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Women Inclusion, Technical Support, Funds and Maintenance of Handpump Operated Boreholes: Case of Kitui South Sub-County

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Abstract

Women are half of the community and they are key participants in successful projects. Involving women has also a positive impact on their position in the community. The aim of this study was to assess the effect of inclusion of women in water users' committees on level maintenance of hand-pump operated boreholes in Kitui South Sub-county. The study adopted descriptive survey research design. The target population consisted of the executive leadership of WUCs which includes chairperson, treasurer, and secretary. The population was grouped into: executive WUC officials and non-office-holder WUC members. Since the ratio of executive WUC members to non-office-holder members is 1:2, out of five executive officials (5) and at least ten (10) non-office-holder members, the researcher sampled one executive official and two committee members were picked from every ward summing the respondents to 296. Data was collected by use of questionnaire administered through drop-and pick later method. Variables data were analysed using Statistical Package for Social Sciences. A multiple regression model was used to determine the effect of women inclusion in water users' committees on maintenance of hand pump operated boreholes. Regression analysis was used to establish the relative significance of each of the variables on the effect of gender composition, community participation, technical Support and maintenance funds on maintenance of hand pump operated boreholes. The study found that maintenance of hand pump operated Kitui South Sub County was being influenced though differently by gender composition, community participation, technical support and maintenance funds. Community members are involved in project site identification, project implementation and community participation supports in project efficiency. The study concluded that maintenance of the hand pump operated boreholes could be achieved through women inclusion in the

identification, design and implementation of the water projects, enhancing the level of community participation, developing programmes that addressed technical support of the community water management committees in terms of technical and managerial aspects, and developing sustainable financing strategies for operations and maintenance of the hand pump operated boreholes in Kitui South Sub County. The study made recommendations that policy makers should also formulate policies to address financing of operations and maintenance of community water projects as the study shows that majority of the respondents indicated that there was no financial support for operations and maintenance. The ministry of Agriculture, Water and Livestock Development should factor in its annual budgets capacity building funds for committees managing community based water project committees to enhance sustainability of these projects. It is recommended that choice of technical support to be used in hand pump operated boreholes be based on maintenance costs, availability of spare parts and technical expertise required for maintenance of these boreholes. This should be regulated by the ministry in charge of water resources.

Key Words*: Women Inclusion, Community Participation, Technical Support & Maintenance Funds.*

1.1 Introduction

Globally, women are active in water supply policymaking, planning and implementation. However, women are often excluded from water management activities; this can result in the failure of water projects (Campbell & Reyes-Picknell, 2006). Research to date shows that women's exclusion from water management processes stem from top-down approaches and traditional norms and gender differences. Over recent decades, the link between gender and water resources management has become an issue of growing concern. Considerable efforts have been made to identify the role of gender in the field, as well as to empower women and their voices in the arena of water management policies. In developing countries, women are the main users of water- for cooking, washing, sanitation and family hygiene (Aureli & Brelet, 2004). Women could play a key role in water management as major stakeholders in the process of policymaking, planning and implementation, but are often excluded and regarded as merely the recipients (Singh, 2004).

According to (WaterAid, 2010a), involving women has also a positive impact on their position in the community. Further, women's status in managing domestic water supplies is one of the clearest indicators of infrastructure having a gender impact. Water is not used only for drinking but also for food preparation, care of domestic animals, personal hygiene, cleaning and washing, which are women's tasks in many cultures (Coates, 2007). Regular maintenance decreases problems, which affects massive cost of repairs. In order that preventive maintenance can be done, quality spare parts have to be available (Parry-Jones, 2001).

Cleaning the pump-stand does not require special skills but checking the pump regularly and doing small repairs already require basic skills, so all caretakers must be trained. In addition to caretakers, users, especially children, should be trained (Bredero, 2003). Promoting women's access to the basic maintenance skills will enable them not only to exchange their knowledge, ideas and experiences but also to improve their co-operation. Moreover, training women and girls in the ethics of water use is not only essential but crucial for the generations to come. Technology is necessary but not sufficient for maintenance of hand-pump operated boreholes. In many countries the relationship between women and water is a complex issue that can best be tackled by a multidisciplinary approach including social sciences, cultural and ethical aspects (Edgard, 1997).

Hand-pump- maintenance management is important because it is a major production cost; if too expensive, hand-pump, like any plant shuts down into a period of down time. Downtime is unproductive time caused by lack of pump maintenance due to lack of repairers, spare parts or technical know-how. Pump- maintenance, therefore, keeps the pump as an asset performing to the standard that is required by end-users. The aim is to maximize services (clean water supply) and minimize input of resources (financial, human and physical) thus providing the best value to end-users as well as the funders (Campbell & Reyes-Picknell, 2006).

In most developing societies, women are the most vulnerable group with respect to water issues because they are in charge of providing clean and safe water for their households (Buckingham, 2000). In developing countries, millions of women and young girls must walk long distances to fetch water to meet their households' water needs (UNDP, 2006). This drastically limits women's participation in productive economic activities and decreases girls' rates of school attendance (Coles & Wallace, 2005). Also, previous studies point out that policy constraints and gender inequalities remain common in water-related development projects, resulting in low sustainability of conventional water supplies at local levels (Ademun, 2009; Svahn, 2011).

