

The Water Act 2002 encourages the participation of all relevant stakeholders. The new institutions both in WRM and WSS involve the NGOs and civil society organizations in participatory forums in which decisions about interventions are discussed. However, it is clear that representation from local communities and consumers is minimal and not well structured to be representative enough since community involvement particularly in rural and poor urban areas is limited.

## **STATEMENT OF THE PROBLEM**

Management of water points is an important aspect of sustainable delivery of water resources to both the rural and urban populations in Kenya (Kakumba 2010). Although Ministry of Water and Irrigation in collaboration with both international and local organizations, is actively involved at the grassroots level to improve the situation, clean water supply coverage is still in its infancy in many parts of the country. It is estimated that more than 60% of the Kenyan population do not have access to clean water despite the fact that much of the country have reliable water sources and adequate rainfall. The situation is worse in rural areas, occupied by the majority of the population. The ongoing efforts, which are measured based on the performance in achieving short term objectives need to be re-engineered to raise their output by 2000% to meet the water and sanitation Millennium Development Goals (MDGs) by 2015 (MWI, 2011).

Earlier studies provide figures of operational failure rates from individual African countries ranging from 30% to 60% (Lockwood 2014). It is estimated that 55% of all rural water supplies/projects in Kenya, Tanzania and Uganda are not functioning (Baumann, 2009), and despite the frequency with which it appears in development discourse, the reality of sustainability remains elusive. The widespread failures in water supplies have been attributed to a number of flaws in the project; the intervention was not desired by the community, the capital and/or recurrent costs are too high for the community, lack of ownership results in neglect of maintenance and repairs, the promised benefits don't materialize, education programmes are too short and trained members of the community move away or lose interest (Carter, Tyrrel & Howsam, 2011).

Most of the water projects in Kenya have been performing dismally with most becoming un-operational or requiring rehabilitation. In Kenya, it is quite a common phenomenon to observe non-functional water projects that are not operational in most parts of the country (MWI, 2011). However, if the current trend of poor performance of water projects is allowed

to continue, rural water facilities will be completely non-functional which significantly lowers the effective coverage. This is manifested in some water project such as Isiolo water supply; LMD Borehole being nonoperational after very few years of operation while even those in operation is either silted up or requires rehabilitation. Currently, there seem to be low level performance of water projects in Isiolo County in Kenya, resulting from low levels of ownership at community level especially in the Ewaso Ng’iro North Borehole Projects. And yet participation alone without effective community organization and leadership to carry out operation and maintenance and other mobilization activities of rural water supply may not work. Similar study by Donge for example reveal that, non-functionality of water sources could be resulting from lack of maintenance, irresponsibility of users and ‘free-riding’, all of which cause management failures (Donge, 2013).

Ali (2015) looked at determinants of community ownership of water projects in central division, Isiolo County. Management of water points is an important aspect of sustainable delivery of water resources to both the rural and urban populations in Kenya. Currently, there seem to be low level of community participation of rural water supply in Kenya, leading to low levels of ownership at community level. Rimberia (2012) studied on the determinants of water projects sustainability in Kieni East Division, Nyeri County. The sustainability rate on water projects in developing countries is alarmingly low, due to a lack of resources, capabilities and spare parts for service and maintenance. Kemuma (2015) assessed the determinants of financial sustainability in water resources management authority in the Kenyan water sector. None of these studies has looked at water project performance in Ewaso Ng’iro North borehole projects in Isiolo County. Therefore this study will answer the question what are the factors influencing performance of water projects in arid and semi-arid areas?

## **PURPOSE OF THE STUDY**

The purpose of this study was to establish the factors influencing performance of water projects in arid and semi-arid areas with reference to Ewaso Ng’iro North Borehole Projects, Isiolo County, Kenya.

## **SPECIFIC OBJECTIVES**

1. To determine how community participation affect performance of Ewaso Ng’iro North borehole projects in Isiolo County.
2. To establish how water infrastructure affect performance of Ewaso Ng’iro North borehole projects in Isiolo County.
3. To establish the effect of project management on performance of Ewaso Ng’iro North borehole projects in Isiolo County.
4. To assess the influence of maintenance funds on performance of Ewaso Ng’iro North borehole projects in Isiolo County.

