FACTORS INFLUENCING COMMUNITIES' ADOPTION OF SAND DAMS PROJECTS TECHNOLOGY: THE CASE OF EKALAKALA SUB CATCHMENT, MACHAKOS COUNTY, KENYA

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DECLARATION

This research project report is my original work and has not been presented for a Degree in any other University.

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DEDICATION

This work is dedicated to my father Mr. John Musyoki, my late mother, Mary Kalekye Musyoki, my wife Purity and Children Jacqueline, Ida and Boniface.

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ABBREVIATIONS AND ACCRONYMS

IDT	Innovation Diffusion Theory
PBC	Perceived Behavioural Control
SN	subjective norm
TAM	Technology Acceptance Model
TPB	Theory of Planned Behaviour
TRA	The Reasoned Action
UTAUT	Unified Theory of Acceptance and Use of Technology
UCRT	The Ujamaa Community Resource Team
WARIS	Water Regulation Information System
WASREB	Water Services Regulatory Board
WRMA	Water Resources Management Authority
WRUAs	Water Resources Users' Associations
WSB	Water Services Board
WSPs	Water Service Providers
WSTF	Water Services Trust Fund

ABSTRACT

Despite the fact that the Government of Kenya and donors have been implementing sand dams in Kenya, the adoption of these projects by the local communities has been minimal, adversely affecting the sustainability of the dams. The failure to allow the communities to participate has significantly eroded commitment by the beneficiaries to safeguard the water facilities, which has compromised the sustainability of such schemes. The local communities have therefore refused to adopt the water projects to the extent of being unwilling to contribute to the cost of operation and maintenance, which has highly threatened the water supply projects. As a result, many sand dams are unattended, even in the early project implementation stages, rendering the sand dam projects unproductive to the extent of some drying up. The outcome is: food insecurity manifesting itself as hunger, starvation, food rationing and poor nutrition; Conflicts from competing water use demands, low incomes, inadequate fodder and pasture for livestock; school drop outs; vulnerability to diseases because of poor nutrition; stalled development activities. In an effort to obtain a solution, this study assessed the factors that influenced the adoption of sand dams projects technology in the Sub catchment by local communities with a view of ameliorating the situation for socio-economic development. The study used descriptive design and with the 17,000 inhabitants of Ekalakala sub-catchment area as its target population. The study used the Krejcie *et al.* (1970) method to obtain a sample size of 400 respondents from a target population. A stratified proportionate random sampling technique was employed to select respondents from the sample frame. Data was collected using a semi structured questionnaire administered to the respondents during data collection and a focus group discussion tool. A pre-testing was conducted before data was collected to test the research instrument before administering it. The data was analysed using descriptive analysis and multiple regression tests carried to establish whether the independent variables predicted the dependent variables. The study found that although residents of Ekalakala sub catchment highly adopted the sand dams' project technology, they perceived that that the project belonged to the donors. The low income levels of these residents negatively affected adoption of sand dam projects. The study also found out that there was adequate information which motivated the residents to adopt these projects and the residents had the readiness to adopt and support this technology. The sand dams' project technology was found be very beneficial to the community. The study recommends that; review of the legal framework to ensure professionalism in the Water Resource Users Associations (WRUA) management; the authorities should make policies for introducing cheap sand dam building technology; create an economic value of the sand dams to ensuring the communities benefit economically from the projects; and for awareness programs to sensitize the public about the sand dam projects. Using regression, Socio-Economic Factors, Level of Awareness, and Perceptions were found to be predictors of adoption of sand dams' projects technology.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Gbadegesin and Olorunfemi (2007) content that water is the most precious commodity to all life and should therefore be adequately management to ensure sufficiency, avoiding reaching extreme levels, too much or too little. These extremes usually bring destruction, death or misery to the life this water is supposed to support. When adequately supplied and evenly sustained, water becomes an instrument for economic survival and growth, poverty alleviation instrument, and development instrument (Kinuthia, Warui, & Karanja, 2009). Proper management of water resources is therefore a prerequisite to development, poverty alleviation, and economic growth in a country.

However, globally, there is an outcry for water as portrayed by (Mutiso, 2009). The study by Excellent (2011) indicates that up to 884 million people globally lack access to safe water which highly compromises their health and food security. This status of affairs has led to undernourishment of not less than 830 million people worldwide. The situation is worsened by most of the world's poor (80%) living in dry land, where they only rely on natural resources for their survival. Stern and Stern (2011) clearly put it that there are short rainy seasons and all rain water flows into seasonal rivers and either runs quickly into oceans or dries up. These people only have water for very short periods in a year, which translates into regular drought and water shortages.

The regional situation is explained by Gbadegesin and Olorunfemi, (2007), who show that access to safe and adequate water in Africa is low owing to high levels of poverty. This has adversely affected the economic productivity and development of the continent, as it renders

the people in the continent vulnerable to more communicable diseases and without food security.

In Kenya, the situation is not different, as those living in semi-arid regions are stressed due to lack of water occasioned by unpredictable rainfall patterns and increasing desertification (Excellent, 2011). Poverty levels in these arrears are too high to be managed by the government or any willing donor. Further, the areas lag far behind in development and economic productivity. The remedy to the unpredictable rainfall pattern is adoption of indigenous technologies in the form of the cheap and cost effective sand dams (Munguti, 2009; Manzi & Kuria, 2011).

On realizing that almost all the rainwater running into the seasonal rivers is definitely lost, the Kenyan government and donors turned to capturing and storing that water, where and when it falls (Stern& Stern,2011), using sand dams. Sand dams, which use the cheapest technology in water catchments, are conveniently erected on the seasonal river to ensure high water infiltration and aquifer recharge. According to Manzi & Kuria (2011), the storage capacity of a sand dam is subject to the stream capacity. In which case, the amount of water available to the people and the environment from a sand dam depends on the amount of water collected at that dam. Ultimately, this enhances avoidance of high soil erosion in that area.

Sand dams transform a dry land into a habitable place, where people, plants and animals can thrive happily, for they provide year-round water supply, Self-sufficiency, create time and money, and ensure agriculture and nutrition for rural communities, (Lasage *et al*., 2008; Excellent, 2011).

Further the Government of Kenya prioritized water and sanitation in its vision 2030 development blue print through development of flagship projects. In this respect, Vision 2030 strives to ensure provision of high quality water to all, through conservations and using new ways of harvesting rain and underground water. The vision emphasizes on dam technology in water harvesting (Republic of Kenya, 2008).

Past studies have attributed the failure of a community to adopt sand dam projects to socio-economic factors (Mutiso, 2009; Njodzeka, 2009**)**, awareness (Munguti, 2009), perceptions (Madian, 2007), and willingness (Casmiri, 2007; Mushi, 2009). The study by Mutiso (2009) showed that although sand dams are a successful way to adapt to drought, most local communities find it hard to implement sand dam projects without external help, owing to socio-economic factors. These communities find the cost of startup and maintenance too high for them and that the project requires a lot of labour (most members are busy farmers, or have full time jobs). Further, the communities have limited skills to manage these projects. The challenges hinder the faster growth of sand dams in Kenya and instead many sand dams are now drying up. Njodzeka (2009) echoed what Mutiso (2009) had said and showed that traditional techniques of handling the project, such as letting cattle in to the basin, would determinate its status. Awareness was found by study done by Munguti (2009) to be a very important factor in influencing the community to adopt water projects. He showed that for the water project to be sustained, the implementing agents must integrate the local communities in the development process. The study by Munguti (2009) posits that the communities hold immense local knowledge (environmental knowledge, beliefs and values). This renders the whole process community owned.

1.2 Statement of the Problem

Mushi (2009) showed that the poor water supply systems in developing countries, with most people having little or no access to clean; adequate and safe water, has forced governments in these countries to install, run, operate and manage the water supply systems without involving the local communities (water beneficiaries). The failure to allow the communities to participate has significantly eroded commitment by the beneficiaries to safeguard the water facilities, which has compromised the sustainability of schemes. The local communities have therefore refused to adopt the water projects to the extent of being unwilling to contribute to the cost of operation and maintenance, which has highly threatened water supply projects.

According to Ekalakala WRUA, WRMA and other Stakeholders (2011), the community in Ekalakala sub-catchments has been facing acute water shortages, which has adversely affected the community domestically, economically, and socially. In response, the Government and other stakeholders have initiated various projects in their efforts to addressing these challenges, including building sand dams. The key stakeholders for the management of sand dam projects in Ekalakala sub-catchment are donors, Government agencies, Non-Governmental Organizations (NGOs), Faith Based Organizations and, Water Management agencies (such as WRMA, WRUA), leaving the community to become a mere spectator and a beneficiary. The local community is overshadowed by the donor and government agencies representations in ownership of sand dam projects. In fact, the local community treats the sand dam projects as government and donor projects and has resisted adoption of these projects, meaning they care less over the ownership of the sand dams (Excellent, 2011). As a result, many sand dams are unattended, even in the early project implementation stages, rendering the sand dam projects unproductive to the extent of some drying up (Mushi, 2009). When the dam do not give enough water, then it is not possible to

address the challenge of acute inadequate water availability in Ekalakala sub-catchment; (Ekalakala WRUA, *et al.*, 2011). The outcome is: food insecurity manifesting itself as hunger, starvation, food rationing and poor nutrition; Conflicts from competition over water, low incomes, inadequate fodder and pasture for livestock; school drop outs, vulnerability to diseases because of poor nutrition, stalled development activities (The Centre for Science and Technology Innovation, 2009). Scarcity of water at Ekalakala sub-catchments is an opportunity for disputes and conflicts over water by the community sharing water and land in the region (Osman-Elasha, 2009).

Despite the fact that the government and donors in Kenya have been implementing sand dams in Kenya, the adoption of these projects by the local communities has been minimal, adversely affecting the sustainability of the dams. This state of affairs was probably attributed to socio-economic factors, awareness, perceptions, and willingness. Although many studies have been conducted on sands dams adoption by the local communities (such as by Mutiso, 2009; Njodzeka, 2009; Munguti, 2009; Madian, 2007), none has addressed the socio-economic factors, awareness, perceptions, and willingness as the factors influencing the adoption of sand dams by the local community in Ekalakala sub-catchment. It is against this background that this study attempted to assess the factors that influence the adoption of sand dam's projects technology in Kenya by local communities with a view of ameliorating the situation for socio-economic development.

1.3 Purpose of the Study

The purpose of this study was to assess the factors influencing local communities' adoption of sand dams' projects technology in Ekalakala Sub catchment.

1.4 Objectives of the Study

This study was guided by the following objectives:

i. To establish how socio-economic factors influence local communities' adoption of sand dams' projects technology in Ekalakala Sub catchment.

ii. To establish how the level of awareness influence the local communities' adoption of sand dams' projects technology in Ekalakala Sub catchment.

iii. To establish the extent to which perceptions influence the local communities' adoption of sand dams' projects technology in Ekalakala Sub catchment.

iv. To establish the extent to which level or readiness influence the local communities' adoption of sand dams' projects technology in Ekalakala Sub catchment.

1.5 Research Questions

The study answered the following questions:

i. How do socio-economic factors influence local communities' adoption of sand dams' projects technology in Ekalakala Sub catchment?

ii. How does the level of awareness influence the local communities' adoption of sand dams' projects technology in Ekalakala Sub catchment?

iii. What is the extent to which perceptions influence the local communities' adoption of sand dams' projects technology in Ekalakala Sub catchment?

iv. What is the extent to which level or readiness influence the local communities' adoption of sand dams' projects technology in Ekalakala Sub catchment?

1.6 Significance of this Study

The study provided information on the factors influencing local communities' adoption of sand dams projects technology in Kenya. Additionally, information on the challenges and coping mechanisms of adoption of sand dams by local communities, in addressing water shortage in semi arid and arid areas, was also be availed. This facilitated the filling of gaps in knowledge in this pertinent area of national development and economy, making the study very beneficial to academicians and scholars.

The information acquired from this study is also useful to water resource policy makers both in government (such as MWI, WRMA, WRUA) and donors, especially in strengthening policy on enhancing access to water in semi arid and arid areas. Such policy improvement would be handy in ensuring access to water by all in Kenya, hence growth in the economy of the country. As a consequence, the Government of Kenya (GoK) would be on the right track in the achievement of its goals as stipulated in the vision 2030.