1.2 Statement of the problem

Most of the water projects in Kenya have been performing dismally with most becoming non-operational or requiring rehabilitation. 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). In Kenya, it is quite a common phenomenon to observe non-functional water projects in most parts of the country (MWI, 2011).

Currently, there seem to be low level performance of water projects in Kitui South Sub-county in Kenya, resulting from low levels of ownership at community level. This is manifested in some water project such as those in Kitui south; hand-pump operated boreholes being non-operational after very few years of operation while even those in operation require some form of repairs and/or rehabilitation. 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 reveals 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).

According to Wanjala (2009), women are not empowered to participate in water resource management and there are other numerous reasons which include poverty, education, cultural beliefs and gender inequality which make women passive to become involved in water management. It is imperative to understand these gender roles, and develop action plans to reduce any negative impacts of these differences. It is important that rural water supply projects present communities in Kitui South Sub-county with a true water infrastructure choice and that they are made aware of the financial and managerial implications of each possible option. If a water supply system is not maintained it is because it is too complicated, not "attractive" or too expensive (Holtslag, 2012). The relationship between inclusion of women and maintenance of hand-pump operated boreholes is inconclusive and quite contradicting. This is despite the fact that inclusion of women and other factors are being recognized as central drivers of performance and

sustainability of projects. Due to the gaps identified in previous research and lack of consensus in findings from previous studies, the need for further study in this area is identified. Hence the study sought to establish on effects of women inclusion on maintenance of hand-pump operated boreholes in Kitui South Sub-county.

1.3 General Objectives

The broad objective of this study was to assess the effects of women inclusion on maintenance of hand pump operated boreholes in Kitui South Sub-county

1.3.1 Specific Objectives

The study was guided by the following specific objectives:

i. To establish effect of gender composition of water user's committee on maintenance of hand-pump operated boreholes in Kitui South Sub-county
ii. To determine the effect of community participation on maintenance of hand-pump operated boreholes in Kitui South Sub-county
iii. To investigate the effect of technical Support on maintenance of hand-pump operated boreholes in Kitui South Sub-county.
iv. To assess the influence of maintenance funds on maintenance of hand-pump operated boreholes in Kitui South Sub-county.

1.4 Justification of the study

This study makes useful contribution in filling the research gap and providing information on the link between inclusion of women in water users committees and maintenance of hand-pump operated boreholes in Kitui South Sub-county and other counties. Knowledge was also added into the already existing resources. The findings of this study makes contribution to policy and practice by assisting the County Governments when developing policy to manage community water projects. This study makes significant contribution in policy development, improving effectiveness and efficiency, driving investments, increasing consumer satisfaction and leading to improved maintenance and performance of community water projects. This study makes contribution in helping private and public project managers in Kenya to evaluate the effect of inclusion of women in management of hand-pump operated boreholes.

2.1 Literature Review

2.2 Theoretical Review

2.2.1 Alternate Approach Model Theory

The alternate approach model is based on fundamental ideas that implementation of gender mainstreaming needs new perspectives, knowledge, innovative ways of project facilitation and employing of current methodologies so as to improve operations. This means that gender mainstreaming is refocused in operations based on the experiences of implementation. The alternate operation model emphasizes that gender mainstreaming can be successful if strategies and policies are re-examined (Kirima, 2012). This model requires actors to be strategic at every stage of the development process.

The first step is establishment of the development issue that needs to be worked on. It needs identification and subsequent acting on the opportunity that is most likely to yield tangible results to the target population. One main advantage of this approach is that gender mainstreaming issue

is already relevant. It requires neither approval nor effort in convincing stakeholders of its importance. Another main advantage of the strategic approach is that it facilitates in ordering of priorities for gender-based input as well as intervention (Lee, 2016). The issue is then selected and gender expertise is required to lay out a course of action. The gender expert should specialize in the sector so that they can gain credibility with sector specialists. The course of action is then determined in line with the broader operational goals and the expert is required to offer technical assistance with regard to mainstreaming project affairs. Gender experts are required to design monitoring and evaluation systems and to document outcomes. After the completion of the project, gender expertise is required for documenting results strategically and effectively.

The documentation is crucial for filling the existing gap in knowledge of gender mainstreaming operations (Kirima, 2012). Appropriate finances are then allocated for the completion of the projects and ensuring that resources are available to fund components and activities deemed crucial for the success of gender mainstreaming. The finances are also required to ensure the necessary expertise is available for the operations. As gender mainstreaming becomes successful, accountability is very important and outcome indicators are needed to assess whether the project goals have been met and the extent at which the social and economic conditions and well-being of target populations have improved. Ultimately, leadership is the most important and critical aspects of the model to garner the resources required and ensure that gender mainstreaming projects are carried out effectively (Kirima, 2012). The researcher is making use of these models as they integrate all the necessary elements required for effective gender mainstreaming. The models are vital for the study's theoretical framework to outline and analyze the expected results as pertains to gender mainstreaming. The models have been selected as they outline better framework for analyzing factors that affect gender mainstreaming in maintenance of hand-pump operated boreholes.

