DETERMINANTS OF PERFORMANCE OF IRRIGATION PROJECTS: CASE OF NTHAWA IRRIGATION PROJECT OF MBEERE NORTH SUB- COUNTY, EMBU COUNTY, KENYA

BY

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DECLARATION

I declare that this project report is my original work and has not been submitted in any other university or college.

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L50/84339/2016

This research project report has been submitted with my approval as the University Supervisor.

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DEDICATION

I dedicate my work to my dear wife, Jane, my son Derrick and my daughter Ivy for the support and encouragement that has always inspired me to work hard, without which this hard work would not have been successfully accomplished.

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ABBREVIATIONS AND ACRONYMS

ASALs	Arid and Semi-Arid Lands
ASDS	Agriculture Sector Development Strategy
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization's
GDP	Gross Domestic Product
GoK	Government of Kenya
IFAD	International Fund for Agricultural Development
LDCs	Least Development Countries
MDGs	Millennium Development Goals
MW&I	Ministry of Water & Irrigation
NEMA	National Environment Management Authority
NGOs	Non-Governmental Organizations
NIB	National Irrigation Board
O&M	Operation and Maintenance
PIM	Participatory Irrigation Management
PMBOK	Project Management Body of Knowledge
SPSS	Statistical Package for Social Sciences
SRA	Strategy For Revitalizing Agriculture
SSA	Sub-Saharan Africa
VLOM	Village Level Operation and Maintenance
WRMA	Water Resources Management Authority
WUAs	Water Users' Associations
WRUAs	Water Resource Users Associations

ABSTRACT

Water Irrigation has become one of the vital income generating activities on land ,in that it enhances food security ,creates employment opportunities ,improves nutritional status of a nation and brings about good health in a particular society. The purpose of this study was to establish the determinants of performance of irrigation projects a case of Nthawa irrigation project of Mbeere North Sub- county of Embu county Kenya. The study sought to determine the effect of management of the project, community participation, resources adequacy, technology and availability of sizable land for irrigation on performance of irrigation projects in Mbeere North Sub-county,Embu county Kenya. The target population for this study comprised the 500 registered members in Nthawa Irrigation Project of Mbeere North Sub- County, Embu County. In addition, 19 key informants comprising 9 executive management committee members from the project and 10 Ministry of Water and Irrigation officials made up of 2 technical officers from the District Irrigation Office and 8 Water Resource Management Authority (WRMA) regional officials. For this study, the sample size was 130 respondents. On the Executive committee members and officials, the researcher did not sample since the target population is was small, hence the study employed a census method that is by capturing the entire population of Executive Committee Members and Ministry of Water and Irrigation Officials. The primary data was collected using self-administered questionnaires made up of both open ended and closed ended questions. The data collected was analyzed using Statistical Package for Social Sciences (SPSS Version 21.0). All the questionnaires received were referenced and items in the questionnaire were coded to facilitate data entry. After data cleaning, the data was presented inform of tables showing frequencies, percentages, mean score and standard deviation. From the results, it was observed that management of the projects , resource adequacy, and technology used, community participation and availability of sizable land for irrigation all positively and greatly affect the performance of public irrigation projects in Kenya. It is thus recommended that full participation of members in irrigation project development should been encouraged to enhance capacity to perceive their own needs and members' managed irrigation projects should encourage a maximum number of people to participate at various stages of project development.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Ensuring adequate and access to nutritious food for the growing population has a major concern globally. Global efforts aimed at ensuring food sufficiency by increasing staple food production have adopted irrigated farming as one of the main strategies. According to Valipour (2015), irrigation has a role to reduce poverty in the world through improvement of production, enhancement of employment opportunities and stabilization of income and consumption using access to reliable water, and finally by its role in nutritional status, health, societal equity and environment.

Irrigation has historically had a large positive impact on poverty reduction and livelihoods, in both urban and rural areas, producing relatively cheap food for everyone and providing employment opportunities for the landless poor (Hussain, 2005). Through increased productivity irrigation produces secondary benefits for the economy at all levels, including increased productivity of rural labour, promotion of local agro-enterprises, and stimulation of the agricultural sector as a whole (Faurès*et al*., 2007).

The emerging and developing countries are faced with the challenge in meeting the sustainable Development Goal of food security. This challenge can be overcome by increasing production in their own regions, combined with increased import of food, where possible. Irrigation was expected to play an important role in the agriculture of the developing countries. Presently, its production was estimated at 20 percent of the arable land (30 percent of harvested area because of its cropping intensities) to contribute 40 percent of total crop production approximately60 percent of cereal production. This is expected to increase to 47 percent by 2030. In principle, by that year the developing countries would be exploiting for agriculture some 60 percent of their total potential for irrigation. Naturally, the harvested area under irrigation will increase by more (33 percent), following fuller exploitation of the potential offered by controlled water use for multiple cropping.

Until recently, irrigated agriculture was almost exclusively supported by the state in most African countries. However, government-managed (large- and small-scale) schemes have generally performed far below expectations and most of the time, initial capital costs have not been recouped and the financial returns have not been able to cover operation and maintenance (O&M) costs. Meanwhile, privately developed and managed (small-scale) irrigation schemes in most of the Sub Saharan African countries show that there is business potential for private entrepreneur involvement in irrigation. Groups of farmers or water users' associations (WUAs) running parts of irrigation schemes for which responsibility was transferred to them by government, can also be considered as operating private irrigation schemes. Recent developments have shown the increasingly important role of these new operators. However, for private operators to function efficiently a clear institutional framework is required – in many parts of Sub Saharan Africa, this framework is not in place.

Despite several investments, development of irrigation projects in Sub-Saharan Africa has been slow, except for a few countries in northern Africa, Madagascar and South Africa. Out of a total arable land of about 874 million hectares (ha), the current area under managed water and land development totals 12.6 million ha, or 3.7 % of the surface area of Sub Saharan Africa. In spite of this potential, and the demand for more dependable sources of water, the development of irrigation has not picked up. Furthermore, existing irrigation farms operate at sub-optimal levels.

Over the last ten years Kenya's population has exponentially grown from 28.7 million to 38.6 million in 2009. Therefore the country was required to make strategies for food supply to match this population growth. Although agriculture was the backbone of the economy accounting to about 25% of the country's GDP, the scope for increasing production through expansion of arable agricultural land is severely constrained by over-reliance on rain-fed agriculture (GoK, 2015). Currently, only 114,600 hectares (20% of total irrigation potential) have been put under irrigation in the whole country, categorized into three types: large private commercial farms (40%), government-managed schemes (18%), and smallholder individual and group schemes (42%) (Government of Kenya, 2010). In general, irrigation in Kenya accounts for only 1.8 per cent of total land area under agricultural production, but it was approximated to be directly providing 18 per cent, contributing 3 per cent to Kenya's GDP (Government of Kenya, 2010).

As reported in the agriculture sector development strategy (ASDS) of 2009 to 2020, irrigation holds the promise for the Kenyan future, given the unexploited 9.2 million hectares in Arid and Semi-Arid Lands (ASALs).

Less than one per cent of the land in medium and high rainfall areas is under irrigation. To sustain food production, the government has invested on rehabilitation and expansion of irrigation, with the aim of bridging the gap of 1.085 million hectares by the year 2030 (Government of Kenya, 2012).Despite these efforts, food insecurity in Kenya still remains a challenge, since public irrigation schemes realizes only 40 per cent of the target production levels compared to private operated irrigation schemes. In Kenya, it is estimated that Kshs. 8 billion is invested annually in developing irrigation projects; however most of these Projects hardly serve their intended purpose because they cease to function or operate below capacity as soon as the financing agencies and development partners pull out.

1.2 Statement of the Problem

Recently, emphasis has been on the importance of sustaining and improving the performance of existing irrigation schemes in parallel with area expansion and development of new irrigation. In Kenya, like in many other African countries, irrigation expansion has been hindered by poor performance of the existing public irrigation schemes. In addition, the performance of public irrigation scheme was way off the mark realizing only 40% of the target production levels and 28% of the expected revenues. Paradoxically, there are successful irrigation undertakings especially among the private commercial large-scale agricultural irrigated farms such as Delamare, Delmonte and Kakuzi. Continuous funding of irrigation projects followed by their collapse soon after donors pull out in Kenya such as Bura irrigation scheme, Kibwezi irrigation scheme and Ciambaraga irrigation project is an issue of great concern both locally and internationally. This was due to lack of proper operation and maintenance of these projects and mismanagement of water at field level due to lack of comprehensive community and or beneficiary involvement.

Regardless of the motivation behind a project undertaking, most countries and organizations have realized that projects are strongly linked to an organization's effectiveness and success in the long run. There are different frameworks for assessing project success and a question remains on how project success can be best defined. In Kenya, close to 25 percent of the population experiences food insecurity, with close to 1 percent of the population being severely food insecure. There are still close to 2 million people who rely on relief food in Kenya. The agriculture sector development strategy of 2009 to 2020 reports that irrigation is the promise for the Kenyan future. There are close to 9.2 million unexploited hectares in Arid and Semi-Arid Lands (ASALs). Less than one per cent of the land in medium and high rainfall areas is under irrigation. To sustain food production, the

Government has invested on rehabilitation and expansion of irrigation, with the aim of bridging the gap of 1.085 million hectares by the year 2030.

Government and donors' policies in ensuring sustainable projects seem inadequate due to lack of community and beneficiary participation at various stages of project identification, feasibility studies, design and indeed implementation such as formation of Water Users Associations and Water Resource Users Associations. Several studies have been conducted on irrigation projects in Kenya. However, most of these studies did not focus on determinants of performance of irrigation projects in Embu County. Further, it is not clear what factors impact on the performance of public irrigation schemes in Kenya. Against this backdrop, this study sought to establish the determinants of performance of irrigation projects, a case of Nthawa Irrigation Project of Mbeere North Sub- County, Embu County, Kenya.

1.3 Purpose of the Study

The purpose of this study was to establish the factors that affect performance of irrigation projects, case of Nthawa Irrigation Project of MbeereNorth Sub- County, Embu County, Kenya.

1.4 Objectives of the Study

The study was guided by the following specific objectives:

i. To examine the effect of management of the project on the performance of public irrigation projects in Kenya
ii. To determine the effect of community participation on the performance of public irrigation projects in Kenya
iii. To assess the effect of resources adequacy on the performance of public irrigation projects in Kenya
iv. To evaluate the effect of technology used on the performance of public irrigation projects in Kenya
v. To find out how availability of sizable land for irrigation affect the performance of public irrigation projects in Kenya

1.5 Research Questions

The study sought answers to the following research questions:

i. What is the effect of management of the project on the performance of public irrigation projects in Kenya?

ii. What is the effect of community participation on the performance of public irrigation projects in Kenya?
iii. How does technology used affect the performance of public irrigation projects in Kenya?
iv. To what extent does resources adequacy affect the performance of public irrigation projects in Kenya?
v. How does availability of sizable land for irrigation affect the performance of public irrigation projects in Kenya?

1.6 Significance of the Study

The researcher hopes that the findings of the study offered valuable contributions from both a theoretical and practical standpoint. From a theoretical standpoint, the findings of this study will broaden the understanding of determinants of performance of public irrigation projects. This would be valuable to the agricultural sector, since it would complement the debate on public irrigation scheme performance, and provide a basis for reformulation of strategies that are geared towards the country's self-sufficiency in food production and food security. It was expected that the recommendations of the study will inform the government on the need for policy development or review to ensure a conducive environment for implementing sustainable irrigation projects. This will lead to improved service delivery by concerned government departments.

Target communities and other stakeholders in irrigation projects have an understanding of the various factors affecting the projects. The findings of the study are also expected to add to the existing body of knowledge especially in the field of management of irrigation projects at community level as well as enhancing the efforts towards the overall sustainable development.

The findings of this study are expected to help the community development practitioners such as donors and funders in designing sustainable projects. This study would be useful to the Kenya's Ministry of water and Irrigation (MW&I) especially now as it draws up the National Irrigation Policy, International Fund for Agricultural Development (IFAD), German Financial Cooperation and JICA all of whom are involved in development of community based irrigation projects and could use the results of the research in policy formulation, decision making and practice. The national Environment Management Authority (NEMA) and the people of Kenya at large especially the farming communities would also greatly benefit from these results especially in formulation and implementation of sub-catchment management plans.

The literature would be useful to scholars as a reference material when carrying out further research on issues of sustainability of community based irrigation projects. The intervention mechanism found in the study can be used to strengthen the already existing projects as well as incorporating them in design of new schemes/projects both locally and internationally. The result can be also used as an input for researchers involved in similar thematic areas to further knowledge generation in concepts related to irrigation development and food security in Kenya and other parts of the world. Finally, the study was expected to provoke the analysis of similar projects in the country. This would facilitate the development and integration of best management practices in the irrigation water-use in such projects.

1.7 Delimitation of the Study

This study was on the determinants of performance of irrigation projects in Kenya. The study was based in Nthawa Irrigation Project of Mbeere North Sub- County, Embu County. The various stakeholders within Nthawa Irrigation Project including the registered members of the irrigation Project, executive management committee members and the Ministry of Water and Irrigation officials formed the population for the study.

1.8 Limitations of the Study

The study encountered some limitations that could have hindered access to information that the study sought. The respondents targeted in this study would have been reluctant in giving information fearing that the information being sought could have been be used to intimidate them or paint a negative image about them. The researcher handled this by carrying an introduction letter from the University to assure them that their identity as regards the information they gave would be treated with confidentially and the report was to be used purely for academic purposes.Communication could have been a a problem due to language barrier and education level of the respondents especially the members of the project. The researcher however used local interpreters from within the interview locations. Local school leavers were also engaged at a fee to help in data collection.

The other limitation is that the study was based in Nthawa Irrigation Project and did not include more irrigation projects around the Country owing to the amount of time and resources available. This study therefore suffered suffer from generalizability of the results if the nature of projects undertaken was significantly different from those in Nthawa Irrigation Project. In addition, the findings of this study was limited to the extent to which the respondents were willing to provide accurate, objective and reliable information. The researcher checked for consistency and tested the reliability of the data collected.

1.9 Basic Assumptions of the Study

The assumptions of the study were that the sampled population represents the general population of membership of the irrigation project. The researcher also assumed that the experiences of the membership of the project are representative of other irrigation projects in Kenya, the methods of data collection used were accurate and valid to enhance acquisition of the required data, the respondents were truthful and gave correct information and that the chosen respondents gave the required information freely. The study also assumed that there was no serious changes in the composition of the target population that might have affected the effectiveness of the study sample. Finally, the study assumed that the information given by stake holders was correct and the authorities granted the required permission to collect data to the right people.

1.10 Definition of Significant Terms

Land for irrigation: In the context of this study it refers to the measure of area of land under man-made precipitation that can yield maximum expected economics of scale.