Since the study will target mostly semi arid and arid areas of Ekalakala sub catchment, it can be seen, that many drought stricken areas will be reached. By the mass population being reached hence relevant ways of further adopting the skilled water technology to dry conditions, mass production in dry regions would be achieved in the near future. The study findings proposed some proprietary measures to ensure local communities' adoption of sand dams' projects technology in Kenya, hence sustainability of the projects. It would be noted that especially the poor group, from arid and semi arid areas, would benefit from this knowledge.

Finally, the study opened opportunities for further research in the area of sand dams projects technology in Kenya. Accordingly, the present study opened a window of research opportunities with regard to the operations and effectiveness of sand dams with a view of mitigating poverty and unemployment in the country. The study was useful and an eye opener to poverty alleviation in dry regions.

1.7 Delimitations of the Study

The study based the research on the factors influencing local communities' adoption of sand dams' projects technology in Kenya. The aim was to assess socio-economic factors, level of awareness, perceptions, and level of readiness as the factors influencing the adoption of sand dams by the local community in Kenya. The study was carried out in Ekalakala sub-catchment area, Masinga in Kenya. This was because the study was able to cover all the areas of Ekalakala sub-catchment. The study targeted the entire community of Ekalakala sub-catchment. More specifically, the study was conducted on all the inhabitants of Ekalakala sub-catchment.

The rationale behind choosing Ekalakala was owing to its uniqueness in terms of water users. It had a large number of often conflicting water uses such as domestic, Livestock, Irrigation, environment and commercial among others which was not available in many other sub-catchments areas with sand dams.

1.8 Limitations of the Study

This study was limited in a number of ways. Firstly, the study used focus group discussions as one of the data collection methods and an ideal focus group discussion should be between

8 to 10 respondents. Although the research team tried to restrict the attendance, the crowd was overwhelming, more than 10 respondents in a single sitting. This might have constrained on the available time and other resources (human, financial, stationery, and the like). The study therefore limited participation by organising the respondents into groups, each with a team leader who presented the opinions of that group to the focus group meeting.

Secondly, the study respondents might have felt being disturbed and decide to provide inappropriate responses; others might have deliberately opted not to participate in the study. This would have rendered the data collected inaccurate and incorrect, meaning dealing with false data. The study avoided these limitations by first sensitising the respondents about the study and how the study would benefit them. The study conducted meetings in advance to acquaint the respondents with the study data collection. During these meetings the researcher told the local community the truth about the study and allayed any fears.

Thirdly, the researcher dealt with different respondents from different educational background. This might have led to a breakdown in communication. In such situations, the researcher used the services of research assistants from the concerned communities. This might have weakened the quality of information collected as the assistants might have been influenced by their cultural underpinnings during the process. However, to ensure quality and consistency of information collected the assistants were trained on the procedures of data collection. Another limitation was the sample frame. It was difficult to do research in all areas within the Ekalakala sub-catchment and represent all types of people. The sample size selected was small to represent all the all groups within the study area. However, the study collaborated with administrative authorities (such as WRUA committee members and chief)

to ensure that it obtain information on all people and ensure that each group was well represented.

1.9 Assumptions of the Study

The study made the following assumptions

1. The local government authorities at Ekalakala Sub-catchments provided adequate necessary assistance in identifying respondents
2. The respondents freely gave the correct information without fear
3. The Water Resource Users Association (WRUA) in Ekalakala Sub-catchment remained as going concern during the period of study.
4. The Water legal framework remained unchanged during the period of the study.
5. Economic factors in Ekalakala Sub-catchment remained unchanged during the period of the study.

1.10 Definitions of Significant Terms

Socio-economic factors – Circumstances, situations, state of affairs etc. related to a social and economic phenomenon contributing to a result

Adoption of sand dams project technology – acceptance of the knowledge and the use of applied science of reinforced concrete walls built across seasonal riverbeds to capture and store water beneath sand.

Level of awareness – Degree of knowledge or consciousness about a certain aspect

Perceptions-apprehend with the mind, understand

Level of readiness- degree of willingness or eagerness to consent or undertake an activity

1.11 Organization of the study

The study is organised into five chapters in which chapter one deals with an introduction of the research project report whereas chapter two will consider literature review. Chapter three will tackle the Research Methodology while chapter four will deal with Data analysis. The last chapter will present a summary of the Findings, Discussions, Conclusion and Recommendations,

CHAPTER TWO

LITERATURE REVIEW

2.1Introduction

This chapter of literature review is intended to review theories and related studies on the adoption of sand dams projects technology by the local communities. It also reviews empirical studies on sand dam projects adoptions, highlighting the authors own findings and the gaps that were not filled by those studies and attempts to provide a solution for the same. Further, it explains the conceptual framework of this study.

2.2 The Benefits of Sand Dams

Excellent (2011) purports that the communities using sand dams enjoy benefits such as; reduction of evaporation (water is stored beneath sand), filtering the water clean, protection from parasitic carriers such as mosquitoes and snails (considerably reducing incidences of malaria and bilharzias for Mosquitoes cannot breed and Snails carrying the bilharzias virus cannot survive in sand). Further, sand dams ensure year-round source of water, which changes the lives of people. The communities using water from sand dams are assured of more food for themselves and animals. This means improved diets to people, as the people have time to improve harvests and diversify crops, and time to spend on livelihoods (Stern & Stern, 2011). The environment surrounding the dams change drastically, in that stored water raises the water table level both upstream and downstream from the dams (Brandsma et al., 2009) and the higher water table increases the natural vegetation (Manzi & Kuria, 2011). After the first dams were built in Kenya in 1950's, the growth in number of sand dams in Kenya grew exponentially up to the period between 1980 and 2010, which experienced a significant increase in the number of sand dams built in Kenya. After sands dams were

successful in Kenya other African countries; Mozambique, Ethiopia, and Sudan followed the suit. Countries such as Yemen, Jordan, Japan, Turkey, SW USA, Zambia, Burkino Faso, Ghana, Somaliland and Zimbabwe have also introduced sand dams but on very small scale Excellent (2011b).

Notably, sand dams are built on seasonal rivers of a water scarce population, to ensure the community gains access to water for domestic and agricultural use during the region's long dry seasons. Consequentially, the community is the main beneficiary of the sand dam project. According to Mtitu (2009*)*, the community must take a lead in the management of the sand dam's project. In fact, the community must take the responsibility of the water service operations after the donor or implementing agency has completed the project implementation. The community should be in charge of planning, developing and maintaining their sand dam water supply services. As a matter of fact, the community must be involved in all aspects of sand dam project development, to sustain the water project. The community must participate in the sand dam project by; mobilizing local resources and people, planning, financing, operation and maintenance, and cost recovery. Through participation, the community claims ownership and possession of the sand dam, building a sense of responsibility of the project on the community (UNICEF, FAO and Oxfam GB, 2012).

Surprisingly, many community managed sand dam projects are under-performing, as put across by UNICEF *et al*. (2012). Such projects; lack infrastructure improvement, have poor management and financial systems, lack operation and maintenance, and better inclusion into the regulatory framework. The community managed sand dam projects must be supported from outside the community (especially by Ministry of Water and Irrigation and the Water Resources Management Authority), even after the projects have been implemented, otherwise

the projects would stall. Apparently, the communities that both invest in the construction of the dams and help to build it become owners and are therefore allowed to fetch water from the dam. A majority of the people are aware of this, although they behave as if the Water Resource Management Authority (WRMA) or the Kenyan government owns the sand dams. In short, the community fails to adopt the sand dams' project to the extent that the project stalls, even when the community desperately needs services from the sand dam.

The theory of Public Goods as explained by Liebe, Preisendorfer and Meyerhoff (2011), indicated that individuals might perceive projects as the provision of a public good and no one should be excluded from using it once it is provided. In the community there could be those who are ready to pay as a contribution to the provision of a public good and those who hold Nonexcludability. There are those who do not contribute to the provision of the good, since these are perceived as public goods, such are the Nonexcludability individuals who rely on the contributions of others and do use the good as a free rider. The information from the theory agrees with Madian (2007), that the perception by the community influences the water projects. Gbadegesin and Olorunfemi (2007) who likened the willingness by a community to social solidarities said that the willingness by community to embrace and implement any programmes and policies that will address water supply problems in rural communities ensure sustainability of that project.

2.3 Theoretical Background

Innovations in Technology have a very significant importance in human life. The rapid technology advancements, occurring in the world today, are introducing major changes in the worldwide economic, development, and business atmosphere (Qureshi et al, 2008). Research on consumer attitude and adoption of technology shows that certain factors influence the

acceptance of the technology: socio-economic factors (Mutiso, 2009; Njodzeka, 2009**)**, awareness (Munguti, 2009), perceptions (Madian, 2007), and willingness (Casmiri, 2007; Mushi, 2009). With regards to water system management, it has been established that the same factors influence adoption of sand dams projects technology in Kenya by local communities (Excellent, 2011). This study found certain theories very useful in explaining adoption of sand dams projects technology by local communities in terms of socio-economic factors, awareness, perceptions, and willingness.

One of these theories is The Reasoned Action (TRA), which postulates that an individual's consciously intended behaviour is a result of his attitude towards performing the behaviour and subjective norm (SN), which is the overall perception of what family, friends, and colleagues think the individual should or should not do. The Theory of Reasoned Action (TRA) and family theories (Cheung et al., 2005) are central to the factors considered in customer behaviour on adoption of a technology. These include the Technology Acceptance Model (TAM), the Theory of Planned Behaviour (TPB), and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003).

According to the Technology Acceptance Model (TAM) theory, when users are satisfied with a technology the technology adoption is likely to be higher. It asserts that the users' decision to use a technology depends on: complexity (or perceived ease of use) and perceived usefulness. That is, the attitude towards participation in the sand dam project is influenced by perceived usefulness and ease of use. Specifically, the adoption of sand dams is determined by a community's intention to use the technology and that intention is determined by the community's attitude as well as perceived usefulness and ease of use (AbHamid, 2008). This theory is very useful in proposing that the adoption of sand dams is determined by perception

of the community. The Theory of planned behaviour expands the boundary conditions of TRA to deal with behaviours over which individuals have incomplete volitional control by introducing Perceived Behavioural Control (PBC) as an additional determinant of intentions and behaviour. In the sand dams project context, where a cost is involved, once an individual perceives that water resources are available to him and that he is able to use sand dams, it is more likely that he will adopt or continue to use it (Yousafzai et al., 2010). The UTAUT has moderating effects of consumer traits (Venkatesh et al, 2003) and considers four factors; consumer traits; situational factors (such as convenience); product characteristics; and trust. The UTAUT seems to be move comprehensive in explaining the adoption of sand dams projects technology, for it regards all aspects

Innovation Diffusion Theory (IDT), which was found very useful to this study, identifies five characteristics of an innovation that influences its adoption: relative advantage (the degree to which an innovation is perceived better than the idea it supersedes), compatibility (degree to which sustainable practice is perceived as consistent with the existing values, past experience and needs of potential adopters), complexity (the degree to which a practice is perceived as relatively difficult to understand and to adopt (Lewin, 1947). According to Rogers (1994), it is negatively related to its rate of adoption), trialability (degree to which an innovation may be experimented at a limited basis), and observability. Relative advantage refers to an individual's belief that technology is better than traditional ways of doing things and can be related to diverse economical, social, convenience and satisfaction dimensions of the technology. It is the Rogers's model that suggests that although it is difficult to find adoptable Technology, encultured technologies can easily resist change (Rogers, 2003, p. 8–11). The theory is very useful in explaining the adoption of sand dams' projects technology by local communities in terms of socio-economic factors, awareness, perceptions, and willingness.

This study will also picked the Basic Economic Model, which shows that the income of an individual constraints his/her ability to pay for improved environmental quality. The theory claims that the individual's income correlates to the amount of money he/she is willing to spend for the environmental goods (Liebe, Preisendorfer & Meyerhoff, 2011). Liebe *et al.* (2011) further claims that people would use the environment good because it is increasing their well-being. This theory is going to be very useful to this study as it relates the adoption of an environmental service/good to financial ability of the people using it. The community would only be able to spend on the sand dam project to the extent of their income. This means that any thing above their expected expenditure, based on their income, will not be accounted for by the community.