2.2.2 Stakeholder Theory

Stakeholder theory was developed and championed by Edward Freeman in the 1980s. The stakeholder approach has been described as a powerful means of understanding the firm in its environment (Oakley, 2013). The Freeman Model (1984), has some strengths and limitations when applied to drinking-water project practices. The Freeman (1984) model focuses on stakeholder relationship and classifies internal or external stakeholders (Achterkamp & Vos, 2008). The Freeman Model (1984) also highlights stakeholder relationship and influence (PMI, 2008; & APM, 2006). The model situates stakeholder influence at the center of the business success. Freeman (1984) proposes a project as a business firm with a nexus of contracts with several stakeholders who form part of the firm's environment-and that, indeed, may have some impact on its activities and its stake in the firm itself (Freeman, 2004). Internal stakeholders are those who have a direct impact upon the project cost, schedule and scope. Examples of internal stakeholders in the drinking water framework include: the project team, sponsors, funders and the project managers.

External stakeholders are those who indirectly affect project operations and examples of these include customers (end-users) and supply chain team (hand-pump spare part vendors). External stakeholders are not part of the direct business operations (Freeman, 1984). Freeman argues that because these stakeholders exist outside the project operations, the project manager had no obligation to consult them although the project managers have to pay close attention to their actions, needs and demands, which may be rare in social projects. Freeman also increases the scope of stakeholder definition to include those who influence the operations within the project by virtue

of their interest in its activities even though they are not part of the business environment and might not be directly affected by the operations in the project.

The stakeholder theory can contribute to understand projects by highlighting the importance of consideration of the stakeholders during planning, whether due to moral value for considering them or due to their influence on the project (O'Halloran, 2014). It has a potential to assist in identifying the stakeholders including who and what they affect. It can also assist to classify the stakeholders as internal and external, primary, and secondary, or based on evaluation of their influence and importance towards the project (Menoka, 2014). However, the theory does not give a clear guidance on how to exactly understand the settings and implementation, thus various frameworks of stakeholder theory exists that assist to achieve this (Adan, 2012). Even though the theory holds the potential to identify and group stakeholders, other authors argue that grouping approach of the theory widely focuses on heterogeneity across groups than within groups hence resulting in false perceptions on some of the groups and their members (Wolfe & Putler, 2012).

2.2.3 Community Participation Theory

Community Participation Theory was propounded by Khwaja in 2014. 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 constrains. 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 & 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 the effect of inclusion of women in level maintenance of hand-pump operated boreholes.

2.2.4 System theory

Systems theory was originally proposed by Hungarian biologist Ludwig Von Bertalanffy in 1928 (Kast & Rosenzweig, 1972; Scott, 1981; Olum, 2004). The foundation of systems theory is that all the components of projects in an industry are interrelated, and that changing one variable might affect many others, or if one sub-system fails, the whole system is put in jeopardy. Projects are viewed as open systems, continually interacting with other environmental factors.

Hartman et al., (2010) observed that all organizations consists of processing inputs and outputs with internal and external systems and subsystems, which is helpful in providing a functional overview of any organization or project. This theory views an organization/project as a social

system consisting of individuals who cooperate within a formal framework, drawing resources, people and finances to produce products. Involvement of all stakeholders will ensure efficient and effective management of their projects and other resources for maximum outputs.

2.2.5 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, 2014). 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, Ketchen & Wright, 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 et al., 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 (2009), 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).

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.

2.3 Empirical Review

2.3.1 Gender composition and maintenance of hand-pump operated boreholes

Gender is commonly associated with unequal power as well access to choices and resources. The different positions of women and men are influenced by various factors including historical, economic, religious and cultural realities. These relations and responsibilities can and do change over time. It has become increasingly acceptable that women should play an important role in water management and that this role could be enhanced through the strategy of gender

mainstreaming (Lundqvist, 2004). Female membership of WUCs can provide a proxy measure for women's involvement in water management. However, WUC membership does not guarantee women's active involvement in decision-making (Kilsby, 2012; World Health Organization, 2012). Even when national policies and affirmative action support women's participation in water management, there are often obstacles to their meaningful rather than tokenistic representation (Kilsby, 2012; World Health Organization, 2012).

Recent studies have suggested that men and women have different interests in the management and use of water resources. The two genders obtain different benefits from the resources. When there is poor sanitation, water and food scarcity, girls, and women become the major victims. As such, they are most committed to ensuring that water resources are managed in a sustainable way. This attests to the fact that when people influence or control decisions that affects them, they have a greater stake in the outcomes and are committed to ensuring success. Participation of both genders, therefore, would produce more efficient and more sustainable water plans, projects, and programs.