Community participation: Refers to the involvement of community members throughout the project life cycle and in decision making processes and activities during needs assessment, project design and implementation

Performance of public irrigation projects: Refers to the land at which irrigation projects resources to achieve maximum results with minimal inputs.

Resources adequacy: Refers to sufficiency of an economic or productive factor required accomplishing an activity, or as means to undertake an activity and achieve desired outcome

Technology: Scientific knowledge used in practical ways in industry e.g. in agriculture high technology implies use of the modern methods, varieties, breeds and machines

1.11 Organization of the Study

This study was organized into five chapters. Chapter one contains the introduction to the study. It presents background of the study, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the Study, delimitations of the study, limitations of the Study and the definition of significant terms. On the other hand, chapter two reviews the literature based on the objectives of the study. It further looked at the conceptual framework and finally the summary. Chapter three covers the research methodology of the study. The chapter describes the research design, target population, sampling procedure, tools and techniques of data collection, pre-testing, data analysis, ethical considerations and finally the operational definition of variables. Chapter four presents analysis and findings of the study as set out in the research methodology. The study closes with chapter five which presents the discussion, conclusion, and recommendations for action and further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter provides an extensive literature and research related to determinants of performance of irrigation projects. This literature review summarizes a diverse spectrum of views about the determinants. The chapter is thus structured into theoretical, conceptual and empirical review. The chapter also presents the knowledge gap the study sought to fulfill.

2.2 An Overview of Performance of Irrigation Projects

Agricultural production can be enhanced and boosted through improvement in the water management system and of particular importance is irrigation. Chambers and Moris (2010) observed that irrigation agriculture is not only the most fruitful type of farming devised by man, but also the most costly. What make it costly are the large capital costs of provision of irrigation waters. These costs hence cannot be met by individual farmers but must be spread throughout the economy. The need for the irrigation costs to be spread throughout the economy emanates from the fact that the benefits that accrue from irrigation farming will benefit the whole economy and not just the individual farmers for example by boosting the food security situation of a country and raising incomes from the agricultural sector.

Over the years, empirical evidence have shown that irrigation increases yield of most crops by between 100 and 400% and it is expected that, in the next 30 years, 70% of the grain production will be from irrigated land in the world (FAO, 2009). A study by Valipour (2014) indicated that 46% of the cultivated areas in the world are not suitable for rain-fed agriculture because of climate changes and other meteorological conditions. Therefore, this needs to be thought carefully in order not to put too much attention to only commercial enterprises and goals but to also apply the experts‟ comments to the irrigation systems for any crop to achieve sustainable agricultural production activities (Valipour *et al*., 2015).

Irrigated agriculture has been a major solution used in addressing water challenge affecting food production in areas of unreliable rainfall patterns. Approximately 70% of the world's irrigated land is in Asia, where it accounts for almost 35% of cultivated land. Of the total cultivated area in Africa, estimated at 198 million ha, just 4% (slightly above 7 million ha) is equipped with irrigation infrastructure (Svendsen *et al*., 2009).

According to Jurriens *et al* (2011), good management of irrigation schemes involving all the stakeholders including members is becoming increasingly recognized as an essential mean to achieve successful irrigated agriculture. It is recognized that poor performance is not only a consequence of technical performance in the design and operation of irrigation systems (although it is sometimes an important factor), but many of the problems are based on weaknesses in the organization and management of the scheme when all the stakeholders especially the community recipients are not involved.

According to the FAO (2007) sub-Saharan Africa has an irrigation potential of about 42 million hectares of which only 17% is developed. The average rate of expansion of the irrigated area over the past 30 years was 2.3% per annum. Expansion slowed to 1.1% per year during 2000–2003 but has since picked up as a result of renewed investments by multilateral and bilateral donors and foundations (Makombe, 2010). In sub-Saharan Africa there is thus great potential for expansion of irrigated agriculture.Research estimates that in the coming decades, about 80-90% of the required increase will need to be realized on existing cultivated land and about 10-20% on newly reclaimed land (Hussain and Hanjra, 2014).

The developing countries are estimated to have some 400 million ha of land which, when combined with available water resources and equipped for irrigation, represents the maximum potential for irrigation extension. Of this total, about one half (some 202 million ha) is currently equipped in varying degrees for irrigation and is so used. The projections conclude that an additional 40 million ha could come under irrigated use, raising the total to 242million ha in 2030.

While investments in irrigation have yielded significant impacts in terms of improving food security and poverty reduction in areas such as South-East Asia and East Asia, the same cannot be said for sub-Saharan Africa (Hussain 2015). Regions such as South-East Asia have almost exhausted their irrigation development potential, making the potential irrigable land in Sub-Saharan Africa a major hope for the world in terms of feeding the future population (FAO, 2013).In Africa, agriculture forms the backbone of most of the continent’s economies, providing about 60% of all employment. During the last decade, per capita agricultural production has not kept pace with population growth. Consequently, as per the Food and Agriculture Organization's (FAO’s) assessments, at the end of the 1990s, 30 countries in Africa had over 20% of their population undernourished, rising to 35% in the 18 worse affected countries (FAO, 2012). In terms of absolute numbers, between1997–99, 200 million people were malnourished, with 194 million of these people living in sub-Saharan Africa (SSA). The food gap estimated at 17 million tons in 2000 was filled by imports (14.2 million tons) and food aid (2.8 million tons) at a cost of US$18.7 billion. In 2001, close to 30 million people required food emergencies due to droughts, floods and civil strife.

Irrigation in Kenya has a long history spanning over 400 years. Records reveal that irrigation in Kenya has existed for many years in West Pokot, along River Tana, and Baringo districts. Rice irrigation activities also existed along river valleys such as Kipini, Malindi, Shimoni and Vanga. This was in the era of slave trade (19^{th} century) where slaves were used to construct the rice schemes. Asian workers building the Mombasa-Nairobi Railway line also started some irrigation activities around Makindu and Kibwezi (NIB, 2010). Currently, Kenya's total irrigated area is about 80, 000 hectares. Public and private small-scale irrigation is still less than 50,000 ha. Kenya has an overall estimated irrigation potential of 1.3 million hectares and a drainage potential of 600,000 hectares (Government of Kenya, 2010). According to the National Irrigation Board-NIB (2012), only 540,000 hectares of the available irrigation potential can be irrigated given the available water resources, while the rest require water harvesting and storage.About 46% of the gross value of global agricultural production comes from irrigated areas, which makes up 28% of the total harvested area (de Fraiture0*et al*., 2007). Many expect that the contribution of irrigated agriculture to food production and rural development will increase in the coming decades (Bruinsma, 2013).

Irrigation farming especially for high value crops and horticultural crops has a number of challenges, since irrigation farming requires the co-operation of several farmers and different stakeholders, apart from individually owned irrigation projects and flower farms. To ensure success of irrigation, awell-organized operation and maintenance schedule and a scale of water distribution in the schemes among beneficiaries is required (Ministry of Water & Irrigation, 2009).

Ngigi (2002) disclosed that in Kenya for the two decades agricultural production has not been able to keep pace with the increasing population. To address this challenge the biggest potential for increasing agricultural production lies in the development of irrigation. The same study revealed that irrigation can assist in agricultural diversification, enhance food self-sufficiency, increase rural incomes, generate foreign exchange and provide employment opportunity when and where water is a constraint.

Projections by FAO (2007) predict a much slower expansion of irrigation in sub-Saharan Africa over the next 20-30 years (0.6% per year) as compared with 1.6% per year recorded from 1960-1990. The extreme variability in rainfall, long dry seasons, recurrent droughts, floods and dry spells pose a key challenge to food production. The sole dependence of farming on rainfall has been a major cause of low food productivity, food shortages, undernourishment and famine in sub-Saharan Africa. The world's hotspots for hunger and poverty are concentrated in the arid, semiarid and dry sub humid regions of the world which depend solely on rainfall for food production (Faurès *et al*., 2007). In large parts of Africa, the fight against poverty and the prospects to reach the Millennium Development Goals (MDGs) has been the focus of governments (Birner*et al*., 2015).

At current levels of population growth, the slower expansion in irrigated areas is resulting in an unprecedented amount of irrigated land decline. This has been exacerbated by increased construction costs, falling real prices for irrigated crops, a growing awareness of environmental and social costs and poor irrigation performance at the farm and project levels (Azad and Ancev, 2010). In addition, the environmental efficiencies of irrigated enterprises vary considerably across different agricultural water management regions (Valipour, 2013). Based on the irrigation potential in Kenya, the development of the irrigation is among the long-term initiatives towards the achievement of a 10% annual economic growth envisioned in Vision 2030. Despite heavy initial investments, huge costs relating to land preparation, and the different kinds of machinery, irrigation in Kenya has not realized its full potential. Most of the public irrigation schemes productivity was boosted by the implementation of the strategy for revitalizing agriculture (SRA) 2004-2014 and the Maputo declaration of increasing the agricultural sector budgetary allocation to 10 percent from 2003. In addition, stable and growing economy as well as the implementation of the Agriculture Sector Development Strategy (ASDS, 2009-2020) and the first medium term plan for Vision 2030 also shows positive contribution to public irrigation productivity in Kenya.

According to FAO (2007) irrigation is defined as the artificial application of water to the crop for the purpose of food and fiber production overcoming deficiencies in rainfall and help in creating stabilized agriculture. Irrigation development could also be defined as a case of agricultural development in which technology intervenes to provide control for the soil moisture regimes in the crop root zone in order to achieve a high standard of continuous cropping. A working definition of irrigation for this paper is therefore as defined by Uphoff (2010) Irrigation is the practice of applying water to soil to supplement the natural rainfall and provide moisture for plant growth.

Before embarking on defining small-scale irrigation, it is useful to come across at different criteria used to categorize and classify different types of irrigation. Around the world, scholars use different standards for classification of irrigation schemes. Regarding the ways of supplying water, flood irrigation, furrow irrigation, sprinkling or spray irrigation and drip irrigation are identified (Nigussie, 2012). Irrigation may also be categorized using other criteria such as ownership, economic objective and modernity.Turner (2009) also points out that irrigation systems can be classified according to size, source of water, management style, degree of water control, source of innovation and type of technology. Most authors, however, agree that concepts of local management and simple technology should be combined with size.

Moreover, small-scale irrigation can be defined as irrigation, usually on small plots, in which small farmers have the controlling influence, using a level of technology, which they can operate and maintain effectively. In terms of management, there are three broad types of smallholder schemes: government-managed, farmer-managed, and jointly managed schemes. Farmer-managed schemes are developed either by community or by government but owned and managed by farmers' irrigation management committees or water users' associations with minimal government interventions.

Irrigation performance is the level at which resources such as water, land, and labour can be effectively utilized for the production of maximum output levels. In addition, irrigation performance assessment is the regular observation of irrigation performance parameters with the objective of acquiring important information on the use of resources within an irrigation scheme, and allows irrigation managers to make well informed decisions in terms of resource management (Mati, 2011; Valipour, 2014). Irrigation performance assessment can be used to satisfy different set objectives on different irrigation schemes but the procedure will vary depending on the system and purpose of assessment. Despite the fact that there is still no one standard way of measuring irrigation performance, most analysts suggest at least two basic domains for the purpose of irrigation or water delivery and agricultural productivity. While the former is associated with the immediate service output and determined most frequently through the performance criteria of adequacy, equity and reliability of water supplied, the latter is considered more outcome-based and can be judged against such parameters as farmers‟ crop yields, cropping intensities and most recently water productivity.

Other studies suggest that such a limited set of indicators should also include measures determining the maintenance status of irrigation infrastructure as well as more user-based socio-economic impact measures (Bos*et al*., 2015). Molden*et al.* (2010) pointed out that for an increase in irrigation scheme performance, it will require strategies that are based on existing biophysical and socio-economic factors. Frequent evaluation of irrigated areas have become more important in diagnosing and improving the performance of irrigation schemes in order to achieve optimal productivity in the context of increasing food demand, open global markets and competition for limited freshwater resources (Clemmens, 2014). Such assessments should analyze the productive and hydrological impacts of internal irrigation processes to assist agents involved in crop production, water management and agricultural policy to improve the performance of irrigated schemes (Perry *et al*., 2009; Molden*et al*., 2010).

Irrigation performance indicators have been sub-divided into four different categories, including agricultural performance, water supply and delivery, economic and environmental indicators (Greaves, 2007). The agricultural performance indicators have generally been used to analyze the output from an agricultural system in relation to the inputs used; that is agricultural productivity (Gomo, 2012; Thairu, 2010). Molden*et al*. (2008) however, pointed out that agricultural indicators must be viewed in context to the region in which they are used. This is in regard to what is constraining in the region. For instance, where water is a more constraining factor compared to land, then output per unit water may be more important than output per unit land. The reverse is true for a region where land is a constraining factor (Greaves, 2007).

This has been used by Svendsen*et al*. (2009) and Ntsonto (2005) in determining the difference in performance of 16 irrigation projects following adaptation of new water management practices from developing countries. They found that the performance indicators are insufficient for decision making, planning and control operations in a dynamic irrigation environment. This is because they do not reflect all dimensions of organizational performance in a balanced and integrative framework (Gomo, 2012; and PMU-Kenya, 2014). In addition, Jusoh*et al*. (2008) concluded that there is need to include financial and environmental indicators, since they concentrate on the costs and returns, in monetary value, and they include cost recovery ratio; maintenance cost to revenue ratio, total cost of management, operation and maintenance per irrigation scheme and revenue collection performance. Finally, Yokwe (2009) and Greaves (2007) revealed that environmental indicators concentrate on sustainability of irrigation scheme performance, pollution of both land and water, as well as the effects of irrigation on the surrounding area.

Vandevelde*et al* (2012) summarized various works on irrigation project performance measurement which are based on the multidimensional, multi-criteria concept. In all, they identified seven dimensions: respect for time, respect for budget and technical specification, knowledge creation and transfer, contribution to business success, financial and commercial success. They merged these seven dimensioned model into a three-polar model namely, process, economic and indirect poles.

2.3 Management of the Project and Performance of Irrigation Projects

One very important factor that largely affects productivity in irrigation schemes is management. Uphoff(2011) observed that irrigation analysts and different agencies of development have recognized irrigation management as a very important factor affecting productivity and consists of a technical infrastructure and an institutional framework which determines the use of that infrastructure, which are both important in the success of the irrigation system. There is need to have institutional capacity to manage all these factors in order to ensure that the schemes operate to their full capacity.