The Schwartz's norm-activation model (Schwartz & Howard, 1982) is very beneficial to this study. According to Liebe *et al.* (2011), the model claims that "*a personal norm leading to moral obligations regarding a specific action (such as paying for an environmental good) is only activated and transformed into behavior if certain conditions are fulfilled."* (p. 112). The specifications considered by this model include: "*the awareness of need and the awareness of responsibility as determinants of norm-activation. Awareness of need refers to the precondition that individuals must recognize that something has to be done concerning the object in question. Awareness of responsibility means that individuals must recognize that they are responsible for doing something. Given awareness of need and awareness of responsibility, a perceived moral obligation can result in specific behavior. Both determinants mediate the effect of a perceived moral obligation on behavior*." (p. 112). In the context of this study, the willingness of the community to be involved in management, the awareness of the responsibility to pay, the awareness of the need to manage the project, the

behavioral determinants to adoption the sand dam projects will be assessed. This theory links the factors used in the study to the readiness to adopt the sand dams.

2.4 Empirical Studies

Various studies have been found very useful in explaining the local communities' adoption of sand dams projects technology in terms of socio-economic factors, awareness, perceptions, and willingness. These studies are reviewed accordingly.

2.4.1 Sand Dams Adoption Related Studies

A paper by Bennett & Peirson (2008) shows that dams are a key farm infrastructure and are essential for the economic survival of rural business during sustained drought. The results obtained showed that, evaporation is significantly reduced and water saved, when groundwater dams are erected in arid regions. These dams reduce evaporation losses and are an effective storage solution. The study by Lasage *et al.* (2008) showed that sand dams are a potential good measure to cope with droughts under future climate change.

Locally, Manzi and Kuria (2011) carried out a study to investigate the effect of sand dam construction on land cover changes along the stream bank during the dry season using satellite images. The study established that after construction of a sand dam, there is change in evaporation on the land cover, recharging of ground water and stream discharge, which results to sustenance of natural resources, environmental protection and food security. In fact there is a significant presence of vegetation during the dry period due to the sand dam's construction. This study was very useful in exposing the benefits associated with sand dams,

as well the need of these dams. This means that adoption of sand dams greatly benefit the community, and the country at large.

2.4.2 Social-Economic Factors and Adoption of Sand Dam Technology

A study by Njodzeka (2009) found out that although the communities may want to participate in projects, lack of finances usually limits them, which further limit the scope of the project. Further the projects for providing environmental goods are destroyed by uses of persisting traditional techniques. The most important information that could be obtained by the present study from this study is the relationship between the economic factors to the adoption of the projects used in supplying environmental goods. Although, this study did not test for any relationship, it is useful in giving direction to the present study. The present study will relate the socio-economic factors to adoption of the sand dams by the local communities.

Regionally, the study by Mtitu (2009) examined the challenges facing community management of rural water supply systems in Tanzania and found that most communities did not adopt these projects due to socio-economic issues. The study recommended the local communities 'involvement in all aspects of water scheme development including the mobilization of local people. The study recommends that the local community should be involved in planning and financing of these water projects, which would sustain the water projects. The locals should ensure the operation and maintenance as well as ensure cost recovery. By so doing, the community would enjoy such benefits as multiple uses of water to address food and nutritional security. In showing that the adoption of water projects by local communities relates well with socio-economic factors, the study provides very useful information to the present study. This makes it possible to relate the socio-economic factors to local communities' adoption of sand dams projects technology. Although the study by

Mtitu F. (2009) gave a very clear direction, it did not give the relationship between these factors to water projects adoption. In filling this gap, the present study will test for relationship between the socio-economic factors using a statistical method (chi square tests).

The study by Aharikundira (2009) used a statistical method (chi square test) to test for the relationship between the factors determining the Sustainability of Pre-Paid Water Services Delivery. The study established that low sustainability of these services was as a result of low and inconsistent nature of income. This report recommended for a community action framework in the water sector, including water user associations and policy or water user bylaws. The study provided a very good lead by relating the economic factors to the project sustainability using a statistical method. This gave a hint on one of the factors as regards the present study. However, the study did not deal with the four factors considered in this study jointly. It did not show how the four factors influence the projects adoption. This provides a gap to be filled by the present study.

Another study by Ngoda (2009*)* assessed and evaluated the performance of small water supply associations. The study established that there were very little improvements of water services provisions accompanied by inadequate system maintenance. Lack of technical staff, high level of unaccounted-for-water, low metering rates and many others are some of problems facing water utilities. Generally, results could be used as baseline data for benchmark of water utilities. The study recommends for support for small water utilities for their sustenance, since most of them were unable to raise enough funds for capital development. It s very clear from this study that the adoption of the water supply projects was influence by availability of finances; where lack of financial support brought these project down unto their knees. This is vital information to be considered in establishing the factors

influencing the adoption of sand dams in Kenya. The study struggled to assess and evaluate the sustainability of these water projects but failed to show the exact relationship between the economic aspects to the outcome using any statistical method. This research using the information provided by this study tested for dependence of sand dams adoption on socio-economic factors.

A study by Excellent (2011) attributed the failure to adoption of sand dams project by the local communities to lack of awareness, lack of technical knowledge and experience to design and construct sand dams, labour intensiveness of the exercise and Lack of fianances. The study recommends that local community must be engaged in management of the sand dams and must claim ownership of the project. Awareness should be raised of sand dams at all levels from community to governments through a structured advocacy programme, technical knowledge should be increased to design and build dams through training, technical support and the creation of learning resources for non-engineers. The study also recommended for; increasing understanding of sand dam application, engaging with and influencing policy makers and funding agencies. The study by Excellent (2011) provided very important information of factors influencing the adoption of sand dams by the communities. In fact, it touched on all the factors considered in this study. This was very beneficial information. However, the study did not test the relationship between these factors and the adoption of sand dams by communities using any statistical methods, which is what this study will do. This study will test for existence of relationship between these factors and the adoption of sand dams using the chi tests. This is the gap, in the study by Excellent (2011) that the present study will fill.

2.4.3 Level of Awareness and Adoption of Sand Dam Technology

A study by Ngowi and Mtana (2007) explored the nature and extent of community participation in a project. The study established that the community participated minimally due to lack of project knowledge. The local community did not receive sufficient information about the projects, since their representatives, who were supposed to disseminate information to the community had low level of understanding, hence the inability to disseminate the project knowledge. This study provided very beneficial information, of the influence of awareness to adoption of community projects. This is to say that the lack of awareness leads to the failure to adoption of the sand dam projects. The study suggested for participatory approach to these projects. The study was based on the land survey project but did not explain how the same people would react to sand dam projects.

The study by Meliyo (2008) was to identify strategies for improving local community participation in environmental management. The study revealed that local communities were well informed on the subject; communities had high positive perceptions towards management and participatory approach as the best solution to sustainability of environmental projects. The study findings were in the reverse to the one by Ngowi and Mtana (2007), although, they address related issues of community involvement. However, the results point to the same things: awareness influences the adoption of these projects

Although the study very well explains that the projects may not be adopted owing to lack of awareness, it is not clear what relationship exists between the two, which is what this study will achieve.

Locally Mutiso (2009) conducted a study, which showed lack of enough capital, and awareness hindered most local communities from implementing sand dams. The study by Mutiso (2009) gave a very useful lead towards establishing the factors influencing the adoption of sand dams in Kenya. It is very clear that meager incomes and lack of awareness of the local communities in dry regions are the largest hurdles to adoption of the sand dams. What this study did not bring out clearly is the impact or extent to which the two factors influenced the adoption of sand dams in Kenya.

2.4.4 Level of Readiness and Adoption of Sand Dam Technology

The study by Casmiri (2007) points out that the local community must be involved in all the water related projects and at all stages. The study also encouraged for the willingness to get involved by recommending for training the local community to accepting the projects. The study was very categorical that the willingness to pay highly promoted the sustainability of the project. The information thus provide by this study provide strong evidence that willingness was a factor influencing adoption water projects.

The study by Mushi (2009) assessed water user's Associations, where it found that generally the communities did not participate in these schemes, although the service delivery and cost recovery was satisfactory. The study recommended for community participation to ensure better performance on sustainability of water supply services. The study vehemently insisted that community participation was key to sustainability of the water project through its recommendations. However, it failed to show the actual relationship between community participation and the sustainability of the project. That the study is insisting on community participation, the present study will then fill the gaps that were left by the study, by testing the relationship using a statistical method.

Another study by Gbadegesin and Olorunfemi (2007) shows that water supply provision and management can even be more successful and sustainable in the rural areas than in the urban areas if the community was involved in such projects. The study found out that the local community was not aware of the government policies, which made it difficult to establish how the willingness influenced their participation. Although the study struggled to establish a relationship it did not go far owing to lack of awareness. This created a gap, which the present study will strive to fill.

2.4.5 Perception and Adoption of Sand Dam Technology

A study by Madian (2007) addressed the sustainable use and management of renewable resources in forested catchments, by examining the perception of the local communities and implementers. It found out that there were perception differences of communities and the implementers of the water projects. The study had shown that the perception highly influenced the sustainability of the projects, which would mean that the perceptions of the local communities affected their adoption of sand dams. The study tried to balance sides, the local community and the donors. It is now not clear how the perception of a community alone affects the adoption of the sand dams' technology, which is what the present study will do.

The Ujamaa Community Resource Team [UCRT] (2012) conducted a study which found that the biggest challenge in a sand dam project was the local community participation. The study by UCRT, (2012) found that the perception by the local communities influenced their adoption of the projects. Again once the dams were constructed the community failed to manage them sufficiently.

2.5 Conceptual Framework

The proposed by this study that the adoption of sand dams projects technology by local communities in Kenya was influenced by socio-economic factors, awareness, perceptions, and willingness as advocated for by the TRA theory (Cheung et al., 2005) and Innovation Diffusion Theory (IDT) (Rogers, 2003). The conceptual model is captured in figure 2.