However, despite the common and universal use of water, there are notable gender differences. Specifically, men and women may have different water uses and this rests mostly on the established and the culturally or socially embedded gender roles. According to Upadhyay and International Water Management Institute (2004), men and women have different uses of water based on ascribed gender roles. Household water needs rank high for women compared to men. This is attributable to women's domestic gender roles including cleaning and maintaining household hygiene. Supplying water for household use is a major role vested on women as they often collect, use and manage water as household level (Lusuva 2009). Women often visit water sources to fetch and supply water for use in domestic chores and this role and water use has been used to demonstrate women's centrality in water resources management (Mkandla, 2004). Men on the other hand use water mostly for livestock. Especially in pastoralist and nomadic communities, men are responsible for looking after livestock and move from one to another in search of water and pastures (Morara, MacOpiyo & Kogi-Makau, 2014).

Assessing whether women hold key posts in the committee may provide a better indication on their level of participation in decision-making. It is generally assumed that, since women are the main beneficiaries of water service delivery, they have a vested interest in its success, and their involvement in management decision-making will lead to better performance. By improving the participation of women in water management, including in key posts, it is believed that water programmes and policies will be more efficient and effective (Carrard *et al*., 2013). While there has been no systematic review on the subject, studies from Africa, Asia, and Latin America appear to support this hypothesis (Foster, 2013; Whalen & Belo, 2013). It is also reported that women's involvement in water management enables them to develop confidence, self-reliance, and leadership skills and to gain more power and respect in the community (United Nations Department of Economic and Social Affairs, 2005; Fisher, 2006; Aladuwaka & Momsen, 2010; Kilsby, 2012; Carrard *et al*., 2013).

The role of women in the construction and maintenance of water and sanitation facilities varies from fundraising to active work on construction, preventive maintenance and repairs, to paying for water with work (Harvey & Reed, 2013). Thus, even where women have been trained as pump mechanics or caretakers, they are usually expected to begin this work voluntarily whereas men get paid for the same job. Many African countries now have positive policies towards women's participation in the maintenance of the water well. Nevertheless, while the woman is an official

member of the water committee, the husband might undertake all the duties. The solution is that the communities are allowed to build on their own judgements of roles and responsibilities, and women are given the opportunity to reach technical and facilitation skills (Parry-Jones, 2001).

Existing studies have shown that social and cultural factors, including gender inequalities and lack of decision-making power, inhibit the participation of women in water resources management (Ademun, 2009; Svahn, 2011). Further, Ockelford and Reed (2012) intimate that having the right core team can make or break a project and therefore, the community must take care when selecting the team members. The elements to consider include: overall team composition, team selection criteria, team size and the process for selecting team members. On team composition, they indicated that a well-rounded team includes a mix of people and skills. According to Harvey and Reed (2013), participation of women in water project management provides an effective means to mobilize resources, to tap knowledge and energy, and above all provides legitimacy to the project or activity, and promotes commitment and ownership, and thus sustainability.

Water Project Sustainability is a desire of every community, private agency or Government as a means of ensuring that positive gains are delivered to the target communities in long term (Ongw'en, Kyalo, Mulwa & Matula, 2014). The findings of the study revealed that both men and women were involved in leadership with more men (88%) in local leadership and more women (65%) in project leadership. Almost all Community Water Users (CWUs) as well as the leaders were employed with the highest percentage in self-employment thus able to contribute towards repair and maintenance of Community Water Projects (CWPs) in monetary terms. The study also revealed that, of the four factors under study, (Community Participation, Community Training on water Technology used and Community Capital Contribution) community participation influenced sustainability of CWPs in Shianda Division to a very great extent (80.6%) and project location though an important factor to consider for CWP s sustainability, its influence was the least (41.3%).

2.3.2 Community participation on maintenance of hand pumps operated boreholes

Mahama and Badu-Nyarko (2014) supported this through their findings in the study carried out in Ghana which established that involvement of community members from planning of water projects to utilization level led to community empowerment. The community members were enabled to take total control, ownership, maintenance and sustainability of the water supply facilities. The best way community can take control of their project was through contribution of resources so as to have a stake in the community project. In a study on factors influencing community participation in project planning in Kenya, Kamuiru (2014) observed that community support for the project is an important ingredient in determining the success of the project. The contribution of unpaid labour by the community to projects, was widely accepted as the only way most low income communities participated in development initiatives. Labour contribution was a form of equity contribution to development initiatives. Most development partners believed that, as long as local community volunteer labour, "acceptance" of the project was guaranteed as well as full participation by the community.

According to Beyene (2012), in his study the sustainability of rural water supply projects in Ethiopia, in Mecha Woreda, only one of the 21 (5% percent) of water projects initiated without community support was still functioning. In contrast, only 12 of the 142 (93 percent) of the water projects initiated with community involvement failed. The reasons of abandonment of dug wells and boreholes, despite full participation of communities initially during planning and implementation, was very weak institutional support of the water supply projects due to

understaffing of the Woreda office. Another reason was lack of proper maintenance of the initiated water projects.

Yerian *et al*, (2014) observe that women and men of different socio-economic and cultural categories have different needs, interests, and means in the use, development, and management of freshwater resources. Hence, principles for integrated water resources development and management need to be specified according to the interests which such categories have, the roles they do and should play and the impacts which changes in water use and management have on them. In other words, each principle has to be understood in the context of what it means for poor and less poor men and women with different ages, economic roles and ethnic and religious backgrounds.