Ruigu(2009) notes that some degree of control and discipline is required in an organized community such as Mwea and Ahero where the wellbeing of the tenants and of the schemes are dependent on the performance of a technically determined cycle of activities. The importance of institutions has been given emphasis by several authors, the leading one being North (2010) who notes that; the growth of economies has occurred within the institutional framework of well-developed coercive policies, economic history is overwhelmingly a story of economies that failed to produce a set of economic rules of the game that induce sustained economic growth.

Institutional management plays a very crucial role in the formulation and operation of any economic or social policy. In irrigation schemes, the management thus sets the rules and regulations which specify the rights and obligations of both the tenants or farmers on one hand and the management team on the other. Therefore it is important to have a strong institutional capacity to bring the different factors together in order to enable the irrigation project achieve maximum results. This is consistent to the theory of management of common property resources (Valipour, 2015).

According to Wade (2014), another important factor in the management of irrigation schemes is the state's models of local government forms. He found that in irrigation villages in India, state officials often respond to pressure or bribes just like in other services provision for example agricultural extension services, supply of electricity or village access roads which implies that the villages which can organize to collect quickly the required amounts of money or contacts are better and will be advantaged in comparison to those that are less well organized (Wade, 2014). This therefore implies that in the management of irrigation schemes, the way the tenants and farmers organize themselves in the schemes have an implication on how they will access the various services that the state officials offer and hence have an effect on the yield levels. In Kenya, the state officials involved in the management of irrigation schemes include the settlement managers, general manager, Engineers, Accountants, irrigation officers and field staff in the ministry of water and irrigation.

According to Ministry of water and Irrigation (2014), scheme operation is concerned with the passage and distribution of water in an irrigation scheme. For the success of an irrigation scheme, the objectives of scheme operations that are crucial are first, there should be equity of water distribution among irrigation schemes and within tenant plots in a scheme. Secondly, is adequacy of water in terms of flow rate to meet the individual tenant plots and the overall scheme irrigation requirements, in addition to the water supply being reliable to ensure that tenants have water when they need it for their cultivation and lastly there has to be efficiency in management to ensure that the water that is available is used optimally and that wastage is avoided (GOK, 2009).On the other hand, the complexity of operations of an irrigation scheme depends on the size, type and design of the scheme, the area cropped, number of plot holders; the patterns of cropping and water availability. It is more challenging to manage a scheme with less water available than is demanded by the farmers compared to one where water is sufficient.

Woldeab (2013) argued that although both the human and physical aspects interact in their irrigation domain, the management aspect of irrigation is often ignored while priorities are givento the construction of irrigation. Woldeab (2013) identifies three categories of irrigation management activities and organizational activities. The first involves water acquisition, distribution, and drainage. The second focus on design, construction, operation and maintenance. The third focuses on conflict management, communication, resource mobilization and decisionmaking. The management aspect of irrigation is often neglected while priories are giving to theconstruction of irrigation infrastructure, although both the human and physical aspects interactional irrigation domain.

The main function of irrigation management organizations is normally to manage theannual flow of irrigation water from the main feeding canal, coordinate the sharing of irrigationwater among the different farming units, and presuppose responsibility for the maintenance andrepair of the on-farm infrastructure. If they are properly registered and put on a secure legal basis, irrigation water management organizations will also become an effective way for farmerstorepresent their interests with reference to local and national authorities on a wide range of issuesrelating to the allocation of water rights and the administration of irrigation infrastructure (Teferi, 2010). Improved irrigation management may lead to better productionand getting it to the market at the right time. And in turn, this leads to the availabilityof products at affordable price to the poor.

Byrnes (2012) conjointly classified irrigation management activities into a few dimensions.These are water use activities, management structure activities and organizational activities. Water use activities are management activities that are focusing on the provision of water to crops in an adequate and timely manner include acquisition, allocation, distribution and drainage.Acquisition is the first management activity concerned with the acquisition of water from surface or subsurface sources, either by creating and operating physical structures such as dams, weirs or wells or by actions to obtain some share of an existing supply. Allocation on the other hand is heavily refers to the assignment of rights to users thereby determining who shall have access to water. Distribution refers to the physical process of taking the water from a source and dividing it among users at certain places, in certain amounts, and at certain times. Drainage is important where excess water must be removed.

Secondly, control structure activities are management activities that are focusing on the structures required for water control include design, construction, operation and maintenance. Design involves the design of dams' diversions or well to acquire water, of systems of rules to allocate it, of channels and gates to distribute it and of drains to remove it. Construction involves the construction of the structures to acquire, distribute and remove water, or implementation of rules that allocate it. Operation refers to the operation of the structures that acquire, allocate, distribute or remove water according to some determined plan of allocation. Maintenances are the final control structure activity. This provides for the continued and efficient acquisition, allocation, distribution and drainage.

Thirdly, organizational activities: are management activities focusing on the organization of efforts to manage the structures that control irrigation water includes resource mobilization conflict resolution communication and decision-making. The activity of resource mobilization entail marshaling management and utilization of funds manpower, materials, information or other inputs needed to control water through structures or to undertake various organizational tasks The activity of communication entails conveying information about decisions made, resource requirements etc. to farmer or any other persons involved in irrigation managements. The activity of decision making entails the processes including planning involved in making decision about the design, construction, operation or maintenance of structures; acquisition, allocation, distribution or drainage of water or the organization deals with these activities.

2.4 Community Participation and Performance of Irrigation Projects

Community participation has been defined as 'a process in which people take part in decision making in the institutions, programmes and environments that affect them (Heller, 2004). Community participation is usually conceptualized as a process by which members of the communities individually or collectively assume increased responsibility for assessment of their own needs, and once these are agreed upon, identify potential solutions to problems, and plan strategies by which these solutions may be realized (Bermejo &Bekui, 2013).Participation is viewed as a tool for improving the efficiency of an irrigation project, assuming that where people are involved they are more likely to accept the new project and partake in its ongoing operation. It is also seen as a fundamental right; that beneficiaries should have a say about interventions that affect their lives. Kumar (2002) asserts that participation is a key instrument in creating self-reliant and empowered communities, stimulating village-level mechanisms for collective action and decision-making. It is also believed to be instrumental in addressing marginalization and inequity, through elucidating the desires, priorities and perspectives of different groups within a project area.

Participatory methods now dominate in the implementation of development interventions at the village level, the most common method being Participatory Rural Appraisal.Community participation in rural irrigation development involves an act of sharing common to all participants as stakeholders of the development process. In this case, each participant is directed towards a specific goal, which is shared by others within the development process. In a wide range of literature, a descriptive definition of participation programs would imply the involvement of a significant number of local persons in situations or actions that enhance their well- being (Harvey and Reed 2007; Kakumba 2010). Therefore in the context of development, CP refers to an active process whereby beneficiaries influence the direction and execution of development projects rather than merely receive a share of project benefits. According to Naika and Siddaramaiah (2006), participation includes management of skills, mobilization of community members, conflict resolution and institution building among extension personnel. People's participation increases the actual benefits to beneficiaries; it decreases people’s dependence on government support and makes the public self-sustaining; it facilitates mobilization of local resources and simplifies implementation of the project at a micro level.

The importance of community participation in irrigation projects is often emphasized, but this must start at the beginning of the project cycle (problem identification); if there is the need for a ‘handover’ from agency to community then the project is already flawed (Thorpe, 2002). Community participation (including the simplest of involvement) from early on in the project, enhances the future sense of ownership, but ongoing motivation is required for continuing participation. Enabling communities to manage their own irrigation facilities means that the promoting agencies should be facilitators, rather than implementers. This may involve a major shift in the way an organization carries out its work, a shift that may not be easy to achieve (Ockelford and Reed, 2012).

Effective collective action for resource management (in this case irrigation) requires that the beneficiaries prepare and agree on a set of rules of restrained access to the resource; make arrangements for financial, labor or other contributions required for the management of th resource and lay out a system of enforcement of the use restrictions and community contributions(Gebremedhin*et al*, 2012). Participatory irrigation management has been considered as the driving force in the effective and efficient irrigation management by participating and involving the farmers in planning, operation and maintenance of the irrigation system (Gulati*et al*. 2005).

The public involvement of stakeholders in development projects is widely recognized as a fundamental element of the process. Timely, well- planned, and well-implemented public involvement programs have contributed to the successful design, implementation, operation, and management of irrigation programme proposals (UNEP, 2016). For instance, the range of stakeholders involved in an Environmental Impact Assessment (EIA) project typically includes: the people, individuals, or groups in the local community. The proponent and other project beneficiaries, Government agencies, Nongovernmental Organizations (NGOs) and others, such as donors, the private sectors, academics, and so forth. It is widely recognized that participation in community agricultural schemes often means no more than using the service offered or providing inputs to support the irrigation project (Smith, 1998). This is contrasted with stronger forms of participation, involving control over decisions, priorities, plans and implementation or the spontaneous, induced, or assisted formation of groups to achieve collective goals (Smith, 2008).

Garces-Restrepo*et al*. (2007) noted that the underlying assumption was that greater participation by the farmers would induce a sense of ownership and responsibility, and hence improve resource use efficiency. Some governments in Sub-Saharan Africa handed over management of smallholder schemes to the farmers in the face of IMT. Due to budgetary reprioritization as well as the need for IMT in the late 1990s in South Africa, financial support for management, operation and maintenance of smallholder irrigation was withdrawn (Maritz, 2001), and ownership and management responsibilities were handed over to the farmers. In 2002, 57 countries, representing 76% of the FAO-irrigated area of the world, had embarked on some form of reform which included IMT(Garces-Restrepo*et al*., 2007). Some countries, however, opted for Participatory Irrigation Management (PIM), a moderate reform of just increasing farmer participation in irrigation management rather than replacing the role of government as in IMT (Giordano *et al*., 2006),while some, like South Africa, adopted both reforms.

However analyses as to whether the objective of improving irrigation performance was fulfilledhave painted a gloomy picture as successes have been reported in countries such as Turkey,Mexico, USA and New Zealand (Shah *et al*., 2010) and failures or no change being reported inthe developing world. A decline in the cropping intensity and an increase in the irrigated areawere reported in the Senegal Valley, while in Nigeria an improvement in water delivery to tail end farmers in the Kano project was recorded following the adoption of IMT (Shah *et al*., 2002).

In Kenya, the government had to provide financial aid to assist in the resuscitation ofinfrastructure at Mwea Irrigation scheme barely 6 years after transfer owing to lack of skilledlabour, machinery and financial resources for scheme maintenance among the farmers (NationalIrrigation Board, Kenya, 2007). Fujita *et. Al* (2010) in the conditions of collective action for local commons management, observed that there is need to recognize the ability of rural communities in conserving common pool resources including irrigation water adequately, while cautioning against the inefficiency of state bureaucracy in the use of local information, and this paradigm has been used to support of 'irrigation management transfer' that advocates the hand-over of the management of irrigation systems from state agencies to the groups of local beneficiaries, commonly called irrigators associations.

2.5 ResourcesAdequacy and Performance of Irrigation Projects

World Bank (2007) indicated that irrigation projects consume a lot of scarceresources through both recurrent and development expenditure and adverselyaffect developing countries whose capacity to set up irrigation infrastructureis limited. In Kenya, like in many other African countries, irrigation expansionhas been hindered by poor performance of irrigation schemes (Thairu, 2010).Kibe (2007) revealed that, the development of irrigation despite the high costs involved is one of the largest potential for addressing the challenge of the declining agricultural productivity with an up surging population in Kenya.

Inocencio*et al*. (2007) compared irrigation development in sub-Saharan Africa with other developing areas, and confirmed that it is more expensive to develop irrigation in sub-Saharan Africa than in other parts of the world. In sampling 314 irrigation schemes implemented in developing countries, the average cost of a new irrigation scheme in sub-Saharan Africa was US$14,500/ha and US$6,000/ha elsewhere. Rehabilitation costs amounted to US$8,200/ha in sub-Saharan Africa against US$2,300/ha elsewhere. The high cost is related to the lack of economies of scale because sub-Saharan Africa has many relatively small irrigation schemes (Faurès*et al*., 2007). Inadequate local expertise in planning, designing and construction of irrigation projects and, hence, the involvement of expensive expatriate expertise at all stages of the project cycle at the early stages of nationhood have also been cited as reasons for high cost of irrigation development (Namara*et al*., 2010). It is further speculated that the best areas for irrigation schemes development in sub-Saharan Africa have been almost exhausted leading to higher construction cost in future irrigation projects (Faurès*et al*., 2007). This is further compounded by the need to mitigate the social and environmental costs associated with these developments. This has reduced the rate of development of new irrigation schemes across sub-Saharan Africa.

Irrigation infrastructure has been funded in targeted areas in a bid to improve food production and rural economies. Currently, the Kenyan government has been running the operations of the major five public irrigation schemes in different parts of the country through the National Irrigation Board (NIB). Generally, irrigation activities demands costly continuous operations in terms of supply of water and adequate maintenance of the water distribution and drainage channels. The government, the private sector, and development partners have funded most of the irrigation structures since it is difficult for smallholders themselves to build such structures (PMU-Kenya, 2014). The cost of developing government-led irrigation schemes vary widely. Jones (1995), reviewing the experience of the World Bank in irrigation development for a few decades, estimated that the average unit cost for 191 irrigation government-led projects was US$4,800 per ha in 1991. The average for the whole of Africa was US$13,000 per ha while that for sub-Saharan Africa was US$18,300 per ha when indirect costs for social infrastructure, including roads, houses, electric grids, and public service facilities, are included. According to the FAO (2003), irrigation investment costs are generally much higher in sub-Saharan Africa compared to a world average of 5,600 $/ha. On the other hand, there are sporadic studies showing relatively cheaper irrigation projects in sub-Saharan Africa with average unit costs comparable to Asia (IFAD, 2010).

Other studies (Awulachew*et al*., 2005; Moris and Thom, 1990) have identified the following problems: the high costs of investment and negative rates of return; technical flaws in infrastructural design, seepage, sedimentation, cracks in dams and silting up of reservoirs; high input costs, especially cost of fertilizer; pests and diseases especially for onions and tomatoes; high interest rates on loans; management failures; political difficulties; and finally marketing problems. Awulachew*et al*. (2015) observed that where these types of failures occurred, they have generated lack of maintenance, broken down scheme machinery due to lack of spare parts, and lack of access to input and output markets.

Shah *et al*. (2013), studying smallholder irrigation systems in sub-Saharan Africa, identified the following challenges: mismanagement, high cost of working capital, poor linkages to credit, input and output markets, institutional vacuum, land tenure issues, improper management transfers, damaged soils, expensive and ineffective mechanisation, poor farmer capacity and lack of farmer entrepreneurship development.

2.6 Technology usedand Performance of Irrigation Projects

To reduce the risks linked with rainfall unpredictability and to increase the yields of food crops, more public investments in yield-enhancing technologies, such as small-scale irrigation and irrigation management practices, have been suggested as one important rural development and poverty reduction strategy (Pinstrup and Pandya, 2011). Farmer- managed irrigation systems are found in varied environments and exploits a wide range of technologies to take advantage of different types of water sources for production of a diversity of crops.