## **THEORETICAL REVIEW**

This section discusses the theoretical foundation on which the study is anchored. The study was grounded on the community participation theory, institutional theory and resource based view theory.

### **Community Participation Theory**

Cohen and Uphoff's (1987) comprehensive model regarding people's participation is chosen to analyze the participation of community level people in development projects in Bangladesh. Besides Cohen and Uphoff's (1987) model, Community Participation Theory propounded by Khwaja (2014) is also consulted and used for the present study. The community participation theory assumes that community participation has a real influence on the decision, that is: greater community participation makes it less likely that the decision is determined by the external agency (Khwaja, 2014). This assumption and found that it is indeed true higher community participation in a decision also implies a lower likelihood that the external organization rather than the community is identified as the main decision maker.

Participation of people is of utmost essence while identifying a project. If their participation is ensured, they can best fit the need, nature and type of project according to their own need as well as challenges and constraints. Moreover, their participation in project identification imbibes the sense of ownership among them which will, help during the implementation of the project in question (Harvey and Reed 2013).

In community participation theory, focuses are given on the participation of beneficiaries, and not that of government personnel in the development project. The joint or collaborative involvement of beneficiaries in groups is a hallmark of community participation; and that community participation refers to a process and not a product in the sense of sharing project benefits. Community Participation theory stands for the general assumption that the higher the community participation in a decision, the lower the likelihood of the interferences of external organizations on that decision (Munguti 2014).

This theory addresses community participation that highly influences acceptance and performance of project. Therefore it is relevant to this study in understanding influence of community participation on performance of water projects in Ewaso Ng'iro North borehole projects in Isiolo County.

### **Institutional Theory**

Institutional theory is a predominant theoretical tool within the field of organization studies (Suddaby, 2010). Institutional theory has its roots in the scholarly understanding of institutions as monolithic, permanent structures invested with socio-cultural meaning, and governing social behaviors. It was initially used in the 1970s to study what were perceived by scholars as the institutional qualities of organizations: their stability, and the rule-like structures they exhibit which shape and constrain members' behaviors (Scott, 2008). Institutional theory was subsequently used to examine how organizations and their behaviors acquired myths and meanings which contribute to formal organizational structure, but which

are not able to be understood as the products of organizations' practical demands (*ibid*). The scope of institutional theory has steadily expanded to include its application to the study of how, through institutional pressures, organizations come to resemble each other, how individuals exercise power within institutional environments, and how institutions change. Institutional theorist Roy Suddaby even goes so far as to say that institutional theory has become ubiquitous within organization studies, being applied by default to any and all questions within the field (Suddaby, 2010).

This theory examines how organizations and their behaviors acquired myths and meanings which contribute to formal organizational structure influence performance. Therefore it is relevant to this study in looking at influence of project management on performance of water projects in EwasoNg'iro North borehole projects in Isiolo County.

### **Resource Based View**

The currently dominant view of resource-based theory is based on the concept of economic rent and the view of the company as a collection of capabilities. This view of strategy has a coherence and integrative role that places it well ahead of other mechanisms of strategic decision making (Kay, 2015). The resource-based view (RBV) offers critical and fundamental insights into why firms with valuable, rare, inimitable, and well organized resources may enjoy superior financial performance (Barney & Arikan, 2011).

The main contribution of the resource-based view lies in the notion of competitive advantage. The resource-based view of the firm, which envisions firms as a bundle of resources, is probably the dominant theory for explaining differences in performance among firms today (Barney and Arikan, 2011). Resources have been variously defined by RBV theorists, but can include financial capital, assets, human skills/knowledge, organizational processes, and technologies (Carmeli, 2010). A portion of the most important of the research to shape resource based thought is rooted in the early research on distinctive competencies, Ricardian economics, and the theory of firm growth proposed by Penrose (1959), since concepts from that historical research influenced the fundamental assumptions of the model (Barney, 2012).