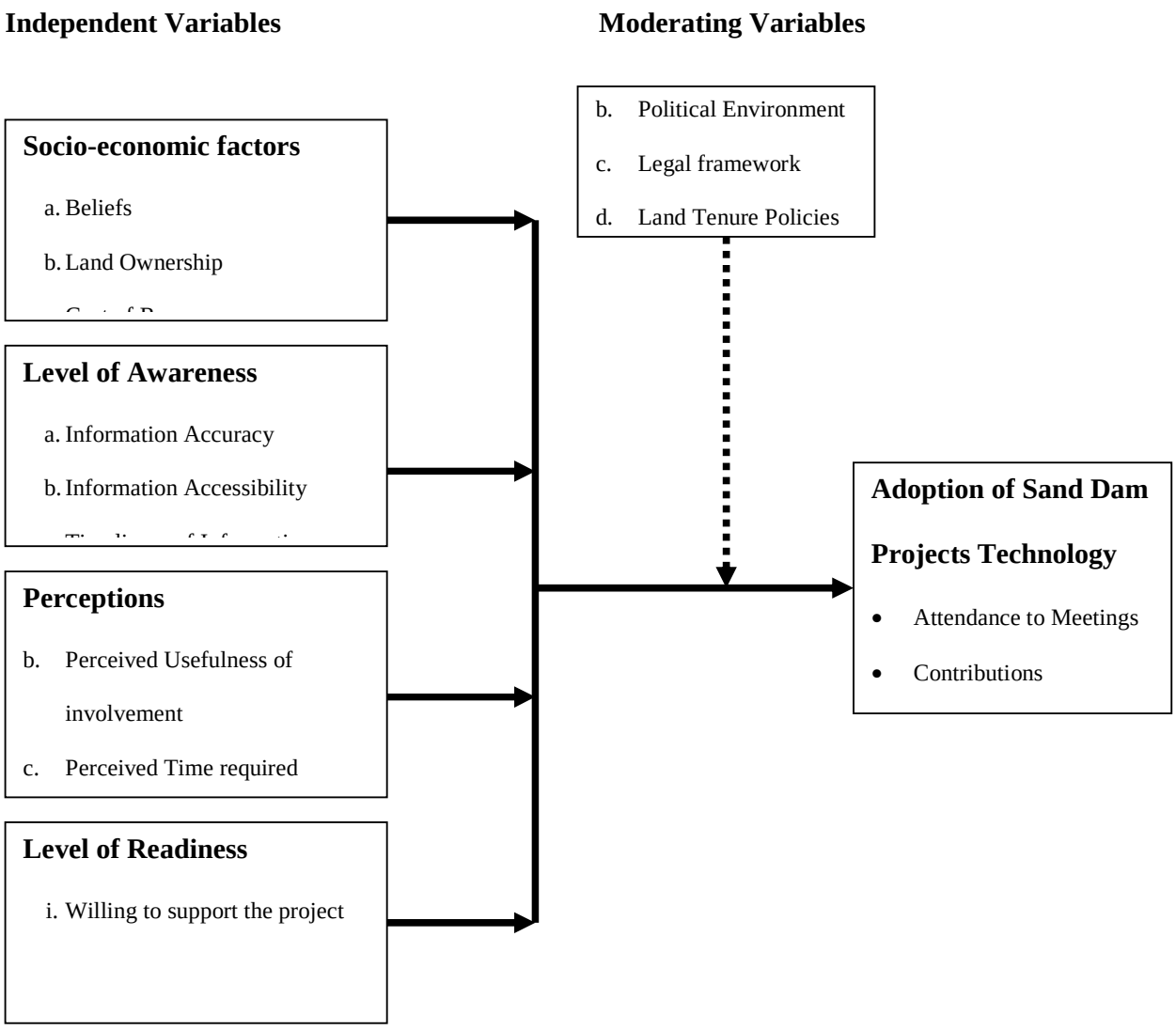

Figure 1 : Conceptual Framework

First, the study proposed that the adoption of sand dam project technology is influenced by socio-economic factors, their Beliefs, land Ownership, cost incurred on the projects, and their Income Levels. Secondly, the study proposes that the communityAwareness also influences adoption of sand dam project technology by the community. The indicators of community awareness include; Information Accuracy; Information Accessibility; Timeliness of Information; and adequate Knowledge about the sand dam technology. The third factor influencing adoption of sand dam project technology by the community according to the present study is the community Perceptions. The factors of community perceptions include; perceived usefulness of involvement in the sand dam project, perceived Time required in handling the project matters, perceived project Ownership, and perceived benefits from the project. Lastly, the study proposes that the adoption of sand dam project technology by the community is influenced by the communities' willingness to be involved in the sand dam project.

However, there are other variables such as Political Environment, Legal framework, and Land Tenure Policies, which may influence the communities' adoption of sand dams projects technology in Kenya. This study regards these variables as intervening variable, which are mitigated accordingly.

2.6 Research Gaps

Various studies have been conducted on adoption of sand dams by the local communities. The present study will review some of the related studies. However, none of these studies has assessed the socio-economic factors, awareness, perceptions, and willingness jointly as the factors influencing the communities' adoption of sand dams' projects technology in Kenya. Most of the studies which related one or more factor(s) to the communities' adoption of sand

dam’s projects technology failed to establish the exact relationship. The present study filled the gaps present in these studies.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter provides an explanation of the research design and the methodology applied in carrying out the research study and justification for using a particular research design. It also describes the characteristic of the population which was used in the study, detailed description of sampling methods used and procedures, data collection instruments and the procedure of data collection, pre-testing and finally describes the appropriate data analysis method which generated the results.

3.2 Research Design

The present study used descriptive design to establish the factors influencing the local communities' adoption of sand dams' projects technology in Kenya. According to Kerlinger (1969) descriptive design results in the formulation of knowledge and solution to existing problems. It is used when collecting information about people's attitudes, opinions, habits and other possible behavior (Orodho & Kombo, 2005). The study aimed at describing the factors influencing the communities' adoption of sand dams' projects technology in Kenya and therefore considers the descriptive design as the most appropriate for this study. It obtained information concerning the factors influencing the communities' adoption of sand dams' projects technology in Kenya.

3.3 Study Location

The study was done in EkalaKala sub-catchment, which was in Masinga district in Machakos County. Ekalakala Sub catchment administratively covers the whole of Ekalakala Sub

location, parts of Ekalakala location in Ekalakala Division of Masinga District. It fell under the Tiva /Tyaa drainage of middle Tana catchment area. The catchment was drained by Kambiti, Kwa Nziu, Kindaruma and Katitika streams which drained into Thika river while Wamboo and Wambiti streams drains in to Masinga dam of river Tana. All these streams were seasonal .Beside these streams the sub catchment had 11 springs which were perennial .The sub catchment experienced two rainy seasons; long rains and shot rains .The long rains occured during the months of March to May while the short rains fell between the months of October and December. The mean annual rainfall ranged from 660 mm to 1100 mm with the altitude falling between 1064 m above sea level at Masinga dam to 1300 m above the sea level at Ekalakala market. Ekalakala Sub catchment was characterised by a rural settlement with varying population densities where small scale subsistence economic activities dominate. The site map is attached on Appendix VI.

3.4 Target Population

The target population of this study consisted of 17,000 inhabitants of Ekalakala sub-catchment area, Masinga sub county in Machakos county, Kenya. The target population was as follows:

Table 3.1: Target population

	Gender	Population
	Male	8,300
	Female	8,700
Total		17,000

Source: Kenya National Bureau of Statistics (2009). Population Census

The ratio of male to female at EkalaKala sub catchment translates to 1:1.05.

3.5 Sampling Procedures

The study used Table 3.5 developed by Krejcie *et al.* (1970) to obtain a sample size of 377 respondents from a target population of 17,000 using the formula the formula;

$$s = \chi 2NP(1- P) /[d^2 (N -1) + \chi 2P(1- P)]$$

Where;

s = required sample size.

$\chi 2$ = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841).

N = the population size.

P = the population proportion (assumed to be .50 since this would provide the maximum sample size).

d = the degree of accuracy expressed as a proportion (.05).

The formula generates the table in Appendix Vii

The study opted to use a sample population of 400 respondents to ensure fair distribution of the sample and a stratified proportionate random sampling technique was employed to select these respondents. First the study determined the number people in each sub location and proportionately obtained homogeneous subgroups from each village in the ratio of 1;1;1.05 of male to female.Simple random samples were taken from each stratum or homogeneous part of the target population independently of each other In this case the calculated sample was proportionately distributed to each Sub location in Ekalakala sub-catchment. The study determined the number of male and female from each sub location using the ratio 83:87. A sample frame consisting of the male in each sub location was made. The same was done for the female counterparts. These sample frames were used to select the respondents. A

sampling interval was designed in each of the sample frames by dividing the total number in the sample frame with the number of respondents required in that sample frame. After which a random starting point in the sample frame was determined. Respondents were then selected with the predetermined sampling intervals. This was done until the required sample size is reached and it was replicated to all other sub locations. The total number of respondents was equal to 400.This assured the researcher of representation not only for the overall population, but also key sub groups of the population, especially small minority groups. The same sampling fraction was used within all strata to obtain a sample of 184 males and 194 females from the entire target population in Ekalakala sub catchment.

3.6 Method of Data collection

Data was collected from both primary and secondary sources.

3.6.1 Data Collection Tools

The study collected primary data using semi structure questionnaire and focus group discussions guide. The questionnaires had both structured questions (closed ended) and unstructured questions which were open ended questions. The structured questions were standardized to allow the respondents to reply to the same questions in a defined manner and the unstructured questions gave the respondents complete freedom of response and encouraged them to offer their opinions. The questionnaire was hand delivered to the respondents and the research assistant provided guidance and clarifications on how to answer the questions. The questionnaire was justified, as it will allowed literate respondents to understand the questions on their own, more time to reflect on their answers thereof. The qualitative phase helped to generate sufficient information areas to enrich the contents of the semi-structured questionnaire

Secondary data was obtained from existing documents.

3.6.2 Data collection Technique

As a requirement, the researcher first obtained a letter from University of Nairobi approving collection of data and conducting the study. He used this letter as an introduction to the respondents. The researcher also sought for permission from Ekalakala WRUA to conduct a study in their area. Once all the documentation was available, the research then conducted a pre-test on the research tool to test on reliability and validity. The respondents in pre-test did not participate in data collection. After the research instrument is successfully tests reviewed, the researcher entered into active data collection, during which time, he first sought to have a forum with the Ekalakala WRUA committees. They assisted in providing necessary information about the people in their jurisdictions, which helped to effectively collect data. Arrangements were then made on when and how to collect the data collection.

When collecting primary data, the researcher organised focus groups and then guided groups in answering questions posed. On other instances, the researcher assisted the respondents to fill the questionnaire during interviews.

3.7 Validity

Validity, which is the accuracy and meaningfulness of inferences, was measured using construct validity. Construct validity refers to degree to which the data obtained from the instrument meaningfully and accurately represents the concept. The study used the data collected during pilot testing to test the validity of the tools used. The indicators of the factors of local communities' adoption of sand dams projects technology were correlated. The test for validity was carried out of these variables to establish whether they support the construct validity. In this case, it was possible to establish whether these factors influenced the local

communities' adoption of sand dams projects technology was correlated. It should however be noted that to use construct validity, there must exist a theoretical framework regarding the concept. The data has construct validity if the measurements are consistent with the theoretical expectations.

Additionally, the study used content validity test to test for validity of instruments. Content validity measures the degree to which data collected using a particular instrument represents a specific domain of indicators or content of particular concept. The assessment of content validity of a measure was carried by using the supervisor and lecturer, who was acquainted with the project planning and management profession knowledge.

3.8 Pre testing for Reliability

A pre-testing was conducted before data collection to test the research instrument before administering it. This test was used to ensure the reliability of the research tool. It helped identify possible problems, clarify on the instrument and appropriateness of the language during the main study (Kvale, 2007). The test assessed the relevance of the research objectives as it tested the understandability of the research tools. It also enabled the researcher to have an idea of how long it would take to complete the data collection using this tool.

The data was tested for reliability to establish issues such as data sources, methods of collection, time of collection, presence of any biasness and the level of accuracy Kvale (2007). The test for reliability established the extent to which results were consistent over time. The study collected data from ten (10) respondents, who did not participate in the study data collection. These respondents were allowed at least one week to respond to the

instruments. The reliability test was done using the internal consistency test, based on Cronbach alpha. Internal consistency of data, determined by correlating the scores obtained from one time with scores obtained from other times in the research instrument. The result is the Cronbach coefficient Alpha, which is value between -1 and 1. The coefficient is high when its absolute value greater than or equal 0.7 otherwise it is low. A high coefficient implies high correlation between these items which means there is high consistency among the items and such items should retained in the tools. This study correlated items in the instruments to determine how best they related. Where the coefficient was very low, then the item was supposed to be reviewed by either removing it from the tool or correcting.

3.9 Operationalization of variables

The table below shows the operationalization of the Independent and the dependent variables,their indicators and the means of measuring the indicators.