All these irrigation systems, however, require that certain indispensable tasks be accomplished if the system is to function productively (Edward and Robert, 2007).Since irrigation is an arena of struggle where social actors negotiate and decide on the technology choice and management of the water, it is true that the management aspect of irrigation must betaken in to account. However, Ostrom (2010) complained that ‘the initial plans for many of irrigation projects in developing countries have focused almost exclusively on engineering designs for the physical systems. Distribution of water for farmers and subsequent maintenance were frequently not addressed.

The use of appropriate technologies which are low cost, easy to maintain, simple to use and readily available is one response to the challenge of ownership of irrigation projects. Appropriate technologies are integral to the concept of Village Level Operation and Maintenance (VLOM) which emerged in the Water Decade (1981 – 1990). Many of its basic principles are still guiding the water sector today, though a tension persists between the ease of maintaining a system and its durability (Reynolds, 2015). The VLOM conceptualization of the community as an island also neglects to recognize the role of external support agencies, such as the government, in achieving sustainability (Webster *et al*, 2009).Experiences in many projects have shown that technical issues cannot be ignored on the basis of the argument that they have nothing to do with managerial aspects. However, technical options should be seen as part of the management solution, not as goals in themselves (Batchelor*et al*., 2010). Even where community members are trained in technology maintenance, some repairs are beyond their ability. Ongoing technical support is therefore required for difficult technical repairs and ongoing institutional support is required to encourage ongoing social mobilization in the community.

It has been suggested that beneficiary participation is the single most important factor contributing to project effectiveness (Narayan, 2009). Without participation, it has been claimed that systems are unlikely to be sustainable even if spare parts and repair technicians are available. Participation can take different forms, including the initial expression of the demand for water, the selection of technology, the provision of labour and local materials and cash contribution to the project costs and the selection of the management type (Harvey & Reed, 2007). It is thus the process through which demand-responsiveness is exercised, and empowerment achieved.It is important that irrigation projects present communities with a true technology choice and that they are made aware of the financial and managerial implications of each possible option. The price of a technical option to a community should be based on the actual cost of delivering and sustaining the service and the people's willingness to pay for it (Deverill*et al*., 2012). Water users need to have the freedom to choose what type and level of water services they are capable of managing without any undue external pressure. Ease of operation and maintenance, user acceptability and cost must be considered jointly. If a water supply system in the irrigation project is not maintained it is because it is too complicated, not 'attractive' or too expensive (Holtslag, 2012).

2.7Availability of Sizable Land for Irrigation and Performance of Irrigation Projects

Land is a basic input in an agricultural production process. Farm size in respect of thisstudy refers to a measure of the area of the land under irrigationduring the period under study. During water conveyance, one has to significantly fillup the primary and secondary canals to enable water flow into the fields downstream,irrespective of the number of such fields irrigated. Conveyance losses at the level ofthese canals are, consequently, dependent more on the duration of conveyance than on the command area downstream. If conveyance losses are prorated per acre of land irrigated, then more land under irrigation is more efficient than less land irrigated through a given canal network. The larger the area being irrigated the better the economies of scale. Farm size is, therefore, hypothesized to be positively correlated with water-use efficiency due to economies of scale.

Pandey and Suresh observed that between 1971 to1990, there was a strong growth in production which was attributed to the growth of the area under cultivation (Pandey and Suresh, 2007). Therefore the issue of land is very important if high productivity levels are to be achieved. There is need therefore to guarantee individual secure rights to individual farmers since the attachment to land is profound. Todaro(2009) observed that it is for reasons of higher agricultural output and the simultaneous achievement of both greater efficiency and more equity that land reform is often proposed as a necessary first condition for agricultural development in many LDCs. Land reform involves the redistribution of the rights of ownership or use of land away from the large owners to cultivators with limited or no holdings, for example the appropriation of large estates for new settlement in Kenya (Todaro, 2009).

Wade (2009) argues that the degree of scattering of the holdings also affects the performance of irrigation schemes. This is because if holdings are not scattered, the externalities of water use are 'uni-directional' that is the actions of irrigators with land at the head of the block impose costs on those towards the tail, but not vice-versa, thus making there to be a clear difference of interest between top-enders and tail-enders, with the tail-enders having a stronger incentive than the top-enders to agree to strong community organization and formal rules. On the other hand, if the holdings are scattered, an irrigator with land near the top end of one block may have another plot near the bottom end of another block, which diffuses the direction of the externality and helps to create a common interest in rules and organization.

Njagi(2009) observed that large irrigation projects benefit from economies of scale from indivisible inputs such as skilled labour, plant and machinery. They also have the capacity to attract highly skilled managers and due to the interest they generate, implementing agencies have incentives to maintain low cost. Smaller irrigation projects on the other hand are easy to manage, e.g. working with fewer farmers makes it easier to coordinate and systems are easier to manage (Njagi, 2009). On the other hand, Inocencio*et al* (2007) found that in Sub Saharan

Africa, small irrigation projects showed higher performance measured by yields, water distribution, and operations within the scheme, due to better management compared to bigger irrigation projects where as they did not benefit from scale economies. Large irrigation projects enjoyed reduced costs per unit, but faced complexities in operations, water distribution and were more complex to manage. They therefore recommended that though scale economies were important to make efficient use of scarce inputs, performance of large scale projects was poorer than that of smaller projects. A carefully designed project, maximizing these complementary factors, would be more efficient (Inocencio*et al*, 2007).

2.8Theoretical Orientation (Theoretical framework)

Theories are set of ideas that describe a social situation, and theories gives directives on what needs to be done to deal with a particular problem. This section discusses the theoretical foundation on which the study is anchored. The study would be grounded on the classical contingency theory which is supported by the public participation theory.

2.8.1 Classical Contingency Theory

This study was underpinned in the Contingency Theory postulated by Pinto and Slevin (1987). An impression created by project management practitioners and underscored by the Project Management Body of Knowledge (PMBOK) is that project management knowledge is applicable to all sorts of industries and environments (Packendorff, 1995). Packendorff (1995) contends that such a view positions project management as a field of study which is held together by conceptions of process rationality in which differences in outcome and process are disregarded in favour of alleged similarities. This difference clearly does not only exist between industries but also within the same industry, in the case of projects. Indeed, the lack of agreement as to what factors affect project success as acknowledged by project management researchers (Pinto &Slevin, 2011) has been blamed on the assumption by project management researchers that a universal theory of project management can be applied to all projects (Dvir*et al*, 2009).

Classical contingency theory suggests that different external conditions to an organization require different organizational characteristics, and that the effectiveness of the organization is contingent upon the goodness of fit between structural and environmental variables (Shenhar, 2011). These classes of behavioral theories posit that there is no one best way to organize a corporation, to lead a company or to make decisions (Fiedler, 1964; Vroom and

Yetton, 1973). Alluding to this, Shenhar (2011) posits that one size does not fit all, and talks of an organization concept project management. This falls in line with the philosophy of the project as a temporary organization (LundinSöderholm, 2008) and so on. The approach to poverty reduction in social fund-supported communities is a process of development-focused collaboration among various stakeholders.

The underlying theory posits that collaboration increases the productivity of resources and creates the necessary and sufficient conditions for community-driven development. Community-driven development represents a people-centered approach to social change, whereby local actors take the lead in conceptualizing projects and programs that address social and economic needs. Local actors are fully involved in implementing such projects and programs. Stakeholder involvement, therefore, is a key element of development-focused collaboration. A major hypothesis embedded in this stakeholder involvement theory is that the greater the collaboration, the greater the productivity of the resources and the more favorable the conditions for community-driven development (Zulu &Chileshe 2008).

Members of communities that received social fund assistance for projects attempted to deal with local-level poverty-related problems by following a four-stage process, that is, identifying problems and priorities, motivating and mobilizing, working together and creating an enabling environment. For each stage, codes at the three levels were identified, compared and contrasted, and collapsed to produce themes (World Bank, 2013). These overarching themes, therefore, do not reflect any a priori selection by the researcher.

2.8.2Public Participation Theory

It is until recently that, scholars and many researchers have concurred that project success concerns not only cost, time and quality, but also the satisfaction and effective management of all the stakeholders involved (Bourne & Walker, 2011). They further define stakeholders as those individuals or group of individuals who have a claim or interest in a project and its activities. The theory underscores the fact that the creation and the ongoing operations of each project/programme are as a result of several actors' activities, who are the stakeholders. The central idea therefore is that a programme/project's success is dependent on how well the organization manages the relationships with key groups such as customers, employees, suppliers, communities, financiers, and others that can affect the realization of the project objectives.

The social responsibility of the government owned Special Purpose Vehicle (SPV) therefore significantly increases and external relationships become crucial for the success of the project. In any government projects, stakeholder management is a decisive factor as well for a project's success or failure and therefore identification of stakeholders and their involvement should be part of the project's planning process (Bourne & Walker, 2011). Most projects/programme consist of individuals and groups with different interests and motivational incentives, hence this makes most of government projects/programmes.

2.9Conceptual Framework

The conceptual framework of the study is summarized in the Figure 1. It shows the relationship between independent variable and dependent variable. Furthermore it also shows other factors, moderating and intervening variables that can play in and affect both independent and dependent variables in this study.

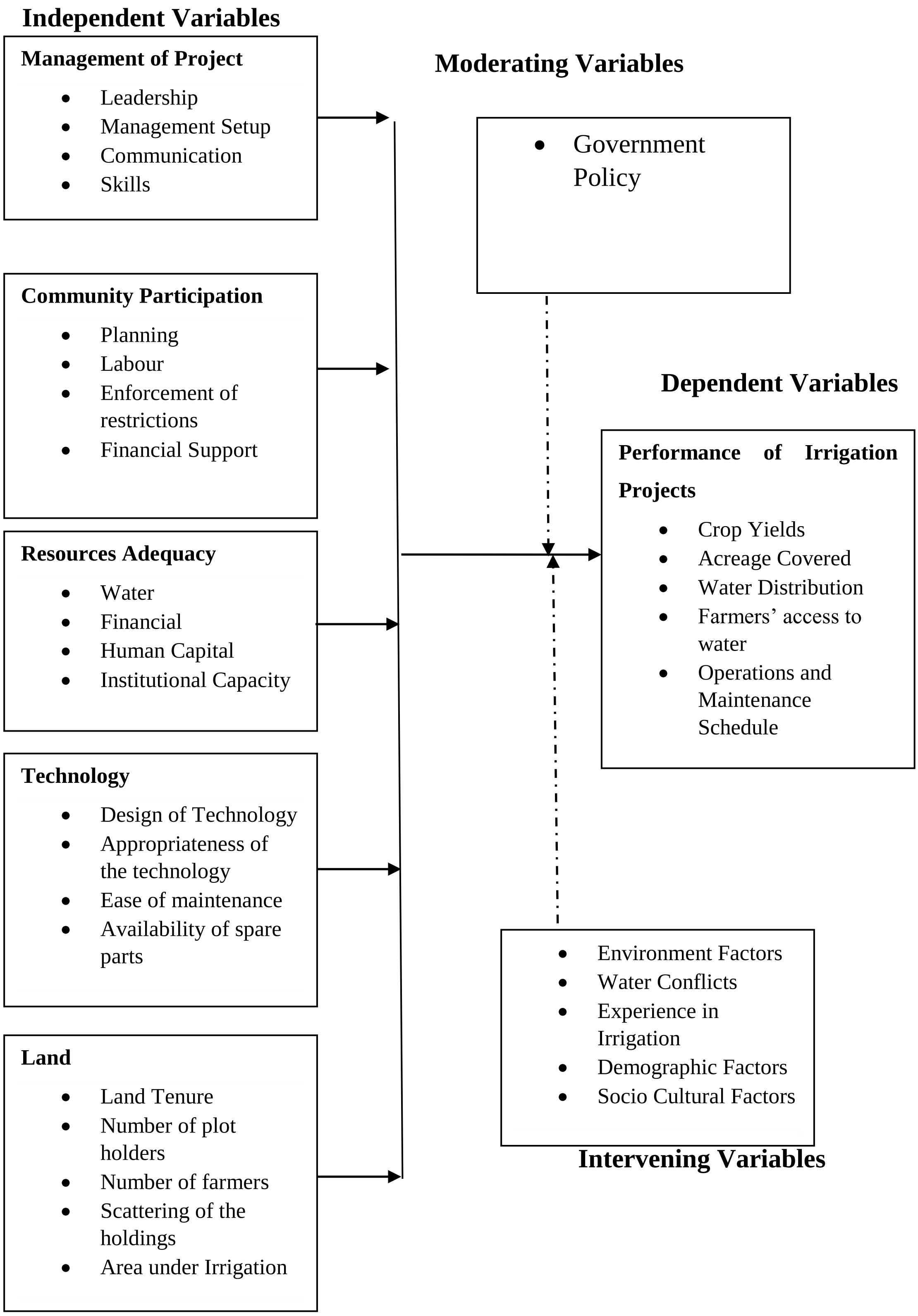

Figure 1: Conceptual framework

2.10 Relationship of variables in conceptual framework

The independent variables; Management of the project, Community participation, Resources adequacy ,Technology used, Availability of sizable land of irrigation, may influence the dependent variable (performance of irrigation projects). The moderating variables; Government policies, Environmental factors and the intervening variables; irrigation water conflicts, Farm position along the pipe line farmers' irrigation experience and Demographic / socio-cultural factors may or may not influence the dependent variable.

2.11 Research gaps

The categories of the determinants of irrigation performance has been described by Malano and Burton (2011), Molden*et al*. (2008) in Molden*et al*. (2010) and it includes those factors such as management of the project, community participation, technology used, resources adequacy and availability of sizable land for irrigation. In Kenya, several studies have been conducted to in irrigation projects (Kibe*et al*., 2007; Owuor, 2006; Nyangito*et al*., 2003; andNgigi, 2002). However, the determinants of public irrigation schemes performanceare not evident. One main challenge in Kenya though, is on howto properly advise and inform policy decisions, if there is little or no knowledgeon how the existing public irrigation schemes perform. There is therefore a literature gap on the determinants of performance of irrigation projects in Kenya.