The resource-based view suggests that a firm can create sustainable competitive advantage through developing its unique resources and capability (Barney & Arikan, 2011). The difference between providing short-term competitive advantage and that which is sustainable resides in the notion that these resources are heterogeneous in nature and not perfectly mobile (Barney, 2012). Managers are not static in the RBV, but instead they are called upon to structure, bundle, and leverage their valuable resources in unique ways to maximize their contribution to providing sustained advantage (Sirmon, Hitt & Ireland, 2013).

Literature on the resource-based view already provides resources which contribute to the formulation of sustainability-related strategies, such as continuous improvement (Christmann, 2010), a shared vision within the church based organizations, high order learning, relationships with external stakeholders stakeholder involvement green supply chain management practices (Rao and Holt, 2015), international experience, working capital management skills, organizational slack and political management capabilities However, this

literature emphasizes how these resources affect an organization's environmental or social performance and ultimately its financial sustainability. According to the resource based view, firms should look into their internal resources, both physical and intellectual, for sources of competitive advantage (Christmann, 2010).

Building on the RBV, Hoopes, Madsen and Walker (2013) suggest a more expansive discussion of sustained differences among firms and develop a broad theory of competitive heterogeneity. The RBV seems to assume what it seeks to explain. This dilutes its explanatory power. For example, one might argue that the RBV defines, rather than hypothesizes, that sustained performance differences are the result of variation in resources and capabilities across firms. The difference is subtle, but it frustrates understanding the Resource Based View's possible contributions (Hoopes et al., 2013).

The Resource Based View's lack of clarity regarding its core premise and its lack of any clear boundary impedes fruitful debate. Given the theory's lack of specificity, one can invoke the definition-based or hypothesis-based logic any time. Again, we argue that resources are but one potential source of competitive heterogeneity. Competitive heterogeneity can obtain for reasons other than sticky resources (or capabilities) (Hoopes et al., 2013). Resources are a firm's accumulated assets, including anything the firm can use to create, produce, and/or offer its products to a market. Resources are eligible for legal protection (as such, firms can exercise property rights over them; can operate independently of firm members (Camisón, 2015); and intervene as factors in the production process to convert input into output that satisfies needs.

### **Research gap**

Previous studies have focused on various aspects of water projects. Kinuthia, Warui and Karanja (2009) did a study in Mbeereon the group-owned water points lack effective committees and this challenges management. Ali (2015) looked at determinants of community ownership of water projects in central division, Isiolo County. Management of water points is an important aspect of sustainable delivery of water resources to both the rural and urban populations in Kenya. Currently, there seem to be low level of community participation of rural water supply in Kenya, leading to low levels of ownership at community level.

Rimberia (2012) studied on the determinants of water projects sustainability in Kieni East Division, Nyeri County. The sustainability rate on water projects in developing countries is alarmingly low, due to a lack of resources, capabilities and spare parts for service and maintenance. Kemuma (2015) assessed the determinants of financial sustainability in water resources management authority in the Kenyan water sector.

Most of the literature reviewed is mostly from different countries whose strategic approach and strategic footing is different from that of Kenya. Further, the studies do not centre into the issue of water projects per se. The studies done in Kenya have also not looked on the issue of factors influencing performance of water projects in the Isiolo County. Thus, there is

a research gap on the determinants of community ownership of water projects in Central Division, Isiolo County which this study seeks to fill.

## RESEARCH METHODOLOGY

### Research Design and Target population

The study adopted a descriptive research design. A descriptive design is concerned with determining the frequency with which something occurs or the relationship between variables (Bryman & Bell, 2011). Thus, this approach is suitable for this study, since the study intends to collect comprehensive information through descriptions which were helpful for identifying variables. The target population composed of employees in different management levels of the 12 development agencies including the NGOs, CBOs and RBOs and government officials from the Ministry of Water and Irrigation.

### Sampling Size

The sample size is a subset of the population that is taken to be representatives of the entire population (Kumar, 2012). A sample population of 162 is arrived at by calculating the target population of 281 with a 95% confidence level and an error of 0.05 using the below formula taken from Kothari (2004).