Table 3.2: Operationalization of Variables

Research objectives	**Type of variable**	**Indicators**	**Measure**	**Scale**	**Data Analysis**
	Dependent Variable Adoption of Sand Dam Projects Technology	Attendance to Meetings	Frequency of attending meeting Questionnaire Focus group guide Interview Guide	Ordinal	Descriptive Chi Square Cross Tabs
		Contributions	Promptness in contributing towards Questionnaire	Ordinal	Descriptive

			the project	Focus group guide Interview Guide		Chi Square Cross Tabs
		Participation in Project work	Participation in project work	Questionnaire Focus group guide Interview Guide	Ordinal	Descriptive Chi Square Cross Tabs
To establish how socio-economic factors influence local communities' adoption of sand dams projects technology in Ekalakala Sub catchment.	**Independent Variable** Socio-economic factors	Beliefs	Extent to which Cultural Belief influence adoption	Questionnaire Focus group guide Interview Guide	Ordinal	Descriptive Chi Square Cross Tabs
		Land Ownership	Influence of land ownership adopting sand dam projects	Questionnaire Focus group guide Interview Guide	Ordinal	Descriptive Chi Square Cross Tabs

		Cost of Resources	Influence of cost of resources	Questionnaire Focus group guide Interview Guide	Ordinal	Descriptive Chi Square Cross Tabs
		Income Levels	Influence of income level in adopting sand dam projects	Questionnaire Focus group guide Interview Guide	Ordinal	Descriptive Chi Square Cross Tabs
To establish how the level of awareness influence the local communities' adoption of sand dams projects technology in Ekalakala Sub catchment	**Independent Variable** Level of Awareness	Information Accuracy	Effects of Level of information accuracy in adopting sand dam project	Questionnaire Focus group guide Interview Guide	Ordinal	Descriptive Chi Square Cross Tabs
		Information Accessibility	influence of level of information accessibility in adopting sand dam projects	Questionnaire Focus group guide Interview Guide	Ordinal	Descriptive Chi Square Cross Tabs

		Timeliness of Information	influence of level of information timeliness in adoption of sand dam	Questionnaire Focus group guide Interview Guide	Ordinal	Descriptive Chi Square Cross Tabs
		Adequate Knowledge	Influence of level of adequate knowledge on adoption of sand dam projects	Questionnaire Focus group guide Interview Guide	Ordinal	Descriptive Chi Square Cross Tabs
To establish the extent to which perceptions influence the local communities' adoption of sand dams projects technology in Ekalakala Sub catchment	**Independent Variable** Perceptions	Usefulness of involvement	Extent to which usefulness of involvement Influences the sand dam projects adoption	Questionnaire Focus group guide Interview Guide	Ordinal	Descriptive Chi Square Cross Tabs
		Perceived Time required	Extent to which the Perceived Time required influences the sand dam projects adoption	Questionnaire Focus group guide Interview Guide	Ordinal	Descriptive Chi Square Cross Tabs
		Project	Extent to which perceived project	Questionnaire	Ordinal	Descriptive

		Ownership	ownership influences the sand dam projects adoption	Focus group guide Interview Guide		Chi Square Cross Tabs
		Cost Involvement	Extent to which the Cost involved influences the sand dam projects adoption	Questionnaire Focus group guide Interview Guide	Ordinal	Descriptive Chi Square Cross Tabs
		Perceived Benefits	Extent to which perceived benefits of project influences the sand dam projects adoption	Questionnaire Focus group guide Interview Guide	Ordinal	Descriptive Chi Square Cross Tabs
To establish the extent to which level or readiness influence the local communities' adoption of sand dams projects technology in Ekalakala Sub catchment	**Level of Readiness**	Willingness	Extent to which willingness to support the project affects the sand dam projects adoption	Questionnaire Focus group guide Interview Guide	Ordinal	Descriptive Chi Square Cross Tabs

Source: Researcher (2013

3.10 Methods of Data Analysis

The collected data was thoroughly examined and checked for error and tabulated. Descriptive analysis, which is the distributional properties of a variable, was carried out for each objective describing all the variables used to achieve the objective. The most useful statistics was produced using descriptive analysis. Descriptive statistics especially, mean was used to help establish patterns, trends and relationships, and to make it easier for the researcher to understand and interpret implications of the study. Data was represented using tables (Aneshensel, 2004).

The study used multiple regressions to test the independent variables against the dependent variable. Multiple regression was done in order to establish the nature of the relationship between the local communities' adoption of sand dams projects technology and socio-economic factors, level of awareness, perceptions, and level of readiness. The Software Package for Social Sciences (SPSS) software version 20.0 was used to analyze the data.

3.11 Ethical Issues

The study ensured that the research was done in an ethical manner. First the research obtained a letter from the University of Nairobi to allow him to conduct the study. The researcher also sought for authority from Water Resources Management Authority (WRMA) and Ekalakala WRUA to collect data from Ekalakala sub-catchment.

The study ensured confidentiality and security of data gathered from the respondents. In this regard, all the data collected was kept in safe custody. The respondents were not required to write their names on the questionnaire to avoid exposing who gave what information. A letter of request to participate in the study was addressed to the respondents. This was a show of courtesy to the respondents as well as a mechanism of ensuring informed consent to participate in the study.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This section of the study contains the analysis of the results obtained using the study data. It contains the questionnaire return rate, results, analysis, presentation of the results, and the interpretation of the results. The chapter contains the results obtained from pre-testing (reliability tests), respondents' demographics, descriptive analysis, content analysis, Focus group results, and model estimation. The reliability tests section contains the results obtained during the pre-testing of the questionnaire, when determining its reliability.

4.2 Questionnaire Return Rate

The table below shows the demographic characteristics of the respondents who submitted responses to the questionnaire.

Table 4.1: Demographic Characteristics of the respondents

Sex	Frequency	Percent
Female	209	53.00
Male	185	47.00
Total	394	100.00

Source: Research Data (2013)

Table 4.1 which contains analysis by respondents' sexual orientation shows that 53.00% of the respondents were female as 47.00% were male. So, most of those who participated in the

study were female respondents. Further the results showed that 394 subjects responded out of the sample population of 400. This was a very high response rate of 98.50%.

The respondents took two weeks to complete filling the questionnaire and the focus group discussions were held in two sites on the same day.

The age sets of the respondents is presented in Table 4.2 with the range of age below 16 years being the underage ,those between 16-30 years being the youth and between 31-60 years termed as the adults or the active participants in sand dams projects in Ekalakala subcatchment. Those above 60 years are the aged or those that play a minimum role in sand dams projects in the sub catchment.

Table 4.2: Respondents Age

Age Groups	Frequency	Percent
Less than 16	15	3.80
16-30 Years	90	23.00
31 – 45 Years	106	27.00
46 – 60 Years	108	27.60
61 – 90 Years	65	16.60
Over 90 Years	10	2.60
Total	394	100.00

Source: Research Data (2013)

Most of the respondents, who formed 27.60%, were of the age group 46 – 60 years. These formed the adult composition of the target population. They were very closely followed by those who were in the age group 31 –45 years, who formed 27.00% of the total response .Those are the youthful composition of the target Ekalakala community Those who were in

the age group 16 – 30 years were next and they made up 23.00% of the total response. Those were also the youthful composition.The respondents in the age group 61 -90 years formed 16.60%.They were the aged in Ekalakala. Some respondents were less than 16 years(the under age) (3.80%) and others were over 90 years (2.60%).

Table 4.3 shows the tabulation of the respondents as per their period of stay in the sub catchment.

Table 4.3: Period of Stay at EkalaKala Area

Period	.Frequency	Percent
Less than 16	20	5.10
16-30 Years	121	30.80
31 – 45 Years	145	36.90
46 – 60 Years	66	16.80
61 – 90 Years	40	10.20
Over 90 Years	1	0.20
Total	393	100.00

Source: Research Data (2013)

From the results in Table 4.3, most of the respondents indicated that they had stayed at EkalaKala sub catchment area for between 31 – 45 years (36.90%), followed by those who were between the ages 16 to 30 years (30.80%).These were the youthful sub set. Those who indicated that they had stayed in the area for between 46 and 60 years formed 16.80% of the total response and were followed by those who showed that they had stayed in the area for

between 61 and 90 years (10.20%). The respondents who indicated that they had stayed in the area for less than 16 years formed (5.10%). Only 0.20% showed that they had they had stayed in the area for over 90 years.

4.3 Reliability Test

The study tested the study instrument for reliability using internal consistency on Cronbach Alpha test. The tool was issued to 10 respondents who were not allowed to participate in the study. The respondents took one and half weeks to return the instrument. The results obtained (Table 4.4) showed that the reliability coefficient, Cronbach Alpha, was 0.976. The Cronbach Alpha of 0.976, which was almost equal to 1, was well above the threshold of 0.7. It should however be noted that the absolute value of Cronbach Alpha should be between 0 and 1 and the acceptable value of reliability consistency should be 0.7 and above. The reliability consistency was 0.976, which indicated a very high reliability of the items in the tool.

The table below shows the results of the reliability test carried out using the Cronbach alpha coefficient.

Table 4.4: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.973	0.976	21

Source: Research Data (2013)

The results further showed that removal of any item from the tool would have reduced the reliability of the item. Table 4.5 shows that removal of any item from the tool would reduce

the reliability to below 0.976, making the tool less reliable. The study then opted to retain all the items in the tool.

The following table shows the results of the effect on reliability of removal of any item from the tool on the Cronbach's alpha coefficient .

Table 4.5: Item-Total Statistics

Item	Cronbach's Alpha if Item Deleted
Frequency of attending project meeting	0.973
Promptness in contributing towards the project	0.972
Participation in project work during project implementation	0.972
Participation in project work after project implementation	0.973
Cultural Beliefs of the area	0.969
Land Ownership	0.973
Cost of maintaining the dam Resources	0.974
Your Income Levels	0.972
Accuracy of Information given about the sand dam	0.971
Accessibility of Information given about the sand dam	0.971
Timeliness of Information on sand dam	0.971
Adequate Knowledge of sand dam	0.971
Usefulness of involvement in sand dam projects	0.97
Perceived time required in project activities	0.972
Perceived ownership of the sand projects	0.971
Cost involved in these projects	0.971
Readiness to adopt the sand dam project	0.971

Source: Research Data (2013)

4.4 Analysis of Study Objectives

The descriptive analysis was used to analyse the data collected on the 5 point Likert Scale and recorded the mean of these results using the Statistics;

0 – 0.8 Not at All

0.8 – 1.6 Low

1.6 – 2.4 Moderate

2.4 – 3.2 High

3.2 – 4.0 Very High

4.4.1 Adoption of Sand Dams. Technology

The study first sought to evaluate the dependent variable, adoption of sand dam technology in an effort to establish how the respondents appreciated the technology. The results obtained were recorded in Table 4.6

The table below is an analysis of the respondents appreciation of the technology of sand dams.

Table 4.6: Analysis on Adoption of Sand Dams Technology

Item	Mean	Std. Deviation
Frequency of attending project meetings	2.39	1.19
Promptness in contributing towards the project	2.47	1.11
Participation in project work during project implementation	2.27	1.98
Participation in project work after project implementation	2.28	1.30
Adoption of Sand Dams Technology	2.35	1.04

Source: Research Data (2013)

The study sought to establish the appreciation of sand dams' technology by the respondents. From the result in the table, the respondents showed that they moderately attended sand dams projects meetings (mean = 2.39, Std. Deviation = 1.19). The respondents also indicated that they at most of the times contributed towards the sand dams projects (mean = 2.47, Std. Deviation = 1.11). The respondents further indicated that they moderately participated in sand dams projects during the project implementation (mean = 2.27, Std. Deviation = 1.98) and moderately participated in these projects after project implementation (mean = 2.28, Std. Deviation = 1.30). Overall, the respondents showed they moderately adopted sand dams projects technology (mean = 2.35, Std. Deviation = 1.04).

4.4.2 Influence of Socio-Economic Factors on Adoption of Sand Dams' Technology

The results on the first objective; how socio-economic factors influenced local communities' adoption of sand dams projects technology in Ekalakala Sub catchment, were recorded on Table 4.7.

Table 4.7 presents an analysis of the influence of socio-economic factors on adoption of sand dams technology.

Table 4.7: Influence of Socio-Economic Factors

Item	Mean	Std. Deviation
Cultural Beliefs of the area	0.84	1.32
Land Ownership	2.12	1.35
Cost of maintaining the dam Resources	2.35	1.20
Your Income Levels	1.89	1.11
Socio-Economic Factors	1.80	0.83

Source: Research Data (2013)

The results on socio-economic factors (table 4.7) indicate that the respondents showed that the cultural beliefs played a very minimal role in the adoption of sand dams projects technology (mean = 0.84 ,Std. Deviation = 1.32). The respondents indicated that their cultural beliefs were not a consequence to sand dam project adoption. It was also found that the land ownership had moderate effects on sand dam project adoption (mean = 2.12, Std. Deviation = 1.35). The cost of maintaining the sand dam resources moderately affected the adoption of sand dams technology (mean = 2.35, Std. Deviation = 1.20). Income levels had moderate challenge on adoption of sand dam projects (mean = 1.89, Std. Deviation = 1.11). Overall, the socio-economic factors moderately affected the adoption sand dam projects.