2.12 Summary

This study is grounded on the classical contingency theory which is supported by the public participation theory. Irrigation development is a critical factor for increasing productivity and promoting economic growth. Furthermore, it enables smallholder farmers to adopt more diversified cropping patterns, and to switch from low value subsistence production to high-value market-oriented production. Recently, emphasis has been on the importance of sustaining and improving the performance of existing irrigation schemes, in parallel with area expansion and development of new irrigation (World Bank, 2006). Kenya's Vision 2030 has placed a high emphasis on investments in irrigation, and envisages a development rate of 32,000 hectares per annum. Despite this effort, the country is still faced with a huge deficit in food production, hence importing to bridge this short fall.Irrigation project performance is often seen by many to be the leading contributor to whether an irrigation project is a success or failure. Effective irrigation project management helps to ensure projects are delivered to the agreed quality, within budget and on time. However, no community based irrigation project will be effective without members' participation.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the procedures and techniques that were used in the collection, processing and analysis of data. Specifically the following subsections are included; research design, target population and sampling, data collection instruments, data collection procedures and finally data analysis.

3.2 Research Design

The study adopted a descriptive research design.A descriptive design is concerned with determining the frequency with which something occurs or the relationship between variables (Bryman& Bell, 2011). Thus, this approach is suitable for this study, since the study intends to collect comprehensive information through descriptions which were helpful for identifying variables. Bryman and Bell (2011) assert that a descriptive design seeks to get information that describes existing phenomena by asking questions relating to individual perceptions and attitudes.

3.3 Target population

According to Sekaran and Bougie (2010), a population is the total collection of elements about which we wish to make inferences. The target population for this study composed of the 500 registered members in Nthawa Irrigation Project of Mbeere North Sub- County, Embu County. Additionally, 19 key informants comprising 9 executive management committee members from the project and 10 Ministry of Water and Irrigation officials made up of 2 technical officers from the District Irrigation Office and 8 Water Resource Management Authority (WRMA) regional officials were also targeted. The project executive management committee members were involved in the study because they were in a position of providing vital information on performance of irrigation projects as opposed to the general project members. The target population is as shown in Table 3.1.

Table 3. 1: Target population

Targeted group	**Population**
Project members	500
Executive committee members	9
MW&I officials	10
Total	**519**

3.4 Sample size and Sampling Procedures

Sampling is a deliberate choice of a number of people who are to provide the data from which a study would draw conclusions about some larger group whom these people represent. The section focuses on the sampling size and sampling procedures.

3.4.1 Sample Size

The sample size is a subset of the population that is taken to be representatives of the entire population (Kumar, 2011). Considering Mugenda and Mugenda (2009) a sample of 10% to 30% is appropriate. For this study, the sample size was 130 respondents (25% of target population). On the Executive committee members and officials, the researcher was not sample since the target population is small, hence the study employed a census method that is by capturing the entire population of Executive Committee Members and Ministry of Water and Irrigation Officials. The study therefore used a totalsample size of 130 respondents

Table 3. 2: Sample size

Targeted group	Population	Sample
Project members	500	111
Executive committee members	9	9
MW&I officials	10	10
Total	**519**	**130**

3.4.2 Sampling Procedures

The study selected the respondents using stratified proportionate random sampling technique. Stratified random sampling is unbiased sampling method of grouping heterogeneous population into homogenous subsets then making a selection within the individual subset to ensure representativeness. The goal of stratified random sampling is to achieve the desired representation from various sub-groups in the population. In stratified random sampling subjects are selected in such a way that the existing sub-groups in the population are more or less represented in the sample (Kothari, 2004). The study used simple random sampling to pick the respondents in each stratum.

3.5 Research Instruments

Primary data was obtained using self-administered questionnaires. The questionnaire was made up of both open ended and closed ended questions. The open ended questions were used so as to encourage the respondent to give an in-depth and felt response without feeling held back in illuminating of any information and the closed ended questions allow respondent to respond from limited options that had been stated. According to Saunders (2011), the open ended or unstructured questions allow profound response from the respondents while the closed or structured questions are generally easier to evaluate. The questionnaires were used in an effort to conserve time and money as well as to facilitate an easier analysis as they are in immediate usable form .Part one of the questionnaire contained the demographic information of the respondents, some closed Yes/No questions sought to establish if the research variables determine performance of irrigation projects

The extent to which each of the research variable determine performance of irrigation projects were investigated using likert scale items that formed the third part of the questionnaire. The likert scale items had five categorization ranging from strongly agree (SA), agree (A), neither agree nor disagree (ND), disagree (D) and strongly disagree (SD). In order to measure the mean (M) and standard deviation (SD) from the likert scale items allotment of numerals were done as follows; SA=1, A=2, ND=3,D=4 and SD=5. The same allotment was accorded to the other likert scale items with the following categorization on the extent scale: Very great extent (5), great extent (4), average extent (3), small extent (2) and no extent (1).

3.5.1 Pilot Testing

Pilot testing refers to putting of the research questions into test to a different study population but with similar characteristics as the study population to be studied (Kumar, 2005). Pilot testing of the research instruments were conducted using stakeholders in another irrigation project in the Embu County. 20 questionnaires were administered to the pilot survey respondents who were chosen at random. After one day the same participants were requested to respond to the same questionnaires but without prior notification in order to ascertain any variation in responses of the first and the second test. This is very important in the research process because it assists in identification and correction of vague questions and unclear instructions. It is also a great opportunity to capture the important comments and suggestions from the participants. This helped to improve on the efficiency of the instrument. This process was repeated until the researcher is satisfied that the instrument does not have variations or vagueness.

3.5.2 Validity of Research Instruments

According to Golafshani (2012), validity is the accuracy and meaningfulness of inferences, based on the research results. One of the main reasons for conducting the pilot study is to ascertain the validity of the questionnaire. The study used content validity which draws an inference from test scores to a large domain of items similar to those on the test. Content validity is concerned with sample-population representativeness. Gillham (2011) stated that the knowledge and skills covered by the test items should be representative to the larger domain of knowledge and skills. Expert opinion was requested to comment on the representativeness and suitability of questions and give suggestions of corrections to be made to the structure of the research tools. This helped to improve the content validity of the data that was collected. Content validity was obtained by asking for the opinion of the supervisor, lecturers and other professionals on whether the questionnaire was adequate.

3.5.3 Reliability of Research Instruments

Instrument reliability on the other hand is the extent to which a research instrument produces similar results on different occasions under similar conditions. It's the degree of consistency with which it measures whatever it is meant to measure (Bell, 2010). Reliability is concerned with the question of whether the results of a study are repeatable. The questionnaire was administered to a pilot group of 20 randomly selected respondents and their responses used to check the reliability of the tool. This comprises 10% of the sample size. A construct composite reliability co-efficient (Cronbach alpha) of 0.7 or above, for all the constructs, is considered to be adequate for this study (Rousson, Gasser and Seifer, 2012). Reliability coefficient of the research instrument was assessed using Cronbach's alpha (α) which is computed as follows:

$A=k/k-1\times [1-\sum (S^2)/\sum S^2 sum]$

Where:

α= Cronbach's alpha

k = Number of responses

$\sum (S^2)$ = Variance of individual items summed up

$\sum S^2 sum$ = Variance of summed up scores

A pilot study was carried out to determine how reliable the questionnaires were. Reliability analysis was subsequently done using Cronbach's Alpha which measures the internal consistency by establishing if certain items within a scale measure the same construct. Bryman and Bell (2011) established the Alpha value threshold at 0.7, thus forming the study's benchmark.

Table 4. 2: Reliability Analysis

	Cronbach's Alpha	Decision
Management of Project	.708	Reliable
Community Participation	.807	Reliable
Resources Adequacy	.713	Reliable
Technology	.736	Reliable
Land	.787	Reliable

Cronbach Alpha was established for every objective which formed a scale. The community participation was the most reliable with an Alpha value of 0.807 while management of project was the least reliable with an Alpha value of 0.708. This illustrates that all the five variables were reliable as their reliability values exceeded the prescribed threshold of 0.7,Bryman and Bell (2011). This, therefore, depicts that the research instrument was reliable and therefore required no amendments.

3.6 Data Collection Procedures

The researcher obtained an introduction letter from the university which was presented to each stakeholder so as to be allowed to collect the necessary data from the respondents. The drop and pick method was preferred for questionnaire administration so as to give respondents enough time to give well thought out responses. The researcher booked appointment with respondent at least two days before visiting to administer questionnaires. The researcher personally administered the research instruments to the respondents. This enables the researcher to establish rapport, explain the purpose of the study and the meaning of items that may not be clear as observed by Best and Khan (2003).

3.7 Data Analysis Techniques

Data was analyzed using Statistical Package for Social Sciences (SPSS Version 21.0). All the questionnaires received were referenced and items in the questionnaire were coded to facilitate data entry. After data cleaning, which entailed checking for errors in entry, descriptive statistics such as frequencies, percentages, mean score and standard deviation were estimated for all the quantitative variables and information presented inform of tables.

The qualitative data from the open-ended questions were analyzed using conceptual content analysis and presented in prose

3.8 Ethical Considerations

The researcher observed the following standards of behaviour in relation to the rights of those who become subject of the study or are affected by it: First, in dealing with the participants, they were informed of the objective of the study and the confidentiality of obtained information, through a letter to enable them give informed consent. Once consent is granted, the participants will maintain their right, which entails but is not limited to withdraw or decline to take part in some aspect of the research including rights not to answer any question or set of questions and/or not to provide any data requested; and possibly to withdraw data they have provided.

Caution was observed to ensure that no participant is coerced into taking part in the study and, the researcher seeks to use minimum time and resources in acquiring the information required. Secondly, the study adopted quantitative research methods for reliability, objectivity and independence of the researcher. While conducting the study, the researcher will ensure that research ethics are observed. Participation in the study was voluntary. Privacy and confidentiality was also observed. The objectives of the study were explained to the respondents with an assurance that the data provided were used for academic purpose only.

3.9Operationalization of Variables

The operationalization of variables is shown in Table 3.3.

Table 3. 3: Operationalization of variables

Objectives	Type of Variable	Variable	Indicators	Scale	Tools of analysis	Type of analysis
To establish the effect of management of the project on the performance of public irrigation projects in Kenya	Independent	Management of the project	Leadership Management Setup Communication Skills	Ordinal	Percentages Mean score	Descriptive statistics Regression analysis
To assess the effect of resources adequacy on the performance of public irrigation projects in Kenya	Independent	Resources Adequacy	Water Financial Human Capital Institutional Capacity	Interval	Percentages Mean score	Descriptive statistics Regression analysis
To evaluate the effect of technology used on the performance of public irrigation projects in Kenya	Independent	Technology used	Design of the technology Appropriateness of the technology Ease of maintenance Availability of spare parts	Ordinal	Percentages Mean score	Descriptive statistics Regression analysis
To determine the effect of community participation on the performance of public irrigation projects in Kenya	Independent	Community participation	Planning Labor Enforcement of restrictions Financial Support	Ordinal	Percentages Mean score	Descriptive statistics Regression analysis
	Independent	Availability of Sizable Land for Irrigation	Land Tenure Number of plot holders Number of farmers Scattering of the holdings Area under Irrigation	Interval	Percentages Mean score	Descriptive statistics Regression analysis
	Dependent	Irrigation project performance	Crop output/Yields Water distribution Acreage covered relative to target, Farmers access to water, Operation and maintenance schedule	Interval	Mean score	Descriptive statistics Regression analysis

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION OF FINDINGS

4.1 Introduction

This chapter presents the findings obtained in relation to research objectives and questions on the study on the determinants of performance of irrigation projects. The researcher provided tables and graphs that summarized the collective reactions of the respondents.

4.2Response Rate

The researcher administered 130 questionnaires to the respondents after which he only got a total of 98 filled questionnaires giving a response rate of 75.38%. This was within what Saunders (2011)prescribed as a significant response rate for statistical analysis and established at a minimal value of 50%.

Table4. 1: Response Rate

Total Questionnaires administered	Filled questionnaires	Unfilled questionnaires	Response Rate.
130	98	32	75.38%

4.3Demographic Information

The study sought to enquire on the respondents' general information including gender, work experience, their level of education and their age bracket. This general information is presented in form tables with frequencies and percentages.

4.3.1 Participant Gender

The participants indicated their gender and the respondents were summarized and prented in Table 4.2

Table 4.2: Participant Gender

	Frequency	Percent
Male	51	52
Female	47	48
Total	**98**	**100**

52% of the participants were male while 48% of the respondents were female. This shows that male participated more in giving the information than the females.

4.3.2 Period Working with Nthawa Water Irrigation Project

Participants were requested to indicate the number of years they have been working with Nthawa water irrigation project. Their responses were as shown in Table 4.3

Table 4.3: Period Working with Nthawa Water Irrigation Project

	Frequency	Percent
Less than 3 years	12	12.2
3 to 9 years	41	41.8
9 to 12 years	33	33.7
Above 12 years	12	12.2
Total	**98**	**100**

From the findings in Table 4.4, 41.8% of the participants indicated that they have been working in Nthawa water irrigation projectfor 3 to 9 years, 33.7% indicated 9 to 12 years while 12.2% indicated that they have been working in Nthawa water irrigation projectfor less than 3 years and above 12 years. This implies that majority of the respondents had worked in Nthawa water irrigation projectlong enough to comprehend the subject under study.

4.3.3Level of Education

The participants were again asked to indicate their level of education. Their responses were as presented in Table4.4

Table 4.4: Level of Education

	Frequency	Percent
Certificate	11	11.2
Diploma	33	33.7
Degree	46	46.9
Masters	8	8.2
Total	**98**	**100**

As per the Table 4.5, 46.9% of the participants showed that they had a degree, 33.7% of the participants indicated that they had a college diploma, 11.2% of the participants showed that they had a certificate while 823% of the participants indicated that they had masters. This implies that majority of the participants were learnt enough to understand the subject under study.

4.3.4Age Bracket

The participants were also requested to indicate their age bracket. The age distribution is presented in Table 4.5

Table 4.5: Age Bracket

	Frequency	Percent
20-30 years	2	2
31-40 years	37	37.8
41-50 years	47	48
51 – 60 years	12	12.2
Total	**98**	**100**

The majority of the participants indicated that they were aged between 41 and 50 as shown by 48%. Others indicated 31 to 40 years as shown by 37.8%, 51 to 60 years as shown by 12.2 % and 20 to 30 years as shown by 2%. This shows that most of the participants were mature enough to cooperate and give information on the subject under study.

4.4 Management of the Project and Performance of Irrigation Projects

Under this the study sought the extent to which management of the project affect the performance of public irrigation projects in Kenya. Participant's reactions were presented in form of Tables 4.6

Table4. 6: Extent of Management of the Project Effect

	Frequency	Percent
Low extent	6	6.1
Moderate extent	38	38.8
Great extent	46	46.9
Very great extent	8	8.2
Total	**98**	**100**

As per the results the participants indicated that management of the project affect the performance of public irrigation projects in Kenya in great extent as shown by 46.9% (46), in a moderate extent as shown by 38.8% (38), in a very great extent as shown by 8.2% (8)and in a low extent as shown by 6.1% (6). This shows that management of the project greatly affects the performance of public irrigation projects in Kenya.