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

Where:  $n$  = Size of the sample,

$N$  = Size of the population and given as 281,

$e$  = Acceptable error and given as 0.05,

$\partial_p$  = The standard deviation of the population and given as 0.5 where not known,

$Z$  = Standard variate at a confidence level given as 1.96 at 95% confidence level.

### Sampling Procedures and Data Collection Tools

The study selected the respondents using stratified proportionate random sampling technique. Stratified random sampling is unbiased sampling method of grouping heterogeneous population into homogenous subsets then making a selection within the individual subset to ensure representativeness. The goal of stratified random sampling is to achieve the desired representation from various sub-groups in the population. In stratified random sampling subjects are selected in such a way that the existing sub-groups in the population are more or less represented in the sample (Kothari, 2004). The study used simple random sampling to pick the respondents in each stratum. For the purpose of this study, the researcher used a semi structured questionnaire and focus group discussion as the primary data collection tool. The questionnaire was structured to include both closed, open-ended and matrix questions to allow variety. The structured questions were normally close ended with alternatives from

which the respondent was expected to choose the most appropriate answer. Matrix questions were also utilized.

### **Pilot Testing and Validity**

Pilot testing of the research instruments were conducted using staff working in Ewaso Ng'iro North Borehole Projects in Isiolo County. 17 questionnaires were administered to the pilot survey respondents who were chosen at random. After one day the same participants were requested to respond to the same questionnaires but without prior notification in order to ascertain any variation in responses of the first and the second test. Content validity which was employed by this study is a measure of the degree to which data collected using a particular instrument represents a specific domain or content of a particular concept. Expert opinion was requested to comment on the representativeness and suitability of questions and give suggestions of corrections to be made to the structure of the research tools.

### **Reliability**

The researcher intended to select a pilot group of 17 individuals from the target population to test the reliability of the research instruments. In order to test the reliability of the instruments, internal consistency techniques were applied using Cronbach's Alpha. The alpha value ranges between 0 and 1 with reliability increasing with the increase in value. Coefficient of 0.7 is a commonly accepted rule of thumb that indicates acceptable reliability (Mugenda, 2008). The pilot data was not be included in the actual study.

### **Data collection methods**

This refers to the means the researcher used to gather the required data or information. The researcher administered the questionnaire individually to all respondents from the government agencies. The researcher exercised care and control to ensure all questionnaires issued to the respondents were received and to achieve this, the researcher maintained a register of questionnaires, which are sent, and which are received. The questionnaires were administered using a drop and pick later method to the sampled respondents in the Ewaso Ng'iro Borehole water project.

### **Data analysis**

Data was analyzed using Statistical Package for Social Sciences (SPSS Version 24.0). All the questionnaires received were referenced and items in the questionnaire will be coded to facilitate data entry. The qualitative data from the open-ended questions were analyzed using conceptual content analysis and presented in prose. Inferential data analysis was done using multiple regression analysis. Multiple regression analysis was used to establish the relations between the independent and dependent variables. Since there are four independent variables in this study the multiple regression models generally assumed the following equation;

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

Where:

$Y = \text{Ewaso Ng'iro Borehole water project performance}$

$\beta_0 = \text{constant } \beta_1, \beta_2, \beta_3 \text{ and } \beta_4 = \text{regression coefficients}$

$X_1 = \text{community participation}, X_2 = \text{water infrastructure}, X_3 = \text{project management}, X_4 = \text{maintenance funds}, \varepsilon = \text{Error Term}$

## RESEARCH RESULTS

### Multiple Regression Analysis

Multiple regression analysis was conducted to test the effect of the community participation, water infrastructure, project management and maintenance funds on the performance of water projects in Ewaso Ng'iro north borehole projects, Isiolo County, Kenya.

**Table 1: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.863	0.745	0.736	1.655

R square value indicates that 73.6% variance in performance of water projects in Ewaso Ng'iro north borehole projects is explained by factors of community participation, water infrastructure, project management and maintenance funds.