2.3.3 Technical Support on maintenance of hand-pump operated boreholes

Kipkeny (2014) in his study to determine the factors affecting sustainability of hand pump operated shallow wells in Garissa Sub-County. The study found out that trained artisans are not available as reported by 77.04%. In conclusion hand pump operated shallow wells can be effectively and efficiently managed by the community established structures with increased functionality and sustainability with adequate capacity building of community institutions, technical support and effective financial management with minimal external supported from the government and other external actors. There is need to strengthen the capacity of the management committees through training on management, operation and maintenance of the shallow wells and established effective networks and supply chains for the spare parts. Furthermore, the National and County Government should develop policy for rural water supply and development to ensure clear systems are place to support the water supply systems and rural water supply.

The study by Ghaffour, Missimer and Amy (2013) in their study on technical review and evaluation of the economics of water desalination: current and future challenges for better water supply sustainability. They noted that the majority of water supply agencies have introduced a two-tier management system. This has limited success because communities lack support from the district level to carry out major repairs. The technology that water supply agencies are promoting was considered to be appropriate as it is easy to handle by rural communities. Communities are able to operate and maintain India Mark II hand pump because it is simple to handle; and spare parts are readily available. However, all communities did not have a say in the technology they are using because it was predetermined at national level. The proliferation of different technologies, some without a backup of spare parts, led to the government and other stakeholders to standardize India Mark II hand pump as the most appropriate technology for rural areas. All communities have not been prepared for the discontinuation of heavy subsidization of spare parts because of high poverty level in rural communities. The study found out that communities are having problems meeting the cost of subsidized spare parts, let alone unsubsidized spare parts.

Ghaffour, *et al*. (2013) concludes that the type of water supply system influences communities 'ability to sustain it because rural communities can only handle less complex water supply systems. Some water supply systems are complex and require specialized technical capacity to handle meaning that incase of any destruction in the water system then the community will go without water for a long time as they try to seek for experts to come and due repairs. In any case most of the technicians do not come from the local village/community and have to be sourced from far (Ghaffour, *et al*., 2013).

2.3.4 Maintenance funds and maintenance of hand-pump operated boreholes

Riziki, Atera and Juma, (2019) conducted a study investigated the influence of resource mobilization on sustainability of community water projects in Kakamega County, Kenya. Explanatory survey design was used to explain hypothesized relationships. The study targeted 474 respondents from 237 registered community water projects (registered community boreholes) in Kakamega County, Kenya. From a target population of 474 respondents, a sample size of 217 was calculated as per Taro Yamane's proportional sampling technique formula. Primary data was collected by means of self-administered structured questionnaires. Collected data was coded, cleaned, tabulated and analyzed using descriptive and inferential statistics with the aid of specialized Statistical Package for Social Sciences, version 24. From the values of unstandardized regression coefficients with standard errors in parenthesis, the independent variable; resource mobilization was significant predictors of sustainability of community water projects (dependent variable). The study concluded that resource mobilization significantly influences sustainability of community water projects in Kakamega County.

3.1 Research Methodology

3.1.1 Research design

Descriptive research design was used in this study. Descriptive survey is design that has a phenomenon or the characteristics associated with a subject population which stipulates answering who, what, where, when and how. This is because it makes use of both qualitative and quantitative data to describe the state of affairs as they exist in the field. This design is simple and easy to execute yet can yield convenient information needed by the study (Muijs, 2004). Descriptive studies are more than mere data collection; they involve measurement, classification, analysis, comparison and interpretation of data (Kothari, 2008). Detailed information can be gathered by subjecting the respondents to a series of items in a questionnaire or interview schedule. Descriptive survey design is also useful in the collection of original data from a population which is too large to observe directly.

3.1.2 Target population

Target population refers to the entire group of individuals or objects to which researchers are interested in generalizing the conclusions (Amin, 2005; Cooper & Schindler, 2014). According to Mugenda and Mugenda (2008), the entire group that a researcher has interest in or would wish to make conclusions from is what is referred to as the population whereas sample population is a set of people or cluster that have similarities in characteristics. The executive leadership of WUCs consists of chairperson, treasurer, and secretary. Chairperson and Secretary have deputies while office of the treasurer has only one person. This study involved both the executive WUC members and non-office holder members. This is because all water committee members are key in ensuring maintenance of hand-pump operated boreholes.

Kitui South Sub-county has 86 functional bore holes with active WUCs within all the six wards. This was according to data obtained through the support of United States Agency for International Development (USAID) sustainable Water, Sanitation & Hygiene (WASH) systems learning partnership in Kitui South Sub-county water audit conducted in November and December, 2017. Each WUC consists of five (5) officials ten (10) committee members making a total of fifteen (15). This sums the population to 1290 WUC members in Kitui South Sub-county.

3.1.3 Sample and Sampling technique

Stratified random sampling was used to select the required samples from the population. This technique divides the elements of the population into small subgroups (strata) based on the similarity in such a way that the elements within the group are homogeneous and heterogeneous among the other subgroups formed. The elements are then randomly selected from each of these strata. This method involved the selection of elements from grouped data (Black, 2004). The population was grouped into: executive WUC officials and non-office-holder WUC members. The method ensured that all WUC members in each group had a known and equal probability of being selected. This involved the procedures applied to get the representative sample from the target population. Thus, since the ratio of executive WUC members to non-office-holder members is 1:2, out of five executive officials (5) and at least ten (10) non-office-holder members, the researcher sampled one executive official and two committee members who were picked from every ward.