The participants were also requested using a likert scale of 1-5 to tell the extent to which various aspects management of the project affect the performance of public irrigation projects in Kenya. Their responses were as shown in Table 4.7.

Table 4.7: Extent of Effects of Management of the Project Aspects

Aspects	Mean	Std Dev.
Water use management (acquisition, allocation, distribution and drainage).	4.048	0.733
Management of organisation (resource mobilization, conflict resolution, communication and decision-making).	4.071	0.747
Management of structures required for water control (design, construction, operation and maintenance).	3.435	0.554
Management set up/structure	2.982	0.770
Leadership and Capacity	3.785	0.684

The findings show that the participants indicatedthat management of organisation (resource mobilization, conflict resolution, communication and decision-making) greatly affects the performance of public irrigation projects in Kenyaas illustrated by mean=4.071 and standard deviation of 0.747.The participants also illustrated that water use management (acquisition, allocation, distribution and drainage) greatly affects the performance of public irrigation projects in Kenya as shown by a mean of 4.048and standard deviation of 0.733.

They also showed thatleadership and capacitygreatly affects the performance of public irrigation projects in Kenyaas illustrated by a mean of 3.785and standard deviation of 0.684.

The participants againindicated that management of structures required for water control (design, construction, operation and maintenance) moderately affects the performance of public irrigation projects in Kenya as depicted by a mean of 3.435 and standard deviation of 0.554.Finally the participants indicated that management set up/structuremoderately affects the performance of public irrigation projects in Kenyaas illustrated by a mean score of 2.982 and standard deviation of 0.770.

4.5 Resources Adequacyand Performance of Irrigation Projects

Further the study sought to examine the extent to which resources adequacy affect the performance of public irrigation projects in Kenya. The study used the responses of the participants to come up with the findings in Table 4.8.

Table 4.8: Extent of resources adequacy Effect

	Frequency	Percent
Low extent	17	17.3
Moderate extent	22	22.4
Great extent	53	54.1
Very great extent	6	6.1
Total	**98**	**100**

The participants indicates that resource adequacy affect the performance of public irrigation projects in Kenya greatly as shown by 54.1% (53), moderately as illustrated by 22.4% (22), lowly as shown by 17.3% (17) and very greatly as illustrated by 6.1% (6). This makes it clear that resource adequacy affect the performance of public irrigation projects in Kenya greatly.

The participants using a likert scale of 1-5, were asked to tell the extent to which various aspects of resource adequacy affect the performance of public irrigation projects in Kenya. Their responses were as shown in Table 4.9.

Table4. 9: Effect of Resource Adequacy Aspects

Aspects	Mean	Std Dev.
Water supply adequacy and reliability	4.207	0.689
Financial capital adequacy	3.811	0.624
Human capital	2.087	0.702
Institutional capacity	3.557	0.502
Transport infrastructure	4.121	0.986
Ease of use and user acceptability	3.823	0.742

Participants indicated that water supply adequacy and reliability (Mean=4.207; Standard deviation=0.689) and transport infrastructure (Mean=4.12; Standard deviation=0.986) greatly affect the performance of public irrigation projects in Kenya.

They also showed that financial capital adequacy (Mean=3.811; Standard deviation=0.624), ease of use and user acceptability (Mean=3.823; Standard deviation=0.742) and institutional capacity (Mean=3.557; Standard deviation=0.502) greatly affect the performance of public irrigation projects in Kenya. The participants further indicated that human capital (Mean=2.087; Standard deviation=0.702) lowly affect the performance of public irrigation projects in Kenya.

4.6 Technology used and Performance of Irrigation Projects

The participants were again were requested to indicate the extent to which technology used affect the performance of public irrigation projects in Kenya. The participants' responses were presented in Table 4.10

Table 4.10: Extent of Effect of Technology Used

	Frequency	Percent
Low extent	17	17.3
Moderate extent	28	28.6
Great extent	41	41.8
Very great extent	12	12.2
Total	**98**	**100**

The results indicate that in great extent technology used affect the performance of public irrigation projects in Kenyaas shown by 41.8% (41). It was also indicated that technology used affect the performance of public irrigation projects in Kenya in a moderate extent as illustrated by 28.6% (28), in a low extent as shown by 17.3 % (17) and in a very great extent as illustrated by 12.2% (12). This reveals that technology used greatly affect the performance of public irrigation projects in Kenya.

The participants using a likert scale of 1-5, were asked to tell the extent to which various aspects of technology used affect the performance of public irrigation projects in Kenya. Their responses were as shown in Table 4.11.

Table .4.11: Effect of Technology Used

Aspects	Mean	Std Dev.
Type of irrigation systems	4.077	0.599
Appropriateness of technology	3.941	0.635
Engineering designs for the physical systems	2.000	0.812
Ease of maintenance	3.357	0.572
Availability and cost of spare parts	4.421	0.976
Ease of use and user acceptability	3.823	0.712
Cost	4.108	0.786

Participants indicated that availability and cost of spare parts affect the performance of public irrigation projects in Kenyagreatly as expressed by a mean of 4.421 and standard deviation of 0.976. They also indicated that cost affect the performance of public irrigation projects in Kenyagreatly as expressed by a mean of 4.108 and standard deviation of 0.786.

Participants again indicated that and type of irrigation systems affect the performance of public irrigation projects in Kenyagreatly as expressed by a mean of 4.077 and standard deviation of 0.599. They also showed that appropriateness of technology affect the performance of public irrigation projects in Kenyagreatly as expressed by a mean of 3.941 and standard deviation of 0.635.

Participants however indicated that and ease of use and user acceptability affect the performance of public irrigation projects in Kenyagreatlyas expressed by a mean of 3.823 and standard deviation of 0.712, that ease of maintenance affect the performance of public irrigation projects in Kenyamoderatelyas expressed by a mean of 3.357 and standard deviation of 0.572 and that engineering designs for the physical systems affect the performance of public irrigation projects in Kenyamoderatelyas expressed by a mean of

2.000 and standard deviation of 0.812 moderately affect the performance of public irrigation projects in Kenya.

4.7 Community Participation and Performance of Irrigation Projects

The study used the reactions of the participants on the extent to which community participation affect the performance of public irrigation projects in Kenya to come up with the findings in Table 4.12.

Table 4.12: Extent of Effect of community participation

	Frequency	Percent
Low extent	3	3.1
Moderate extent	34	34.7
Great extent	48	49.0
Very great extent	13	13.3
Total	**98**	**100**

The results indicate that in great extent community participation affect the performance of public irrigation projects in Kenya as shown by 49% (48). It was also indicated that community participation affect the performance of public irrigation projects in Kenya in a moderate extent as illustrated by 34.7% (34), in a very great extent as shown by 13.3 % (13) and in a low extent as illustrated by 3.1% (3). This reveals that community participation greatly affect the performance of public irrigation projects in Kenya

The participants were also asked to tell the extent of effect of various aspects of community participation on performance of public irrigation projects in Kenya and their responses are presented in Table 4.13.

Table 4.13: Extent of Effect of Community Participation Aspects

Aspects	Mean	Std Dev.
Financial, labour or other contributions	2.935	0.834
Laying out a system of enforcement of the use restrictions	4.363	0.826
Preparing and agreeing on rules of restrained access to the resource	3.958	0.613
Involving the farmers in planning, operation, management and maintenance	4.012	0.709

Analysis of community participation aspects shows that, laying out a system of enforcement of the use restrictions greatly affect performance of public irrigation projects in Kenya as illustrated by mean of 4.363and standard deviation of 0.836. It also revealed that involving the farmers in planning, operation, management and maintenance greatly affect performance of public irrigation projects in Kenya as illustrated by 4.012and standard deviation of 0.709.

The study further showed that preparing and agreeing on rules of restrained access to the resource as shown by mean of 3.958and standard deviation of 0.613, greatly affect performance of public irrigation projects in Kenya. Finally the study showed that financial, labour or other contributions moderately affect performance of public irrigation projects in Kenya as expressed by a mean of 2.935 and standard deviation of 0.834.

4.8Availability of Sizable Land for Irrigationand Performance of Irrigation Projects

Finally the study explored how the availability of sizable land for irrigation affects the performance of public irrigation projects in Kenya. The findings were as shown in Table 4.14.

Table 4.14: Availability of Sizable Land for Irrigation Effects

	Frequency	Percent
Moderate extent	31	31.6
Great extent	56	57.1
Very great extent	11	11.2
Total	**98**	**100**

The findings show that availability of sizable land for irrigation affects the performance of public irrigation projects in Kenya in a great extent as shown by 57.1% (56), in a moderate extent as illustrated by 31.6% (31) and in a very great extent as shown by 11.2% (11). This is shows that availability of sizable land for irrigation affects the performance of public irrigation projects in Kenya in a great extent as per the majority.

Using a likert scale of 1-5, the participants were requested to tell how various aspects of availability of sizable land for irrigation affects the performance of public irrigation projects in Kenya. Their responses were as presented in Table 4.15.

Table 4.15: Aspects of Availability of Sizable Land for Irrigation Affects

Aspects	Mean	Std Dev.
Land tenure issues	4.066	0.735
Area of the land under irrigation	3.738	0.592
Number of plot holders	3.482	0.997
Number of farmers	3.986	0.676
Scattering of the holdings	4.243	0.962

From the findings the participants indicated that scattering of the holdings greatly affects the performance of public irrigation projects in Kenya as shown by mean of 4.243and standard deviation of 0.962. The participants also showed that land tenure issues greatly affects the performance of public irrigation projects in Kenya as shown by mean of 4.066 and standard deviation of 0.735.They also indicated that number of farmers also greatly affects the performance of public irrigation projects in Kenya as shown by mean of 3.986 and standard deviation of 0.676.

Again the participants revealed that area of the land under irrigation as shown by mean of 3.738 and standard deviation of 0.592 greatly affects the performance of public irrigation projects in Kenya while indicating that number of plot holders moderately affects the performance of public irrigation projects in Kenya as shown by mean of 3.482 and standard deviation of 0.997.

4.9Trend of Irrigation Project Performance

Under this the study sought to determine the trend of various aspects of Irrigation project performance in your project for the last 5 years. The findings were presented in Table 4.16.

Table 4.16: Trend of Irrigation Project Performance

Aspects	Mean	Std Dev.
Crop output/Yields	4.366	0.826
Water distribution	3.848	0.502
Acreage covered relative to target,	3.282	0.907
Farmers access to water,	3.784	0.626
Operation and maintenance schedule	4.123	0.862

The study indicated that crop output/yields (Mean=4.366; Standard deviation=0.826) and operation and maintenance schedule (4.123; Standard deviation=0.862) had improved over the last the 5 years.

The study also indicated that water distribution (Mean=3.848; Standard deviation=0.502) and that farmers access to water (Mean=3.784; Standard deviation=0.626) had also improved over the last the 5 years.

They however indicate that acreage covered relative to target (Mean=3.282; Standard deviation=0.907) had also been constant over the last five years.

4.10 Inferential Statistics

The analysis of inferences was employed to get correlation results which are illustrated in the subsequent subsection.

4.11 Correlation Analysis

The results in Table 4.17 show the coefficient of determination of relationship between dependent variable and independent variables as well as coefficient of determination of relationship among the independent variables.

Table 4.17: Correlation Analysis

		Irrigation Project Performance	Management of the Project	Resources Adequacy	Technology used	Community Participation	Availability of Sizable Land for Irrigation
Irrigation Project Performance	Pearson Correlation	1					
	Sig. (2-tailed)	0.000					
Management of the Project	Pearson Correlation	0.548	1				
	Sig. (2-tailed)	0.000	0.000				
Resources Adequacy	Pearson Correlation	0.521	0.475	1			
	Sig. (2-tailed)	0.000	0.000	0.000			
Technology used	Pearson Correlation	0.534	0.363	0.226	1		
	Sig. (2-tailed)	0.000	0.002	0.071	.		
Community Participation	Pearson Correlation	0.541	0.333	0.337	0.324	1	
	Sig. (2-tailed)	0.000	0.005	0.015	0.003	-	-
Availability of Sizable Land for Irrigation	Pearson Correlation	0.643	0.552	0.516	0.324	0.112	1
	Sig. (2-tailed)	0.005	0.016	0.018	0.001	-	-

The outcome showed that management of the project and irrigation project performanceare correlated positively and significantly (r=0.548, p=0.000).The Table further indicated that resources adequacy and irrigation project performance are positively and significantly related (r=0.521, p=0.000). It was further established that, technology used and irrigation project performance were positively and significantly related (r=0.534, p=0.000). Similarly, results showed that community participation and irrigation project performance were positively and significantly related (r=0.541, p=0.000). Finally the results reveal that availability of sizable land for irrigation and irrigation project performance were positively and significantly related (r=0.643, p=0.000).

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter starts by giving the summary of the findings, then discussion of study findings after which the conclusions and recommendations are drawn from the findings highlighted.

5.2 Summary of the Findings

This section gives a brief summary of the findings generated in chapter four.

5.2.1 Management of the Project

Under this the study sought the extent to which management of the project affect the performance of public irrigation projects in Kenya. The study showed that management of the project greatly affects the performance of public irrigation projects in Kenya.The findings also showed that the participants indicated that management of organization (resource mobilization, conflict resolution, communication and decision-making) 46% to a greater extent and 8% very great extent, greatly affects the performance of public irrigation projects in Kenya. The participants also illustrated that water use management (acquisition, allocation, distribution and drainage) greatly affects the performance of public irrigation projects in Kenya. They also showed that leadership and capacity greatly affects the performance of public irrigation projects in Kenya .The participants again indicated that management of structures required for water control (design, construction, operation and maintenance) moderately affects the performance of public irrigation projects in Kenya.Finally the participants indicated that management set up/structure moderately affects the performance of public irrigation projects in Kenya.

5.2.2 Resources Adequacy

Further the study sought to examine the extent to which resources adequacy affect the performance of public irrigation projects in Kenya. The study indicated that resource adequacy affect the performance of public irrigation projects in Kenya greatly .Participants indicated that water supply adequacy and reliability and transport infrastructure greatly affect the performance of public irrigation projects in Kenya. They also showed that financial capital adequacy, ease of use and user acceptability and institutional capacity greatly affect the performance of public irrigation projects in Kenya. The participants further indicated that human capital lowly affect the performance of public irrigation projects in Kenya.