**Table 2: ANOVA results**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	896.68	4	224.170	79.638	0.000
	Residual	306.82	109	2.815		
	Total	1203.5	113			

In this model the f-significance value of  $p = 0.000$  is less than the critical value (alpha)  $\alpha$  of 0.05. Therefore the model is statistically significant in predicting the relationship between the independent variables with the dependent variable,  $F=79.638>5.625$ ,  $p=0.000<0.05$ .

**Table 3: Regression Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	Sig.
	B	Std. Error			
(Constant)	0.924	0.213		4.338	0.000
Community Participation	0.833	0.202	0.616	4.124	0.000
Water Infrastructure	0.632	0.214	0.545	2.953	0.005
Project Management	0.717	0.203	0.443	3.532	0.001
Maintenance Funds	0.563	0.246	0.501	2.289	0.020

Based on the output in table 4, the following equation was established:

$$Y = 0.924 + 0.833X_1 + 0.632X_2 + 0.717X_3 + 0.563X_4$$

The regression equation indicates that holding all factors (community participation, water infrastructure, project management and maintenance funds) constant, performance of water projects in Ewaso Ng'iro north borehole projects, Isiolo County, Kenya was 0.924.

### **Community Participation**

The study also revealed that taking all other independent variables at zero, a unit increase in the community participation would lead to a 0.833 increase in performance of water projects in Ewaso Ng'iro north borehole projects. Community participation was found to be significant since  $0.00 < 0.05$ . The study found that community participation greatly influences performance of Ewaso Ng'iro North borehole projects in Isiolo County. It was revealed that execution, initiation identification and planning affects performance of Ewaso Ng'iro North Borehole Projects in Isiolo County in a great extent. These findings were in line with Katz and Sara (2008) who argued that the existence of a formal community organization that operates the system affects the overall sustainability of a water project, showing that it is significantly lower in communities that lacked such organizations.

Further, it was revealed that locally available materials and selection of sites for water facilities affect performance of Ewaso Ng'iro North Borehole Projects in Isiolo County in a great extent. These are similar to Isham and Kahkonen (2012) who found that well-designed and well-constructed water services are two significant factors for effective community-based approaches. It was revealed that monitoring and controlling, financial support and decision making affects performance of Ewaso Ng'iro North Borehole Projects in Isiolo County in a great extent. This corresponds to Wambugu (2009) who claim that the Water Project in Mwitha Primary School, Sikhendu on the slopes of Mount Elgon has given Inter-christian Fellowships' Evangelical Mission (IcFEM) the opportunity to develop a locally-run Borehole Management Committee to manage the future work relating to the borehole planned for Mwitha Primary School.

### **Water Infrastructure**

The findings also showed that a unit increase in water infrastructure would lead to a 0.632 increase in the scores of performance of water projects in Ewaso Ng'iro north borehole projects. Water infrastructure was significant since  $0.005 < 0.05$ . Further the study found that water infrastructure greatly affects the performance of Ewaso Ng'iro North Borehole Projects in Isiolo County. Further the study indicated that availability of spare affects performance of Ewaso Ng'iro North borehole projects in Isiolo County in a great extent while operational cost were found to affect performance of Ewaso Ng'iro North borehole projects in Isiolo County in moderately. These were similar to Deverill et al., (2012) who claim that the principal of offering communities a range of choices of technology should be planned carefully if it is to be successfully put into practice.

### **Project Management**

Further, the findings show that a unit increases in the scores of project management would lead to a 0.717 increase in the scores of performance of water projects in Ewaso Ng'iro north

borehole projects. Project management was also significant since  $0.001 < 0.005$ . In this case the study project management greatly affects performance of Ewaso Ng'iro North borehole projects in Isiolo County. The findings show that management set up and that team competence affects the performance of Ewaso Ng'iro North Borehole Projects in Isiolo County in a great extent. These correlates with Deverill et al.,(2012) who argue that having a clear vision, realistic objectives and identified actions is another factor that is important in enhancing ownership.