In line with (Mugenda and Mugenda, 2008), the model that was used for selecting the sample from the target population is:

$$\mathbf{n = (z^2pq)/d^2}$$

Where: n = the desired sample size when the target population is > 10,000

z = standardized normal deviations at a chosen confidence level, for instance, if the confidence level is 95% then z = 1.96

p= the proportion of the target population that assumes the characteristics being sought. In this study, the optimal 50:50 basis is assumed.

q = The balance from p to add up to 100%. That is 1-P, which in this case yielded 1- 50% (0.5)

d = the appropriate significance level, for instance at 95% confidence, the level of significance is 0.05.

As such the sample size for this study was found to be:

$$\mathbf{n = (1.96^2 \text{ X } 0.5 \text{ X } 0.5)/0.05^2 = 384}$$

Since the target population in this study was less than 10,000, the sample of 384 was adjusted using the formula $\mathbf{n_f = n/ (1+n/N)}$ where $\mathbf{n_f}$ is the desired sample size when sample size is less than 10,000 and n is the sample size when the target population is more than 10,000 while N is the target population from sampled size (Mugenda & Mugenda, 2008). Accordingly, this summed the sample;

$n_f = n/(1+n/N) = 384/ (1+384/1290) = 296$ respondents.

3.1.4 Data Collection Instruments

Cooper and Schindler (2014), state that data collection methods refer to the process of gathering data after the researcher has identified the types of information needed which is, the investigative questions the researcher must answer, and has also identified the desired data type such as nominal, ordinal, interval, or ratio for each of these questions and also ascertained the characteristics of the sample unit that is, whether a participant can articulate his or her ideas, thoughts, and experiences. The closed ended questions were structured on a 5 (five) point likert scale with options ranging from not at all to a great extent answer options for the respondents to choose from. Open ended questions required the respondent to answer the questions in their own words through their own their opinions and perspectives.

The study used primary data sources. Primary data were obtained from the selected respondents of the research project. Primary data was collected through questionnaire. The study was quantitative in nature. Quantitative data was obtained through close-ended questions (Cooper & Schindler, 2014).

3.1.5 Data collection procedure

The researcher sought the permission/authorization to collect data from Kitui South sub-county water office. Permission was given in the form of a consent letter after the office considering an introductory letter of the researcher from the Management University of Africa as well as research license for the National Commission for Science, Technology and Innovation. To enhance the response rate, the study put into consideration research ethical issues. As a first step, the researcher explained to the respondents the importance of the study (that is for academic purpose) and, thus, gets informed permission from the respondent to proceed with data collection. The researcher assured the respondents of the confidentiality and anonymity of their identities. Data was collected by use of questionnaire administered through drop-and pick later method. One set of the questionnaire per respondent was administered.

3.1.6 Data Processing and Analysis

Qualitative data from open-ended questions was analysed using conceptual content analysis. The data collected in this study was organized and classified based on the research design and the problems formulated. The data was coded, tallied and tabulated to facilitate the presentation and interpretation of results using the following: The percentage and frequency distributions were used to classify the respondents and presented the actual response of the respondents to a specific question or item in the questionnaires.

Quantitative data was analysed using Statistical Package for Social Sciences. A multiple regression model was used to determine the effect of women inclusion in water users' committees, effect of technical support, effect of community participation and effect of maintenance funds on maintenance of hand pump operated boreholes. The objectives were met by computing the regression analysis of the variables. Correlation analysis measured the strength of the relationship between the independent and dependent variables. Regression analysis was used to establish the relative significance of each of the variables on the effect of gender composition, Communication Participation, Technical Support and maintenance funds on maintenance of hand pump operated boreholes.

Regression model

$$Y= \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \mu i$$

Where;

Y= is Maintenance of hand pump operated boreholes

β_0, β_1, β_2, β_3, β_4 = regression coefficients

X_1 = Gender composition

X_2 = Community Participation

X_3 = Technical Support

X_4 = Maintenance funds

μi - Constant errors

4.1 Results and Findings

4.1.1 Questionnaire Return Rate

The study targeted a sample size of 296 WUC members in Kitui South Sub-County from which 249 filled in and returned the questionnaires making a response rate of 87.06%. This response rate was satisfactory to make conclusions for the study. Weisberg, Krosnick & Bowen (1996) recommended a response rate of 70%. According to Mugenda & Mugenda (2003), a response rate of 50 percent is adequate for analysis and reporting; a rate of 60 percent is good and a response rate of 70 percent and over is excellent. Based on the assertion, the response rate was considered to be excellent.