5.2.3Technology used

The participants were again were requested to indicate the extent to which technology used affect the performance of public irrigation projects in Kenya. The study revealed that technology used greatly affect the performance of public irrigation projects in Kenya (53% to a great extent and 6% to very great extent).Participants indicated that availability and cost of spare parts affect the performance of public irrigation projects in Kenya greatly. They also indicated that cost affect the performance of public irrigation projects in Kenya greatly. Participants again indicated that and type of irrigation systems affect the performance of public irrigation projects in Kenya greatly. They also showed that appropriateness of technology affect the performance of public irrigation projects in Kenya greatly .Participants however indicated that and ease of use and user acceptability affect the performance of public irrigation projects in Kenya greatly, that ease of maintenance affect the performance of public irrigation projects in Kenya moderately and that engineering designs for the physical systems affect the performance of public irrigation projects in Kenya moderately affect the performance of public irrigation projects in Kenya.

5.2.4Community Participation

The study revealed that community participation greatly affects the performance of public irrigation projects in Kenya (48% to a greater extent and 13% to a very greater extent). Analysis of community participation aspects shows that, laying out a system of enforcement of the use restrictions greatly affect performance of public irrigation projects in Kenya. It also revealed that involving the farmers in planning, operation, management and maintenance greatly affect performance of public irrigation projects in Kenya. The study further showed that preparing and agreeing on rules of restrained access to the resource greatly affect performance of public irrigation projects in Kenya. Finally the study showed that financial, labour or other contributions moderately affect performance of public irrigation projects in Kenya.

5.2.5Availability of Sizable Land for Irrigation

Finally the study explored how the availability of sizable land for irrigation affects the performance of public irrigation projects in Kenya(56% to a great extent and 11% to a very great extent) . The study showed that availability of sizable land for irrigation affects the performance of public irrigation projects in Kenya in a great extent as per the majority. From the findings the participants indicated that scattering of the holdings greatly affects the performance of public irrigation projects in Kenya. The participants also showed that land tenure issues greatly affect the performance of public irrigation projects in Kenya. They also indicated that number of farmers also greatly affects the performance of public irrigation projects in Kenya .Again the participants revealed that area of the land under irrigation greatly affects the performance of public irrigation projects in Kenya while indicating that number of plot holders moderately affects the performance of public irrigation projects in Kenya.

5.3 Discussion of the Findings

Under this section, the findings summarized in the section of summary of the findings are linked to the literature in chapter two.

5.3.1 Management of the Project

Under this the study sought the extent to which management of the project affect the performance of public irrigation projects in Kenya. The study showed that management of the project greatly affects the performance of public irrigation projects in Kenya.This agrees with Uphoff(2011) who observed that irrigation analysts and different agencies of development have recognized irrigation management as a very important factor affecting productivity and consists of a technical infrastructure and an institutional framework which determines the use of that infrastructure, which are both important in the success of the irrigation system. There is need to have institutional capacity to manage all these factors in order to ensure that the schemes operate to their full capacity.

The findings also showed that the participants indicated that management of organization (resource mobilization, conflict resolution, communication and decision-making) greatly affects the performance of public irrigation projects in Kenya. This correlate with Ruigu(2009) who notes that some degree of control and discipline is required in an organized community such as Mwea and Ahero where the wellbeing of the tenants and of the schemes are dependent on the performance of a technically determined cycle of activities.

The participants also illustrated that water use management (acquisition, allocation, distribution and drainage) greatly affects the performance of public irrigation projects in Kenya. They also showed that leadership and capacity greatly affects the performance of public irrigation projects in Kenya. This conforms to North (2010) who notes that; the growth of economies has occurred within the institutional framework of well-developed coercive policies, economic history is overwhelmingly a story of economies that failed to produce a set of economic rules of the game that induce sustained economic growth.

The participants again indicated that management of structures required for water control (design, construction, operation and maintenance) moderately affects the performance of public irrigation projects in Kenya. Finally the participants indicated that management set up/structure moderately affects the performance of public irrigation projects in Kenya. These concur with Woldeab (2013) who argued that although both the human and physical aspects interact in their irrigation domain, the management aspect of irrigation is often ignored while priorities are givento the construction of irrigation.

5.3.2 Resources Adequacy

Further the study sought to examine the extent to which resources adequacy affect the performance of public irrigation projects in Kenya. The study indicated that resource adequacy affect the performance of public irrigation projects in Kenya greatly. This is in line with Kibe (2007) who revealed that, the development of irrigation despite the high costs involved is one of the largest potential for addressing the challenge of the declining agricultural productivity with an up surging population in Kenya.

Participants indicated that water supply adequacy and reliability and transport infrastructure greatly affect the performance of public irrigation projects in Kenya. This correlate with Shah *et al*. (2013) who when studying smallholder irrigation systems in sub-Saharan Africa, identified the following challenges: mismanagement, high cost of working capital, poor linkages to credit, input and output markets, institutional vacuum, land tenure issues, improper management transfers, damaged soils, expensive and ineffective mechanisation, poor farmer capacity and lack of farmer entrepreneurship development.

They also showed that financial capital adequacy, ease of use and user acceptability and institutional capacity greatly affect the performance of public irrigation projects in Kenya. The participants further indicated that human capital lowly affect the performance of public irrigation projects in Kenya. These were in line with Inocencio*et al*. (2007) who compared irrigation development in sub-Saharan Africa with other developing areas, and confirmed that it is more expensive to develop irrigation in sub-Saharan Africa than in other parts of the world.

5.3.3 Technology used

The participants were again were requested to indicate the extent to which technology used affect the performance of public irrigation projects in Kenya. The studyrevealed that technology used greatly affect the performance of public irrigation projects in Kenya. These agree with Ostrom (2010) who complained that 'the initial plans for many of irrigation projects in developing countries have focused almost exclusively on engineering designs for the physical systems.

Participants indicated that availability and cost of spare parts affect the performance of public irrigation projects in Kenya greatly. They also indicated that cost affect the performance of public irrigation projects in Kenya greatly. This concurs with Narayan (2009) who suggested that beneficiary participation is the single most important factor contributing to project effectiveness.

Participants again indicated that and type of irrigation systems affect the performance of public irrigation projects in Kenya greatly. They also showed that appropriateness of technology affect the performance of public irrigation projects in Kenya greatly. These are in line with Harvey and Reed (2007) who argues that participation can take different forms, including the initial expression of the demand for water, the selection of technology, the provision of labour and local materials and cash contribution to the project costs and the selection of the management type.

Participants however indicated that and ease of use and user acceptability affect the performance of public irrigation projects in Kenya greatly, that ease of maintenance affect the performance of public irrigation projects in Kenya moderately and that engineering designs for the physical systems affect the performance of public irrigation projects in Keny amoderately affect the performance of public irrigation projects in Kenya. These findings concur with Holtslag (2012) who argue that ease of operation and maintenance, user acceptability and cost must be considered jointly and if a water supply system in the irrigation project is not maintained it is because it is too complicated, not 'attractive' or too expensive.

5.3.4 Community Participation

The study revealed that community participation greatly affects the performance of public irrigation projects in Kenya. Analysis of community participation aspects shows that, laying out a system of enforcement of the use restrictions greatly affect performance of public irrigation projects in Kenya. This is in line with Kumar (2002) who asserts that participation is a key instrument in creating self-reliant and empowered communities, stimulating village-level mechanisms for collective action and decision-making.

It also revealed that involving the farmers in planning, operation, management and maintenance greatly affect performance of public irrigation projects in Kenya. This is similar to Smith (2008) who claims that stronger forms of participation, involving control over decisions, priorities, plans and implementation or the spontaneous, induced, or assisted formation of groups to achieve collective goals

The study further showed that preparing and agreeing on rules of restrained access to the resource greatly affect performance of public irrigation projects in Kenya. Finally the study showed that financial, labour or other contributions moderately affect performance of public irrigation projects in Kenya. These rare similar to Garces -Restrepo*et al*. (2007) who noted that the underlying assumption was that greater participation by the farmers would induce a sense of ownership and responsibility, and hence improve resource use efficiency .Some governments in Sub-Saharan Africa handed over management of smallholder schemes to the farmers in the face of IMT.

5.3.5 Availability of Sizable Land for Irrigation

Finally the study explored how the availability of sizable land for irrigation affects the performance of public irrigation projects in Kenya. The study showed that availability of sizable land for irrigation affects the performance of public irrigation projects in Kenya in a great extent as per the majority. These findings concur with Wade (2009) who argues that the degree of scattering of the holdings also affects the performance of irrigation schemes.

From the findings the participants indicated that scattering of the holdings greatly affects the performance of public irrigation projects in Kenya. The participants also showed that land tenure issues greatly affect the performance of public irrigation projects in Kenya. This is in line with Njagi(2009) who observed that large irrigation projects benefit from economies of scale from indivisible inputs such as skilled labour, plant and machinery.

They also indicated that number of farmers also greatly affects the performance of public irrigation projects in Kenya. This conforms to Njagi (2009) who said that smaller irrigation projects on the other hand are easy to manage, e.g. working with fewer farmers makes it easier to coordinate and systems are easier to manage.

Again the participants revealed that area of the land under irrigation greatly affects the performance of public irrigation projects in Kenya while indicating that number of plot holders moderately affects the performance of public irrigation projects in Kenya.This agrees with Inocencioet al (2007) who found that in Sub Saharan Africa, small irrigation projects showed higher performance measured by yields, water distribution, and operations within the scheme, due to better management compared to bigger irrigation projects where as they did not benefit from scale economies.

5.4 Conclusion

The study concluded that management of the project positively and greatly affects the performance of public irrigation projects in Kenya.The study deduced that water use management (acquisition, allocation, distribution and drainage) greatly affects the performance of public irrigation projects in Kenya. They also showed that leadership and capacity greatly affects the performance of public irrigation projects in Kenya. The study again deduced that management of structures required for water control (design, construction, operation and maintenance) moderately affects the performance of public irrigation projects in Kenya. Finally the study deduced that management set up/structure moderately affects the performance of public irrigation projects in Kenya.

The study concluded that resource adequacy affect the performance of public irrigation projects in Kenya greatly and significantly. The study deduced that water supply adequacy and reliability and transport infrastructure greatly affect the performance of public irrigation projects in Kenya. They also showed that financial capital adequacy, ease of use and user acceptability and institutional capacity greatly affect the performance of public irrigation projects in Kenya. The study further deduced that human capital lowly affect the performance of public irrigation projects in Kenya.

The study concluded that technology used greatly and positively affect the performance of public irrigation projects in Kenya. The study deduced that availability and cost of spare parts affect the performance of public irrigation projects in Kenya greatly .The study again deduced that type of irrigation systems affect the performance of public irrigation projects in Kenya greatly. The study finally deduced that and ease of use and user acceptability affect the performance of public irrigation projects in Kenya greatly, that ease of maintenance affect the performance of public irrigation projects in Kenya moderately.

The study concluded that community participation greatly, positively and significantly affects the performance of public irrigation projects in Kenya. The study deduced that Analysis of that laying out a system of enforcement of the use restrictions greatly affect performance of public irrigation projects in Kenya. The study further deduced that preparing and agreeing on rules of restrained access to the resource greatly affect performance of public irrigation projects in Kenya. Finally the study deduced that financial, labour or other contributions moderately affect performance of public irrigation projects in Kenya.

Finally the study concluded that availability of sizable land for irrigation positively and significantly affects the performance of public irrigation projects in Kenya. The study deduced that that availability of sizable land for irrigation affects the performance of public irrigation projects in Kenya in a great extent as per the majority. The study also deduced that number of farmers also greatly affects the performance of public irrigation projects in Kenya. Again the participants revealed that area of the land under irrigation greatly affects the performance of public irrigation projects in Kenya while indicating that number of plot holders moderately affects the performance of public irrigation projects in Kenya.

5.5 Recommendations

The study recommends that full participation of members in irrigation project development should be encouraged to enhance capacity to perceive their own needs. Through participation, local people identify their needs as well as the relevant goals of a program.

i. The study recommends that project members need to participate in decision making and implementation activities, to help irrigation officials identify their needs, strategies to meet those needs and the necessary resources required to implement the various strategies.
ii. The study also recommends that members' managed irrigation projects should encourage a maximum number of people to participate at various stages of project development. Such involvement should give the participants full inclusion in designing, organizing, implementation activities and workshops in order to create consensus thus enhancing ownership.
iii. The study recommends that the adoption of modern technology of irrigation such as drip and sprinkler irrigation system that increases water use efficiency. This will eventually improve the performance of the projects as well as enhancing the work efficiency.

iv. The study further recommends that the study recommends that the management of the projects should adopt stringent measures which would arrest the cost related factors. This also should include less bureaucratic procedures and processes in disbursement of both material and financial resources required by contractors to implement irrigation projects.

v. The study recommends that the project management should strengthen the capacity of supervisory staff involved in irrigation projects. Supervision was found to have the least influence on completion of projects in the study. However, supervision would enhance the identification of trouble areas through spot checks of project implementation activities in order to reduce massive loss of resources and project non-completion.

vi. The study recommends that the Ministry of Agriculture and policy makers should formulate policy on irrigation and technology that is supportive to the development and growth of small scale dry-land farming. The policy should provide incentives that promote small scale dry-land farming establishments. These would include access to the market, access to credit, transport and the general provision of the required infrastructural facilities that could help in enhancing sustainable irrigation of small scale dry-land farming in most of the arid and semi-arid lands.

On the appropriate use of irrigation technology, the agricultural extension officers should develop sensitization programs for small scale dry-land farmers covering appropriate irrigation technology, economical irrigation farming practices and sustainable water supply in the irrigation of small scale dry-land farming. This is because the farmers would have a broad range of options for adoption of appropriate irrigation technology and irrigation farming practices.

5.6 Suggestions for Further Studies

The study recommends that the same study should be done in other counties to establish the factors that affect performance of irrigation projects in the other counties in Kenya since this study only covered Embu County.

Further studies can compare the performance of the irrigation project measured in terms of physical indicators such as efficiency in water use and economic indicators such as return to farmers' inputs and general infrastructure to participation by the members. Policy and practice can also benefit from comparison of relative performance of irrigation projects and member participation.

REFERENCES

Awulachew, S. B.; Merrey, D. J.; Kamara, A. B.; Van Koppen, B.; Penning de Vries, F.; Boelee, E.; Makombe, G. (2010). *Experiences and opportunities for promoting small–scale/micro irrigation and rainwater harvesting for food security in Ethiopia*.(Working paper 98), IWMI, Colombo.

Azad, W. and Ancev, A. (2010). *Contribution of Irrigation to Sustaining Rural Livelihoods:*Literature Review. UK: DFID.

Batchelor, S., McKemey, K. and Scott, N. (2010).*Exit Strategies for Resettlement of Drought Prone Populations* (Project Technical Report).Gamos Ltd: Reading, UK.

Bermejo, B. &Bekui, W. (2013).*Irrigation Water Quality, Journal of Developing Areas,* Vol.25, No.2

Bos, M.G., Burton, M.A. and Molden D.J. (2005).*Irrigation and Drainage Performance Assessment: Practical Guidelines*. CABI Publishing, London, UK.