Further the findings show that constitution affect the performance of Ewaso Ng'iro North Borehole Projects in Isiolo County in a great extent. However the findings revealed that functions affect the performance of Ewaso Ng'iro North Borehole Projects in Isiolo County in low extent. This concurs with Kumar (2012) who asserts that the main indicators of likely success relate to the leadership and the capacity of the management team.

### **Maintenance Funds**

The study also found that a unit increase in the scores of maintenance funds would lead to a 0.563 increase in the performance of water projects in Ewaso Ng'iro north borehole projects. This variable was significant since  $0.020 < 0.05$ . Further the study found that maintenance funds greatly influences performance of Ewaso Ng'iro North borehole projects in Isiolo County. From the findings, the study indicated that funding agencies and government funding greatly affects the performance of Ewaso Ng'iro North Borehole Projects in Isiolo County. These were in line with Fowler, (2010) who said that the more unrestricted funds you have, the more freedom of action you have. You can choose and change the projects that you want to run and you can cover costs that donors are reluctant to fund, like core costs.

Further the respondents indicated that budgeting greatly affects the performance of Ewaso Ng'iro North Borehole Projects in Isiolo County and that water use charges moderately affects the performance of Ewaso Ng'iro North Borehole Projects in Isiolo County. These correlates with Nyong and Kanaroglou (2011) who said that project development process associates, neither as individuals nor as organizations, have any intrinsic interest in either the implementation or the outcome of the project development process, other than the interest they share in common with their host country project clients, their associates, and their stakeholder constituencies.

## **CONCLUSIONS**

The study concluded that community participation greatly and positively affects performance of Ewaso Ng'iro North borehole projects in Isiolo County. The study deduced that execution affects, initiation identification and planning greatly affects performance of Ewaso Ng'iro North Borehole Projects in Isiolo County. Further, it was also revealed that locally available materials and selection of sites for water facilities greatly affect performance of Ewaso Ng'iro North Borehole Projects in Isiolo County. The study also revealed that monitoring and controlling, that financial support and decision making moderately affects performance of Ewaso Ng'iro North Borehole Projects in Isiolo County.

Further the study established that water infrastructure positively affects performance of Ewaso Ng'iro North borehole projects. The study deduced that maintenance cost, type used e.g. solar, Gensets, and hand pump greatly affects performance of Ewaso Ng'iro North borehole projects in Isiolo County in a great extent. Further the study deduced operational costs were found to moderately affect performance of Ewaso Ng'iro North borehole projects in Isiolo County.

Further study concluded that project management greatly and positively affects performance of Ewaso Ng'iro North borehole projects in Isiolo County. The study deduced that management set up and team competence greatly affects the performance of Ewaso Ng'iro North Borehole Projects in Isiolo County. Further it was deduced that constitution greatly affects the performance of Ewaso Ng'iro North Borehole Projects in Isiolo County.

The study also concluded that maintenance funds greatly influences performance of Ewaso Ng'iro North borehole projects in Isiolo County. The study deduced that funding agencies greatly and government funding greatly affects the performance of Ewaso Ng'iro North Borehole Projects in Isiolo County. Further the study deduced that budgeting greatly affects the performance of Ewaso Ng'iro North Borehole Projects in Isiolo County and that water use charges moderately affects the performance of Ewaso Ng'iro North Borehole Projects in Isiolo County.

## **RECOMMENDATIONS**

The study recommends that the Isiolo County Government and stakeholders should allocate funding towards the development of water infrastructure especially in construction of new pipeline extensions and constructing of new water points in Ewaso Ng'iro North. The use of solar energy as an option to replace the diesel generators or a hybrid system should be explored.

The study recommends that more local technicians should be trained on operation and maintenance of generators and hand pumps. The water management committees should be trained on financial management and record keeping. This should be done by the Ministry of Environment, Water and Natural resources.

The study recommends that when water management committee are being formed, and registered, participation and membership of women should be encouraged to avoid gender discrepancy. This will ensure that everyone in the community is involvement in the water projects.

The study recommends that strict guidelines should be set to govern how the management team carries out its activities in relation to the water projects. This will encourage transparency in leadership as well as better financial management resulting to a improved performance of water projects.

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