4.1.2 Effect of Gender Composition on Maintenance of the Hand Pump Operated boreholes

The study also sought to establish the respondents' opinion on various statements on gender composition of water users committee and its influence on the maintenance of the hand pump operated boreholes. From the findings in the SPSS analysis, the statement Our community is gender biased had the highest level of mean (4.65) meaning that majority of the respondents strongly concurred that their community was gender biased. The standard deviation calculated from the analysis of 0.984 indicated uniformity in the responses from the respondents. The study also noted that a great number of the respondents disagreed that Women are considered essential in management of community-based water Projects. This was supported by the mean value calculated of 2.52.

The statement also calculated a standard deviation of .458 which also indicated that there was little variance from the mean mark. A significant number of the respondents also disagreed Women are treated well in community-based development projects. This was inferred from the mean value calculated in the analysis of 2.15**.** The standard deviation of 0.325 calculated in the SPSS which was <1.5 indicated that majority of the respondents were of a similar opinion. The study also established from the descriptive statistics that women's ideas are not taken into consideration in my community. This was noted from the mean calculated of 2.32.

The standard deviation calculated of .584 indicated uniformity in the responses from the respondents. Also noted was that majority of the respondents concurred that there are women who hold executive positions in the water users committees. This was inferred by the high mean calculated of 4.13. The standard deviation calculated of .684 indicated uniformity in the responses from the respondents. The study also noted was that majority of the respondents disagreed that women get the same support as that of men in the community. This was inferred by the high mean calculated of 2.11. The standard deviation calculated of .025 indicated uniformity in the responses from the respondents. The study also established that culture has influenced negatively women's participation in the water projects. This was seen true by the mean calculated of 4.01 and the standard deviation .234 which indicated little deviation from the mean. Generally, it was clear that there is poor gender composition of water users in Kitui South Sub County.

4.1.3 Effect of Community Participation on Maintenance of the Hand Pump Operated boreholes

The study sought to establish the respondents' opinion on various statements in relation to community participation and the maintenance of the hand pump operated boreholes in the community. Based on the responses from the respondents, it was clear that most respondents strongly agreed that Community participation and support increases project efficiency. This inference was realized due to the high mean value calculated in the analysis of 4.79. The standard deviation .109 was in support of the study as it indicated little variation from the mean mark. It was established from the analysis that most respondents strongly agreed that community members are involved in Project implementation. This was established by the high mean value calculated of 4.33.

The small standard deviation calculated indicates uniformity in the responses from the respondents. It was also established that Community members are involved in Project site identification. This was seen true by the high mean value calculated in the descriptive analysis of 4.26. The standard deviation calculated in the analysis of 0.212 indicated little variance from the mean mark in the responses. Also noted from the analysis of findings was that majority of the respondents indicated that Community members are involved in Project Management. This was inferred from the mean calculated of 3.98. The standard deviation calculated of .791 indicated little deviation from the mean. From these findings, the study established that there was a significant level of community participation in the identification, design, implementation and management of the hand pump operated boreholes in Kitui South Sub County.

4.1.4 Effect of Technical Support on Maintenance of the Hand Pump Operated boreholes

The study also sought from the respondents, their level of agreement on the effect of technical support on the hand pump operated boreholes in the community. From the analysis of the descriptive statistics, it was clear that most respondents believed that technical support had a significant influence on the maintenance of the hand pump operated borehole projects in Kitui South Sub County. This was noted by the responses made from the respondents of statements related on statement relative to technical support. For instance, it was noted that majority of the respondents strongly agreed that the equipment's spare parts are locally available. This was seen by the high mean value calculated of 4.55. The standard deviation calculated of 0.58 indicated that majority of the respondents were of a similar opinion. It was also noted that respondents agreed that the procured equipment's spare parts are available at an affordable price. This inference was established by the mean of 4.51.

The small standard deviation of 0.58 indicated that there was little variance in the responses from the respondents. Also noted was that most respondents agreed that there are adequate trained personnel to manage the project. This was noted true by the mean calculated on the statement of 4.26. The standard deviation calculated in the study of 0.87 indicated little variation from the mean mark. The study also noted that majority of the respondents agreed that there are available training opportunities for new members of water users committee members on the hand-pump operated boreholes. This was seen true by the mean calculated of 4.67. The standard deviation calculated of .324 indicated uniformity in the responses from the respondents. Generally, it was evident that technical support plays a significant effect in the maintenance of the hand pump operated boreholes.

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4.1.5 Effect of Maintenance Funds on Maintenance of the Hand Pump Operated boreholes

The study also sought to establish the respondents' opinion on questions relation to maintenance of funds and management of the hand pump operated boreholes in the community. From the findings in the SPSS analysis, the statement; water user committees maintain good financial record had the highest level of mean (4.89) meaning that majority of the respondents strongly concurred that the water user committees maintain good financial records. The standard deviation calculated from the analysis of 0.109 indicated uniformity in the responses from the respondents. The study also noted that a great number of the respondents agreed that the community surrounding water facility is involved in raising funds for the water facility. This was supported by the mean value calculated of 4.33. The statement also calculated a standard deviation of .422 which also indicated that there was little variance from the mean mark. A significant number of the respondents also agreed that the hand-pump spare parts are locally available at affordable price. This was inferred from the mean value calculated in the analysis of 4.14**.** The standard deviation of 0.548 calculated in the SPSS which was <1.5 indicated that majority of the respondents were of a similar opinion.