4.4.3 Influence of Level of Awareness on Adoption of Sand Dams' Technology

The second objective; level of awareness influence the local communities' adoption of sand dams projects technology in Ekalakala Sub catchment was tested and the results captured in Table 4.8

Table 4.8: Influence of Level of Awareness

Item	Mean	Std. Deviation
Accuracy of Information given about the sand dam	2.36	0.98
Accessibility of Information given about the sand dam	2.56	1.00
Timeliness of Information on sand dam	2.46	1.04
Adequate Knowledge of sand dam	2.58	1.18
level of Awareness	2.49	0.91

Source: Research Data (2013)

Results in Table 4.8 show the respondents indicating that the accuracy of Information given about the sand dam contributed moderately towards adoption of sand dam projects (mean = 2.36, Std. Deviation = 0.98). Accessibility of Information given about the sand dam contribute highly towards adoption of sand dam projects (mean = 2.56, Std. Deviation = 1.00). The respondents also showed that Timeliness of Information on sand dams highly affected the adoption of sand dam projects (mean = 2.46, Std. Deviation = 1.04) and adequate knowledge of sand dam highly affected the adoption of sand dam projects (mean = 2.58, Std. Deviation = 1.18). From the results, the level of awareness of sand dam technology highly affected the adoption of sand dam projects (mean = 2.49, Std. Deviation = 0.91).

4.4.4 Influence of Perceptions on Adoption of Sand Dams' Technology

The third objective sought to establish the extent to which perceptions influence the local communities' adoption of sand dams' projects technology in Ekalakala Sub catchment.

Table 4.9: Influence of Perceptions

Item	Mean	Std. Deviation
Usefulness of involvement in sand dam projects	2.71	1.10
Perceived time required in project activities	2.54	0.98
Perceived ownership of the sand dams projects	2.62	1.04
Cost involved in these projects	2.08	1.06
Perceptions	2.49	0.85

Source: Field Survey (2013)

Table 4.9 results show the respondents indicating that they perceived the involvement in sand dam projects useful which highly influenced the adoption of sand dam projects (mean = 2.71, Std. Deviation = 1.10). They also indicated that the perceived time required in project activities highly influenced the adoption of sand dam projects (mean = 2.54, Std. Deviation = 0.98). The perceived ownership of the sand dams projects highly influenced the adoption of sand dam projects (mean = 2.62, Std. Deviation = 1.04). The respondents also showed that the cost involved in these projects moderately influenced the adoption of sand dam projects (mean = 2.08 ,Std. Deviation = 1.06). The respondents' perceptions highly influenced the adoption of sand dams projects (mean = 2.49 ,Std. Deviation = 0.85).

4.4.5 Influence of Level of Readiness to adopt on Adoption of Sand Dams' Technology

Objective four sought to establish the extent to which level or readiness influence the local communities' adoption of sand dams projects technology in Ekalakala Sub catchment

Table 4.10: Influence of the Level of Readiness to adopt the sand dams project

Item	Mean	Std. Deviation
Readiness to adopt the sand dams project	3.07	0.98

Source: Research Data (2013)

Lastly, the respondents' showed that the Readiness to adopt the sand dams project highly influenced their adoption (mean = 3.07, Std. Deviation = 0.98).

4.5 Analysis of Open Ended Questions

The respondents were requested to provide their opinions through the open ended questions in the questionnaire. These questions so provided were based on the research objectives. The results were therefore analysed with references to the research objectives. The study used content analysis to analyse these results.

First the respondents were requested specify what would have hindered them from participating in sand dams' projects technology, a question addressing the adoption of sand dams technology. Most of the respondents, who formed 76.00% of the total response, indicated that they failed to participate in these projects when attending to personal

commitments such as; working for income, looking after cattle, household chores, attending to urgent calls, and attending to community meetings. An overwhelmingly majority (92.00%) showed they would not participate when they were sick otherwise they were always ready to participate any time. Sickness such as HIV/AIDS deterred most respondents from participating in sand dams' projects technology. The results also showed 54.00% indicating that they would not participate owing to the low income level and lack of enough financial resources to enable them to do so. Others (17.00%) showed that political influence and leadership issues led to their failure to participate in sand dams' projects technology. They showed that; community funds were commonly misused, there was inefficient use of public resources and lack of transparency, and there was lack of commitment by the public and lack of cooperation. There were those (7.00%) who showed that issues such as poverty, hunger, unemployment, age, insecurity, long distances, and inadequate information hindered their participation in sand dams' projects technology. Interestingly, the respondents showed that they were very ready to adopt the sand dams' projects technology. They indicated that the project led to accumulation of sand which benefited them through retention of clean water and the growth of ever green vegetation. There was enough water for the household used and their livestock.

Secondly, the respondents were asked to state the socio-economic factors which were hindering them from participating in sand dams' projects technology in EkalaKala sub catchment. Most of the respondents showed that low income levels hindered their readiness to adopt the sand dams projects. They showed that they were not in positions to financially support these projects owing to their low income earning capacity. However, land ownership and cultural beliefs were shown to be other hindrances to adoption of sand dams' project technology.

Thirdly, as regards awareness, the respondents indicated that their level of awareness about sand dams' projects technology was very high. A majority of (71.00%) of the respondents showed that donors or the government provided them sufficient information about the sand dams' projects technology any time they were constructing one. At the same time 27.00% of the respondents showed that donors or the government did not provide them sufficient information about the sand dams' projects technology any time they were constructing one as 2.00% showed that the information provided was fair.

Fourthly, on perceptions, the respondents showed that the sand dams were very beneficial to the community (97.00%) by ensuring availability of quality, promoting the living standards of the community, facilitating water for irrigation, empowering the community economically, preventing soil erosion, enriching vegetation, storing water. The rest showed that these projects required good management to manage the human resource and other resources, the sands dams were misplaced, required the participation of the community, the community needed to be equipped with adequate information, the projects were costly. The respondents also suggested that more sand dams should be set up, government needed to support the sand dam projects financially; sand harvesting needed to be controlled, and follow up needed to be done.

Lastly, the respondents showed that they were willing and ready to adopt the projects despite of a number of challenges. The respondents showed that challenges such as lack of community cooperation, low income levels, distance to the sand dam locations, political influence, poor management and lack of transparency, lack of skills and expertise, and lack of empowerment hinder their readiness to adopt these projects.

4.6 Focus Group Results

The study conducted focus group discussions to obtain more information on sand dam adoption in EkalaKala sub catchment. During the exercise useful information, based on the research objectives, was obtained. First, all the respondents indicated that the sand dam technology was very beneficial to the community. They cited the benefits of Sand dams' projects as the availability of clean water, reduced distance to access water, availability of water to the society and livestock, conservation and enhancement of natural vegetation. Up to 80% of the respondents showed that they benefited immensely from the projects. They showed that water was available at a close locality and their families obtained clean quality water readily. They said that their families were safe from the crocodiles that attacked them when they went fetch water from Masinga Dam. However, the respondents regarded the sand dam projects technology implementation as being the donors' responsibility. Most the respondents (64%) showed that they thought the donors had to do everything to do with implementation of the projects. All the sand dams in the area had been done by donors. The respondents showed the mostly the youth went to sand projects to seek for employment during project implementation.

Secondly, the respondents showed that the participation is sand dams' projects technology was mainly hindered by the low income level, a socio-economic factor. During the discussions the respondents showed that the incomes by most of them were not sufficient to support their needs and allow them to contribute towards the sand dams' projects technology. Although they were very willing to support the projects and even claim ownership of the same, their earning capacity highly hindered the fulfilment of such as desire. They actually showed that the area was semi arid and there was no assurance of consistent harvest of income from the land, which highly limited the earning capacity. Issues such as land

ownership and cultural beliefs did not seem to hinder their adoption of sand dams' projects technology. Most of the respondents (95.00%) showed that these issues did not play any role. The respondents (87.00) showed that they were not even deterred by the cosy of maintaining the sand dams' projects technology. They were very ready to pay for sustenance of sand dams, owing to the value they associated with the sand dams. The only main challenge was lack finances to support this.

Thirdly, the respondents they were provided with enough information about sand dams' projects technology, which meant that they were fully aware of the sand dams' projects technology. They showed that WRUAs gave them information was and when it was needed. Issues such as adequacy, timeliness, reliability and effectiveness of information were rated highly. In fact all the respondents said that the information obtained was sufficient to convince them to adopt the technology. They also showed they owned the projects. Most of the respondents (61.00%) showed they had personnel attachment to sand dams' projects and took such as their own possessions. The rest however showed that the projects were donor and government possessed and the community was not a major partaker.

Fourthly, the respondents showed that it was Useful for them to be involve in the project (69.00%), the time spent in the project was wisely use (78.00%), they felt the project belonged to them and they would guard such (61.00%), Cost Involved was high (49.00%), and perceived the project as beneficial to them (100.00%).

Lastly, all the respondents showed that they were ready to adopt the sand dams' projects technology, which was very beneficial to them.

4.7 Estimation of Study Model

The study used regression analysis to estimate relationship between the independent variables (IVs) and dependent variables (DV), in an effort to establish whether the IVs were predictors of the DV.Regression analysis helped the researcher to understand how the typical value of the dependent variable changed when any one of the independent variables was varied, while the other independent variables were held fixed.

First, the study tested for multi-collinearity problems before carrying out any other tests. The study tested for multi-collinearity in the Independent Variable Indicators against Dependent Variable and the results captured in Table 4.11.

The table below shows results of multi-collinearity tests.

Table 4.11: Collinearity Statistics for Independent Variable against Dependent Variable

	Tolerance	Variance Inflation Factor (VIF)
Cultural Beliefs of the area	.721	1.387
Land Ownership	.398	2.512
Cost of maintaining the dam Resources	.335	2.989
Your Income Levels	.484	2.067
Accuracy of Information given about the sand dam	.345	2.900
Accessibility of Information given about the sand dam	.315	3.178
Timeliness of Information on sand dam	.389	2.571
Adequate Knowledge of sand dam	.318	3.141
Usefulness of involvement in sand dam projects	.334	2.998
Perceived time required in project activities	.326	3.068
Perceived ownership of the sand projects	.461	2.167
Cost involved in these projects	.454	2.201
Readiness to adopt the sand dam project	.366	2.735

Source: Research Data (2013)

From the results in table 4.11, the tolerance value for each Independent variables was greater than 0.1, an indication that there were no multi-collinearity issues in the Independent variables indicators. This was a show that the Independent variables indicators were reliable.

The study further tested for presence of multi-collinearity in the factors used as Independent variables against the dependent variables and the results were recorded in table 4.12.

Table 4.12: Results for Multicollinearity Test of Independent Variables

	Tolerance	Variance Inflation Factor (VIF)
Socio-Economic Factors	.648	1.543
Level of Awareness	.469	2.130
Perceptions	.269	3.717
Readiness to adopt the sand dam project	.424	2.356

Source: Research Data (2013)

The results in Table 4.12 show that the tolerance value for each Independent variable was greater than 0.1, which was an indication there were no multicollineraity issues in the Independent variables.

These results qualified the results for use in any other regression tests, since there was no presence of multi-collinearity. In other words, there is no variable in the model that is measuring the same relationship as is measured by another variable or group of variables

The study then went ahead in estimating the regression model and establishing whether the independent variables were predictors on the dependent variable using backward method. Various interpretations were also made based on Table 4.13 results to establish the significance of the independent variable in determine the dependent variable. Using the backward method, the study established that Readiness to adopt the sand dam project was

removed owing to its inability to estimate the adoption of the sand dam project (β = 0.520, p-value = .392).

Table 4.13: Regression of Independent Variables against the Dependent Variable

Predictor Variable	β	Sig.
(Constant)		
Socio-Economic Factors	0.179	.002
Level of Awareness	0.330	.000
Perceptions	0.462	.000
N= 369 R^2= 0.914 Adjusted R^2 = .913		
Sig. F Change = .000		

Source: Research Data (2013)

As relates to Socio-Economic Factors, β = 0.179 p-value= .002. Since p <.05 then at the α = 0.05 level of significance, there exists enough evidence to conclude that the Socio-Economic Factors is not zero and, hence, that Socio-Economic Factors is useful as a predictor of adoption sand dams' project technology.