The study also established from the descriptive statistics that there are adequate trained personnel to manage the project funds. This was noted from the mean calculated of 3.91. The standard deviation calculated of .458 indicated uniformity in the responses from the respondents. Also noted was that majority of the respondents concurred that the hand pump was properly installed for easy maintenance. This was inferred by the high mean calculated of 3.65. The standard deviation calculated of .577 indicated uniformity in the responses from the respondents. The study also noted that majority of the respondents agreed that they have a steady income in form of formal employment or self-employment to support the water project. This was inferred by the high mean calculated of 3.99. The standard deviation calculated of .177 indicated uniformity in the responses from the respondents. Generally, it was clear that there was maintenance funds in the maintenance of the hand operated boreholes.

4.2 Inferential Statistics

The study sought to determine the relationship between the predictor and dependent variables. The factors under investigation were: Gender composition, community participation, technical support and maintenance funds. The regression model was:

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

Where;

α = Constant

Y = Maintenance of the hand pump operated boreholes

X_1 = Gender composition

X_2 = Community Participation

X_3 = Technical Support

X_4 = Maintenance Funds

ε = Stochastic disturbance error term

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Journal of Public Policy & Governance
Volume 3||Issue 2||Page 22-42 ||October||2019|
Email: info@stratfordjournals.org ISSN: 2616-8413

Multiple Regression Model Validity

The study sought to determine the ANOVA used to present regression model significance. The findings are presented in Table 1.

Table 1: Model Validity

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.304	4	1.576	38.801	.000[b]
	Residual	10.004	244	.041		
	Total	16.308	248			

a. Dependent Variable: Maintenance of the hand pump operated boreholes

b. Predictors: (Constant), gender composition, community participation, technical support, maintenance funds.

The study sought to investigate the multiple regression model whether it was valid or not. The F statistics was used to determine the model validity. The study found out that the model was valid $F_{(4, 248)} = 38.801$, $P<0.001$. Therefore, this implies that all the four predictor variables are good in explaining variation in the maintenance of the hand pump operated boreholes.

Multiple Regression Model Summary

The study sought to determine the model's goodness of fit statistics. The finidngs are presented in Table 2.

Table 2: Model's Goodness of Fit Statistics

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.834[a]	.696	.684	.202

The coefficient of determination as measured by the R-square (R^2) (69.6%) shows that all the four predictor variables explain 69.6% of the total variation. This implies that the stochastic disturbance error term (ε) covers 30.4%.

Multiple Regression Variable Coefficients

The study sought to determine the multiple regression variable coefficients. The findings are presented in Table 3.

Stratford Peer Reviewed Journals and Book Publishing
Journal of Public Policy & Governance
Volume 3||Issue 2||Page 22-42 ||October||2019|
Email: info@stratfordjournals.org ISSN: 2616-8413

Table 3: **Multiple Regression Variable Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	2.772	.702		3.951	.000
Gender Composition (X_1)	.225	.106	.136	2.124	.036
Community Participation (X_2)	.462	.027	.434	2.305	.023
Technical Support (X_3)	.262	.125	.192	2.089	.039
Maintenance Funds (X_4)	.594	.060	.953	9.940	.000

a. Dependent Variable: Maintenance of the hand pump operated boreholes (Y)

From the model, when other factors (Gender composition, community participation, technical support, maintenance funds) are at zero, Maintenance of the hand pump operated boreholes would be 2.772. Holding other factors constant, a unit increase in gender composition would lead to 0.225 (p=.036) increase in Maintenance of the hand pump operated boreholes. Holding other factors constant, a unit increase in community participation would lead to 0.462 (p=.023) increase in Maintenance of the hand pump operated boreholes. Holding other factors constant, a unit increase in technical support would lead to 0.262 (p=.039) increase in Maintenance of the hand pump operated boreholes while when other factors are held constant, a unit increase in maintenance funds would lead to 0.594 (p=.000) increase in Maintenance of the hand pump operated boreholes

5.1 Conclusions

The study found that maintenance of hand pump operated Kitui South Sub County was being influenced though differently by gender composition, community participation, technical support and maintenance funds. Community members are involved in project site identification, project implementation and community participation supports in project efficiency.

The study concluded that maintenance of the hand pump operated boreholes could be achieved through women inclusion in the identification, design and implementation of the water projects, enhancing the level of community participation, developing programmes that addressed technical support of the community water management committees in terms of technical and managerial aspects, and developing sustainable financing strategies for operations and maintenance of the hand pump operated boreholes in Kitui South Sub County.

6.1 Recommendations

The study makes the following recommendations;

Policy makers should also formulate policies to address financing of operations and maintenance of community water projects as the study shows that majority of the respondents indicated that there was no financial support for operations and maintenance.

The ministry of Agriculture, Water and Livestock Development should factor in its annual budgets capacity building funds for committees managing community based water project committees to enhance sustainability of these projects.

It is recommended that choice of technical support to be used in hand pump operated boreholes be based on maintenance costs, availability of spare parts and technical expertise required for maintenance of these boreholes. This should be regulated by the ministry in charge of water resources.

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