Looking at the Level of Awareness, β = 0.330 p-value= .000. Since p <.05 then at the α = 0.05 level of significance, there exists enough evidence to conclude that the Level of Awareness is not zero and, hence, that Level of Awareness is useful as a predictor of adoption sand dams' project technology.

On Level of Awareness, $\beta = 0.362$ p-value= .000. Since $p < .05$ then at the $\alpha = 0.05$ level of significance, there exists enough evidence to conclude that the Perceptions is not zero and, hence, that Perceptions is useful as a predictor of adoption sand dams' project technology.

The constant, β_0, was blank, which means that there was not value for the constant hence the estimated model to determine adoption sand dams' project technology derived from

SDT = $\beta_0 + \beta_1 SE + \beta_2 LA + \beta_3 PS + e$ is given by

SDT = 0.179SE + 0.330LA + .362PS

Where;

SDT is adoption sand dams' project technology

SE is Socio-Economic Factors

LA is Level of Awareness

PS is Perceptions

β_0 is a constant.

β_{1-3} is the regression coefficients or change induced by SE, LA, and PS

e = error of prediction

In conclusion, three independent variables; Socio-Economic Factors, Level of Awareness, and Perceptions, could significantly predict dependent variable; adoption of sand dams' project technology.

Further, the coefficient of determination was .913, an indication that 91.30% of change in adoption sand dams' project technology was determined by the three variables; Socio-Economic Factors, Level of Awareness, and Perceptions. So, the regression equation obtained using these variables would be moderately useful in making prediction simply because the value or R^2 was above 0.8

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This is the Chapter which contains; a summary of the findings, discussions on the study findings, conclusions and recommendations. The summary was drawn from the results and was based on objectives. The chapter summarised the findings in chapter giving a deeper insights of these results obtained. It also provides discussions of the findings which were based on literature reviewed in chapter two. The study made conclusions based summary of findings.

5.2 Summary of Findings

The study was guided by the following objectives; To establish the influence of socio-economic factors on the local communities' adoption of sand dams projects technology in Ekalakala Sub catchment; To establish the influence of the level of awareness on the local communities' adoption of sand dams projects technology in Ekalakala Sub catchment; To establish the influence of perceptions with the local communities' adoption of sand dams projects technology in Ekalakala Sub catchment; and To establish the influence of readinesss on the local communities' adoption of sand dams projects technology in Ekalakala Sub catchment.

5.2.1 Findings on the influence of Socio-Economic factors on communities' adoption of sand dams technology

As regards to socio-economic factors, the study established that cultural beliefs played an insignificant role in sand dams projects adoption (mean = 0.84 Std. Deviation = 1.32) and all the other factors; land ownership (mean = 2.12 Std. Deviation = 1.35); cost of maintaining (mean = 2.35, Std. Deviation = 1.20); and income levels (mean = 1.89 Std. Deviation =- 1.11) moderately affected the sand dam project technology adoption. As a whole, the socio-economic factors moderately affected the adoption sand dam technology projects.

5.2.2 Findings on the influence of level of awareness on communities' adoption of sand dams technology

On the level of awareness of sand dam technology, the study found out that there was moderate of the accuracy of Information given about the sand dam on adoption of sand dam projects (mean = 2.36 Std. Deviation = 0.98). It was also found that there was high contribution towards adoption of sand dam technology by all the other factors, accessibility of Information (mean = 2.56 Std. Deviation = 1.00); timeliness of Information on sand dam (mean = 2.46 Std. Deviation = 1.04) and adequate knowledge of sand dam (mean = 2.58 Std. Deviation = 1.18). The level of awareness of sand dam technology highly affected the adoption of sand dam projects (mean = 2.49 Std. Deviation = 0.91).

5.2.3 Findings on the influence of perceptions on communities' adoption of sand dams technology

The study found out that the respondents' perceptions highly influenced the adoption of sand dam projects (mean = 2.49 Std. Deviation = 0.85). The sand dam projects was highly

influenced by; perceived the involvement in sand dam projects (mean = 2.71 Std. Deviation = 1.10); perceived time required in project activities (mean = 2.54 Std. Deviation = 0.98); and the perceived ownership (mean = 2.62 Std. Deviation = 1.04). The cost involved in these projects moderately influenced the adoption of sand dam projects (mean = 2.08 Std. Deviation = 1.06).

5.2.4 Findings on the influence of the level of readiness on communities' adoption of sand dams technology

The level of readiness to adopt the sand dams project technology was found to be a factor that would influence the adoption of sand dams projects, it was found to highly influence the adoption of sand dams' projects technology (mean = 3.07 Std. Deviation = 0.98).

5.3 Regression Model

The study estimated the regression model using backward elimination method which eliminated factors that would best estimate adoption of sand dams' projects technology. The method involved starting with all candidate variables, testing the deletion of each variable using a chosen model comparison criterion, deleting the variable that improved the model the most, and repeating this process until no further improvement was possible.

The study established that Socio-Economic Factors (p-value= .002), Level of Awareness (p-value= .000), and Perceptions (p-value= .000) were predictors of adoption of sand dams' projects technology. The β value for each was positive; Socio-Economic Factors (β = 0.179), Level of Awareness (β = 0.330), and Perceptions (β = 0.462) which indicated that all the

independent variables were directly proportional to the dependent variable. So an increase in any independent variable caused an increase in adoption of sand dams' projects technology.

5.4 Discussions of the Findings

From the results obtained, it was found that the respondents appreciated the sand dam technology and therefore adopted the technology moderately. The respondents indicated that they were ready to contribute towards the sand dam project technology. Although the participation in the project during and after the adoption; and attendance to the meeting was moderate, the respondents indicated they appreciated the benefits of the sand dams' projects technology. Among the benefits achieved is the availability of adequate clean water and the increase in the natural vegetation (Manzi & Kuria, 2011). The respondents considered the sand dam projects as being donors' initiatives and donors had to fully carter for everything. The results conformed to the theory of Public Goods, which postulates that individuals might perceive projects as the provision of a public good and no one should be excluded from using it once it is provided (Liebe *et al.*, 2011). Such a perception may turn harmful to the sand dam projects in that they may make the sand dam projects under-perform, as suggested by UNICEF *et al*. (2012). These findings also agreed totally with Madian (2007) that the perceptions by the community influences the water projects

5.4.1 Influence of Socio-economic Factors on Communities' Adoption of Sand dams projects technology

The socio-economic factors had moderate effects on sand dam project adoption, which was in total agreement with Mtitu (2009), who found that socio-economic issues affect the development and growth of sand dam technology projects. The respondents had shown that

their income levels and earning capacity was low which moderately affected the sand adoption. They actually showed their land was dry for long period, where they would go without rain for long season even up to two years. This adversely affected their earning ability, which remained very low. In essence, it means that supporting the sand dam project financially was a challenge although they might have been willing to do so. These findings confirm those in the study by Njodzeka (2009), who found that although the communities may want to participate in projects, lack of finances usually limited them and further limited the scope of the project. The study by Aharikundira (2009), which found out that low sustainability of the sand dam projects was as a result of low and inconsistent nature of income of the local community was found to be true and applicable in the present study. Another study that was relevant to the findings in the present study was the one by Ngoda (2009), which established the sustainability of sand dam projects was supported by availability of enough funding. However, cultural beliefs played no role in adoption of sand dam project, which to some extent negated the diffusion theory as explained by Rogers (2003) that cultural influence affected such projects.

5.4.2 Influence of the Level of Awareness on Communities' Adoption of Sand dams projects technology

Although the residents of Ekalakala Sub catchment lacked accurate information about sand dams, their level of awareness of the sand dam technology project was very high. These residents had high accessibility of Information on sand dam projects, obtained this information on time and had developed adequate knowledge of sand dam. These findings totally confirmed the study by Excellent (2011) which attributed the failure to adoption of sand dams' project by the local communities to lack of awareness, lack of technical

knowledge and experience to design and construct sand dams, labour intensiveness of the exercise and Lack of finances. The study by Excellent (2011) insists that awareness on sand dam projects should be raised of sand dams at all levels. The findings in the present study also confirmed the findings in the study by Ngowi and Mtana (2007), which established that the community participated minimally due to lack of project knowledge. From this study it was clear that the lack of awareness would lead to the failure to adoption of the sand dam projects.

5.4.3 Influence of Perceptions on Communities' Adoption of Sand dams projects technology

The perceptions of the residents of Ekalakala highly influenced the adoption of sand dam projects. The study found out that the sand dam projects was highly influenced by; perceived the involvement in sand dam projects; perceived time required in project activities; and the perceived ownership. A challenges factor was the cost of sand dam project adoption. The study found out cost involved in these projects moderately influenced the adoption of sand dam projects, a fact that was earlier agreed upon by Njodzeka (2009), Aharikundira (2009), Ngonda (2009), and Excellent (2011). All these studies had concurred that lack of financing by the local community had negative effects on the adoption of sand dam projects. The findings from the present study echoed what Meliyo (2008) had earlier found that information provide on sand dam technology had high positive impact on the adoption. The study findings also confirmed that the study by Mutiso (2009) was worth its cause and its findings were true. The study by Mutiso (2009) found out that meagre incomes and lack of awareness of the local communities in dry regions are the largest hurdles to adoption of the sand dams. The findings are crowned by the findings in the study by Ngowi and Mtana

(2007), which found low community participation in sand dam projects was due to lack of project knowledge.

5.4.4 Influence of Level of Readiness on Communities' Adoption of Sand dams projects technology

It was established that the respondents were ready to adopt the sand dam project. They had the urge to support and participate in the sand dam projects. The findings were in confirmation to the findings in the study by Casmiri (2007), which was categorical that the willingness to pay highly promoted the sustainability of the project. These findings supported the recommendation by Mushi (2009). The study by Mushi (2009) in its recommendation pointed out that community participation was key to sustainability of the sand dams projects, which is what the present study established. The findings in the present study clarifies sentiments in the study by Gbadegesin and Olorunfemi (2007); advocates for active involvement of the community in sand dams projects for the water supply provision and management to be more successful and sustainable in the rural areas.

5.5 Conclusion

The residents of Ekalakala sub catchment area appreciated the sand dam project technology and highly welcomed it. They actually adopted the sand dam technology and appreciated the benefits attained from adoption of the technology. However, they moderately participated in sand dam projects. Their lack of full commitment to sand dam projects was due to perception that the project belonged to the donors and the government as they reaped the benefits. They would only wait until another project was initiated by the donors. The residents lacked the drive to initiate their own sand dam projects.

The low income level of the residents of Ekalakala had negative effects on the growth of sand dam projects in the sub catchment. They were not able to participate in the maintenance of these projects owing to their inability to consistently contribute towards the projects. This would have dealt a large blow to the projects.

The residents of EkalaKala sub catchment had obtained adequate information on sand dam technology projects and even felt the benefits of these projects. This acted as motivators to their willingness to adopt this technology. However, their earning capacity challenged their participation in these projects. It is the financial aspects, which hindered their participation although they had the morale to make the technology a reality in their area. They actually showed their readiness to adopt and support this technology.

The study established that Socio-Economic Factors, Level of Awareness, and Perceptions were predictors of adoption of sand dams' projects technology. However, the level of readiness to adopt sand dams project was not found to be a predictor of adoption of sand dams' projects technology. It fitted very well as an indicator of the dependent variable.

5.6 Recommendations

This section provides ideas about which corrective action and by whom that need to be taken. It contains policy recommendations whose action need to be taken up by the Central Government, the County Government of Machakos, the Water Resources Management Authority and the Ekalakala WRUA as well as recommendations for further studies. The study gives various policy recommendations for the development and growth of sand dams project technology at EkalaKala and the country at large.

5.6.1 Policy Recommendations to the Central Government

The Government of Kenya should review the legal framework to restructure and empower the Water Resource Users Associations (WRUA).

Related to socio economic issues, the government should introduce tax waiver initiatives for imported technology and building materials. All the material for building sand dams should have their tax waived to reduce the cost of sand dam building materials, which would reduce the cost of sand dam construction.

The Central Government in collaboration with Water Resources Management Authority and the County Government of Machakos should create awareness programs to sensitize the public about the sand dam projects. These programs should inform the water users of their participation in sand dam projects. The Ekalakala community should be empowered with information on sand dam technology. In these campaigns, the facilitators must emphasize on participatory approach to the sand dam technology projects

5.6.2 Policy Recommendations to the Machakos County Government

The Machakos County Government should make sand dams a priority in their development strategy to provide water. They should make legislations that enhance ensuring that the entire community fully participates in the sand dams projects technology. The sand dams technology legal and institutional framework should be capable of making WRUAs responsible for development and growth of Sand dam projects.

The County Government of Machakos should create an economic value of the sand dams, by ensuring that the monetary benefits attained through sale of sand from the dams and any product related to sand dam project should be shared by the community. They should also ensure that those drawing water for irrigation to their farms should pay some predetermined

amount. In fact there should be control on how the sand dam products, such as water and sand are used. This control should in the hands of the WRUAS. The county government and donors should encourage the development of sand dam projects by empowering the local community at EkalaKala. This is by turning the sand dam projects into investments and financing the sand dam projects through lending refundable funds to the local communities (under WRUAS). The donors to the projects would supervise the operation until after recovery of the debt financed. In this regards, the community would be advised on how to use the sand dams economically.

5.6.3 Policy Recommendations to the Ekalakala Water Resources Users Association

The Ekalakala WRUA should make strategic plans (approved by the Machakos County Government) on how to develop and support sand dams projects development in the sub catchment. The WRUA should be composed of water resource professionals, who are well informed of sand dams projects technology or alternative cheap technologies of harvesting surface runoff.

5.6.4 Policy Recommendations to the Water Resources Management Authority

The **Water Resources Management Authority** should make policies for introducing cheap sand dam building technologies. They should make the projects affordable by using locally available and affordable technologies. The community should be encouraged to use local technologies and trained on how to use such technologies widely and for their benefit.

5.6.5 Recommendation for Further studies

The study recommends that further studies should be conducted to establish the most factors that would influence the residents of Ekalakala to initiate their own sand dam projects. It has already been established that residents of Ekalakala know the benefits of this technology, have adopted the technology and are willing to participate in the project but lacked the motivator to accept the projects as being theirs. Although they showed some degree of ownership, they still believed the projects belonged to the donors, which might have been the reason for their not starting their own projects.

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APPENDIXES

APPENDIX I: QUESTIONNAIRE

FACTORS INFLUENCING COMMUNITIES' ADOPTION OF SAND DAMS PROJECTS TECHNOLOGY: THE CASE OF EKALAKALA SUB CATCHMENT, KENYA

This Questionnaire is meant to collect data from the residents of Ekalakala. Any information provided in this Questionnaire will be used for purposes of research only and will not be divulged or availed to unauthorized persons

Tick the correct answer in the boxes provided against the questions where provided.

Write brief answers where explanation is required.

You need not write your name on the questionnaire.

Please answer the questions as accurately as possible.

SECTION A: RESPONDENTS' DEMOGRAPHICS

1. Please indicate your Village _____

2. Please indicate your sex?

Female ( )

Male ( )

3. Please indicate your age groups position by ticking  in the appropriate box

Less than 16 Years	
16-30 Years	
31 – 45 Years	
46 – 60 Years	

61 – 90 Years	
Over 90 Years	

4. How long have you lived in Ekalakala areas?

Less than 6 Years	
6-10 Years	
11 – 15 Years	
16 – 20 Years	
21 – 26 Years	
Over 26 Years	

SECTION B: ADOPTION OF SAND DAM TECHNOLOGY

5. Please indicate in your opinion, your evaluation of each of the following indicators of adoption of Sand Dam Technology. Tick  the correct answer in the space corresponding to the answer.

Scale: Not at All =0; Low = 1; Moderate =2; High = 3; Very High = 4

	Indicator	Not at All	Low	Moderate	High	Very High
(a)	Frequency of attending project meeting					
(b)	Promptness in contributing towards the project					
(c)	Participation in project work during project implementation					
(d)	Participation in project work after project implementation					

6. In your Opinion, what do would hinder you from participating sand dams projects technology in our area?

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SECTION C: SOCIO-ECONOMIC FACTORS

7. Please put a tick on the space corresponding to the correct answer in each question below. In your opinion indicate the extent to which the following Socio-economic factors would influence your adoption of sand dams projects technology.

Scale: Not at all =0; Low = 1; Moderate =2; High = 3; Very High = 4

		Not at All	Low	Moderate	High	Very High
(a)	Cultural Beliefs of the area					
(b)	Land Ownership					
(c)	Cost of maintaining the dam Resources					
(d)	Your Income Levels					

8. What socio-economic factors have been hindering you from participating sand dams projects technology in our area?

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SECTION D: LEVEL OF AWARENESS

9. To what extent do you think the following factors on level of awareness influence your participation in sand dams projects technology in your area? Please Tick the correct answer in the corresponding space.

Scale: Not at all =0; Low = 1; Moderate =2; High = 3; Very High = 5

	Indicator	Not at All	Low	Moderate	High	Very High
(a)	Level of Accuracy of Information on sand dam					
(b)	Level of Accessibility Information on sand dam					
(c)	Level of Timeliness of Information on sand dam					
(d)	Level of Knowledge of sand dam projects					

10. Does the donor or the Government provide you sufficient information about the sand dams projects technology any time they are constructing one?

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SECTION E: PERCEPTIONS

11. In your opinion, please indicate by a ticking  in the appropriate spaces, the extent to which each of the following indicators of your perceptions about sand dam project Influence your adoption of sand dam projects.

Scale: Not at All =0; Low = 1; Moderate =2; High = 3; Very High = 4

	Statement	Not at All	Disagree	Neutral	Agree	Strongly Agree
(a)	usefulness of involvement in sand dam projects					
(b)	Perceived Time required in sand project activities					
(c)	perceived ownership of the sand projects					
(e)	Cost involved in these projects					

12. What are your other perceptions about sand dams projects and what are your reactions to these perceptions?

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SECTION F: LEVEL OF READINESS

13. In your opinion, please indicate by a tick  in the spaces corresponding to the right answer, the extent to which level of readiness to participate in sand dam project influence you to adopt sand dam projects .

Scale: Not at All =0; Disagree = 1; Neither =2; Agree = 3; Very High = 4

	Statement	Not at All	Low	Moderate	High	Very High
(a)	Level of Readiness to adopt the sand dam project					

14. What would deter your willingness to adopt sand dams proejcts in your area?

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Thank you for participating

APPENDIX II: FOCUS GROUP DISCUSSION GUIDE

1. Introduce yourself
2. To what extent do you think the socio-economic factors influence your adoption of sand dam technology projects?
3. What role do the socio-cultural beliefs play in the adoption of sand dam technology projects technology in your area?
4. Does land ownership play any significant role in sand dam technology projects technology, and what role if any?
5. Do you think that lack of substantial finances deters you from participating in sand dam management?
6. Do you always receive all appropriate information about the sand dam projects whenever they are being constructed and how does this influence your adoption of sand dam technology projects?
7. What is the participation of the donor or government in disseminating information and do they provide adequate information?
8. Whom do you think owns the dam projects?
9. How do you evaluate the following with regards to your adoption of sand dam technology projects; Usefulness of involvement, Perceived Time required, Project Ownership, Cost Involvement, and Perceived Benefits?
10. Please evaluate your willingness to adoption of the sand dam technology projects

APPENDIX III: LETTER OF INTRODUCTION

TO WHOM IT MAY CONCERN

Dear Sir/ Madam

RE: LETTER OF INTRODUCTION

I am a student at University of Nairobi undertaking a Masters degree in Project Planning and Management. I have chosen you to participate in this study on the factors influencing local communities' adoption of sand dams projects technology in Kenya. More precisely, the study is making an attempt to assess the factors influencing local communities' adoption of sand dams projects technology in Ekalakala Sub-catchment. Your responses will only be used for the purpose of the study. All information received from the respondents will be held confidentially. Kindly respond sincerely to the issues in the questions posed.

Thanking you in advance of your response

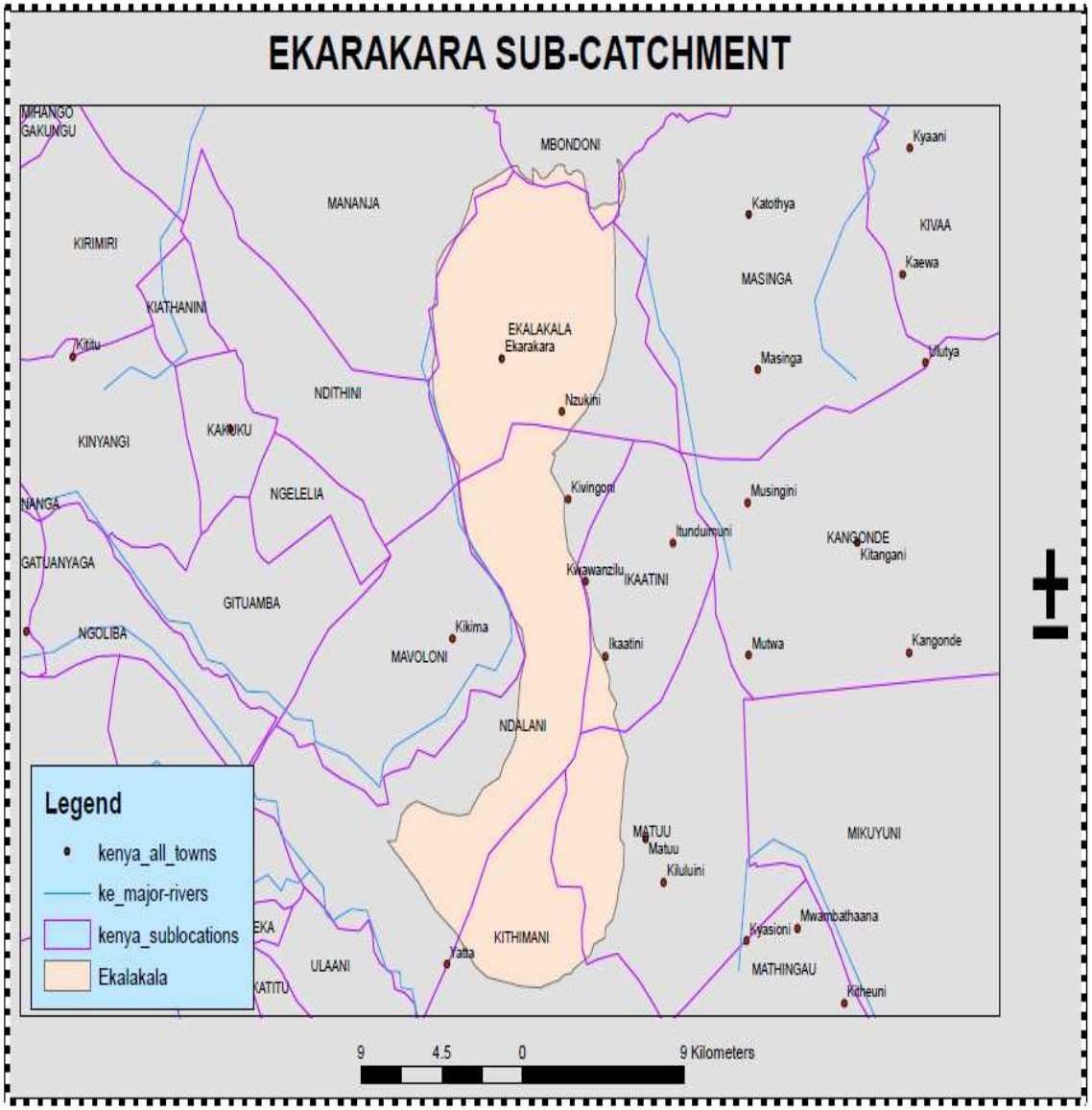
Yours Truly;

DAVID MUMO MUSYOKI

School of Continuing and Distance Education (SCDE)

University of Nairobi

APPENDIX IV: EKALAKALA SUB CATCHMENT MAP



Source: Ekalakala WRUA *et al*. (2011)

APPENDIX V: TABLE FOR DETERMINING SAMPLE SIZE

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size.
S is sample size.

Source: Krejcie *et al.* (1970)