Bruinsma, J., (2013). *World Agriculture: Towards 2015/2030. An FAO Perspective. London: Food and Agriculture Organization and Earthscan.Case of Irrigated Rice Production in Kenya*. Unpublished Master's Thesis at International Institute for Social Sciences, Netherlands.

Byrnes, K., (2012). *Water users association in World Bank assisted irrigation projects in Pakistan*. pp. 31-39. World Bank Technical paper 173. Washington, D.C.

Chambers, R and Moris, J. (eds) (2012). *Mwea, an Irrigated Rice Settlement in Kenya.* Munchen: WeltforumVerlag.

Clemmens AJ (2014). *Improving irrigated agriculture performance through an understanding of the water delivery process*. J. Irrig. Drain. Eng. 55(3):223-234.

Edward, C. and Robert, M. (2007).*Identifying targets of Food Insecurity in South Africa*. Center for Poverty, Employment and Growth.

Faurès, J., Svendsen, M. and Turral, H.(2007). *Reinventing Irrigation. Chapter 9 in D. Molden (ed.), Water for Food, Water for Life: A Comprehensive Assessment of Water Management in Agriculture*. International Water Management Institute: Earthscan and Colombo, London.

Franks, T., Garces-Restrepo, C., Putuhena, F., Franks, T., Garcés-Restrepo, C. and Putuhena, F. (2008). *Developing capacity for agricultural water management: current practice and future directions.Irrig. Drain .57, 255-267.*

Government of Kenya.(2009). Ministry of Water and Irrigation Irrigation and Drainage Master Plan, Government Printer, Nairobi Kenya.

Harvey, P.A. and R.A. Reed (2007).*Community-Managed Water Supplies in Africa: Sustainable or Dispensable?'* Community Development Journal 42(3): 365.

Heller, S. (2004).*Irrigation and cropping intensity.* International Association of Hydrological Sciences (International Association of Hydrological Sciences Press 2004

Hussain I. and Hanjra M. A. (2014). *Irrigation and poverty alleviation: Review of the empirical evidence*. Irrigation and Drainage 53.

Hussain, I. (2005). *Pro-poor Intervention Strategies in Irrigated Agriculture in Asia. Poverty in Irrigated Agriculture: Issues, Lessons, Options and Guidelines (Bangladesh, China, India, Indonesia, Pakistan and Vietnam).* Project Final Synthesis Report. IWMI, Colombo.

Hussain, I. and Wijerathna, D. (2005). *Irrigation and Income-Poverty Alleviation: A Comparative Analysis of Irrigation Systems in Developing Asia. International Water Management Institute (IWMI)*. International Journal of Productivity and Performance Management, 57 (2), 32-79.

Jones, W. I. (1995).*The World Bank and Irrigation*. Washington, D.C: World Bank.

Jurriens, D., Seleshi, B., Merry, A., Kamara, B., Koppen, F., and Boelee, E. (2011).*Institutional alternatives in African smallholder irrigation: Lessons from international experience with irrigation management transfer*. Research Report 60. IWMI, Colombo.

Kakumba, U. (2010). *Local Government Citizen Participation and Rural Development: Reflections on Uganda's Decentralization System*', International Review of Administrative Sciences.

Karina FZ, Mwaniki AW (2011). *Irrigation Agriculture in Kenya. Impact of the Economic Stimulus Programme and Long-term Prospects for Food Security in an Era of Climate Change*.HeinrichBöllStiftung East and Horn of Africa.

Kibe, S.N., Kaluli ,W., Home .P and Gathenya, M. (2007). *Integrated water resources management for crop production and domestic water supply in Kaiti watershed, Eastern Kenya*.Msc.Thesis, Jomo Kenyatta University of agriculture and Technology.

Kimani J. K. (1984). *Small Holder Irrigation schemes: The Kenyan experience, in M. J. Blackie (Ed), African Regional Symposium on Small Holder Irrigation.*: Hydraulics Research, Wallingford.

Kumar, R. (2005). Research methodology: *A step by step for beginners*. London: Sage Publication.

Makombe, G. (2010). *Experiences and opportunities for promoting small–scale/micro irrigation and rainwater harvesting for food security in Ethiopia*.(Working paper 98), IWMI, Colombo.

Maritz, P.J. 2001. *Irrigation Management Transfer: Sharing Lessons from Global Experience: Comments on Overview Paper.* National Department of Agriculture, Pretoria, South Africa

Mati, B.M. (2011). *Optimizing agricultural water management for the green revolution in Africa* In: Bationo A, Waswa B, Okeyo JM, Maina F, and Kihara JM, (ed). *Innovations as key to the green revolution in Africa.*Dordrechet: Springer, pp. 83-94. ISBN 978-90-481-2541-8.

Ministry of Water and Irrigation, Kenya (2010).*Water and Environment Sector Performance Report,* Nairobi.

Molden, D.J., Sakthivadivel, R., Christopher, J., Perry, C.J. and de Fraiture, C. (2008). *Indicators for Comparing Performance of Irrigated Agricultural Systems Research Report 20*. Colombo: IWMI Publications.

Molden.D.,Oweis, T., Steduto, P., Bindraban, P., Hanjra, M.A. and Kijne, J. (2010). *Improving agricultural water productivity: between optimism and caution*. J. Agric. Water Manag. 97(4), 528-534.

Moris, J. R. and Thom D. J., (1990).*Irrigation development in Africa: lessons of experience*. Boulder, CO: Westview Press.

Naika, V.R and Siddaramaiah, B.S. (2006). *Designs of Participatory Extension Approaches in India.*Journal of Agriculture Science.Vol.10, Agrotech Publishing Academy, Udaipur, India.

Ngigi, S. (2002).*Review of irrigation development in Kenya*. International Water Management Institute. Colombo, Sri Lanka.

Nigussie, T. (2002).*The Role of Irrigation development in enhancing household food security*:A case of three SSI schemes in SNNPR.MA thesis, Addis Ababa University.

Njagi, T. (2009).*Irrigation management and Agricultural Production: The case of Rice Production in Kenya.* MA dissertation, National Graduate Institute for Policy Studies.

Nyangito, H.O., Kodhek, A.G. ,Omiti, J. and Nyoro, K. J. (2003*). Revitalising Agricultural Productivity in Kenya.In Restarting and Sustaining Economic Growth and Development in Africaof Sub-Saharan Africa and other Developing Region*s.IWMI Research, Kenya.

Ockelford, J., and Reed, R.A. (2012). *Participatory Planning for Integrated Rural Water Supply and Sanitation Programmes*: Guidelines and Manual. WEDC, Loughborough University: UK (Unpublished DRAFT).

Ostrom , E. (2010). *Governing the Commons*: *The Evaluation of Institutions for Collective Action. New York*: Cambridge University Press.

Perry CJ, Steduto P, Allen RG, Burt CM (2009). *Increasing productivity in irrigated agriculture: Agronomic constraints and hydrological realities*. J. Agric. Water Manage. 96(11):1517-1524.

Pinstrup-Andersen, P., Pandya-Lorch.R., (2011).*Agricultural Growth is the Key to Poverty Alleviation in Low-Income Developing Countries*. In: Pinstrup-Andersen P. and Pandya-Lorch R. (Eds.). *The Unfinished Agenda*. Washington DC: International Food Policy Research Institute.

Republic of Kenya (GoK) (2015). *Agriculture Sector Development Strategy, 2010-2020.*Government printers. Nairobi.

Reynolds, J. (2015). *Hand pumps: towards a sustainable technology*. UNDP-World Bank Water and Sanitation Program, Water and Sanitation Report 5, Washington DC: World Bank.

Shah, T., Van, Koppen, B., Merrey, D., de Lange, M and Samad, M. (2010).*Institutional Alternatives in African Smallholder Irrigation*: Lessons from International Experience with Irrigation Management Transfer Research Report 60. Colombo: IWMI Publications.

Smith, S. C. (2008). *Economic Development*.Ninth edition. Pearson Education Limited, UK. pp 851.

Svendsen, M., Ewing, M. and Msangi, S. (2009).*Measuring Irrigation Performance in Africa*. International Food Policy research Institute Discussion Paper 00894. Washington DC, USA.

Teferi, G. (2010). *Determinants of Irrigation Users Participation in Water Users Association and the Effects of Small Scale Irrigation on Household Food Security*, case of TigrayEthiopia.

Thairu, N. K. (2010). *Agricultural Production and Irrigation Management.The Case of Irrigated Rice Production in Kenya*.Unpublished Master's Thesis, International Institute for Social Sciences, Netherlands.

Thorpe, I. (2002). *Participation, Appropriate Technology (Pump Aid and the Elephant Pump)* .Contribution to 'Beyond the Community' E-conference on Scaling up of Community Management of Rural Water Supplies, Zimbabwe.

UNEP. (2016). *Africa Environment Outlook*: Past, Present and Future Perspectives. Earthprint Ltd, UK. pp 422

Uphoff, N.T. (2011).*Approaches to Community Participation in Agriculture and Rural Development.* Cornell University, Rural Development Committee, New York: Ithaca.

Valipour , M. (2014). *Land use policy and agricultural water management of the previous half of century in Africa*.Appl. Water Sci. DOI 10.1007/s13201-014-0199-1.

Valipour, M. (2015). Future *of agricultural water management in Africa*.Arch. Agron. Soil Sci. 61(7), 907-927.

Valipour, M., Ziatabar, Ahmadi, M., Raeini-Sarjaz, M., Gholami, Sefidkouhi, M.A., Shahnazari, A ., Fazlola ,R. and Darzi-Naftchali A (2015). *Agricultural water management in the world during past half century*.Arch.Agron. Soil Sci. 61(5), 657-678.

Valipour, M. (2013). *Necessity of Irrigated and Rainfed Agriculture in the World*. Irrigat Drainage Sys Eng S9: e001. doi:10.4172/2168-9768.S9-e001.

Vandevelde, C. Tadel, F., and Debel, G. (2012). *Socio-economic and Institutional Determinants of Small Scale Irrigation schemes utilization in Bale Zone,Oromiya National Regional State*. A Master Thesis, Alemaya University.

Wade, R. (2014). *Village Republics: Economic conditions for collective action in South India.*WashingtonDC: The Institute of Development Studies at the University of Sussex.

Webster, J., Dejachew, G., Tseion, B., Mehari, M.andTesfaye, G. (2009). *Sustainability of rural water and sanitation project*s.Proceedings from the 25th WEDC Conference, Integrated Development for Water Supply and Sanitation.Addis Ababa, Ethiopia.

Woldeab, Teshome. (2013). *Irrigation Practice*s, State Intervention and Farmers' Life-Worlds in Drought-Prone ,Tigray, Ethiopia.

Yokwe S (2009). *Water productivity in smallholder irrigation schemes in South Africa*. Agric. Water Manage. J. 96(2009):1223-1228.

APPENDICES

APPENDIX I: LETTEROF TRANSMITTAL

The Chairman,

Nthawa Irrigation Project

P.O Box 6

SIAKAGO

Dear Sir,

RE: ACADEMIC RESEARCH PROJECT

I am a Master of Arts in Project Planning and Management student at University Of Nairobi. I wish to conduct a research entitled determinants of performance of irrigation projects, case of Nthawa Irrigation Project o f Mbeere Sub- County, Embu County, Kenya. A questionnaire has been designed and will be used to gather relevant information to address the research objective of the study. The purpose of writing to you is to kindly request you to grant me permission to collect information on this important subject from your organization.

Please note that the study will be conducted as an academic research and the respondents identity will be treated in strict confidence. Strict ethical principles will be observed to ensure confidentiality and the study outcomes and reports will not include reference to any individuals.

Your acceptance was highly appreciated.

Yours faithfully,

Robert K. Miruri

Researcher/Student

U.O.N

APPENDIX II: RESEARCH QUESTIONNAIRE

This questionnaire is to collect data for purely academic purposes. The study seeks to investigate the *determinants of performance of irrigation projects, case of Nthawa Irrigation Project of Mbeere Sub- County, Embu County, Kenya*. All information will be treated with strict confidence. Do not put any name or identification on this questionnaire.

Answer all questions as indicated by either filling in the blank or ticking the option that applies.

SECTION A: DEMOGRAPHIC INFORMATION

SECTION A: Background Information (Please tick (√) appropriate answer)

1) Please indicate your gender: Female [ ] Male [ ]
2) For how long have you been working withNthawa water Irrigation Project?

Less than 3 years [ ] 3 to 9 years [ ]

9 to 12 years [ ] above 12 years [ ]

3) State your highest level of education

Certificate [ ] Diploma [ ] Degree [ ] Masters [ ] PhD [ ]

Others (Specify) ---

4) Please Indicate your age bracket 20-30 yrs [ ] 31-40 yrs [ ]

41-50 yrs [ ] 51 – 60 [ ]

Management of the project

5) To what extent does management of the project affect the performance of public irrigation projects in Kenya?

Not at all [ ] Low extent [ ]

Moderate extent [ ] Great extent [ ]

Very great extent [ ]

6) To what extent do the following affect the performance of public irrigation projects in Kenya?

	Very great extent	Great extent	Moderate extent	Low extent	Not at all
Water use management (acquisition, allocation, distribution and drainage).					
Management of organization (resource mobilization, conflict					

resolution, communication and decision-making).					
Management of structures required for water control (design, construction, operation and maintenance).					
Management set up/structure					
Leadership and Capacity					

7) In your view how do the above aspects of management of the project affect the performance of public irrigation projects in Kenya?

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Resources Adequacy

8) To what extent does resources adequacy affect the performance of public irrigation projects in Kenya?

Not at all [ ]
Low extent [ ]
Moderate extent [ ]
Great extent [ ]
Very great extent [ ]

9) To what extent do the following affect the performance of public irrigation projects in Kenya?

	Very great extent	Great extent	Moderate extent	Low extent	Not at all
Water supply adequacy and reliability					
Financial capital adequacy					
Human capital					
Institutional capacity					
Transport infrastructure					

10) In what way does resources adequacy affect the performance of public irrigation projects in Kenya?

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Technology used

11) To what extent does technology used affect the performance of public irrigation projects in Kenya?

Not at all [ ] Low extent [ ]

Moderate extent [ ] Great extent [ ] Very great extent [ ]

12) To what extent do the following affect the performance of public irrigation projects in Kenya?

	Very great extent	Great extent	Moderate extent	Low extent	Not at all
Type of irrigation systems					
Appropriateness of technology					
Engineering designs for the physical systems					
Ease of maintenance					
Availability and cost of spare parts					
Ease of use and user acceptability					
Cost					

Community participation

13) To what extent does community participation affect the performance of public irrigation projects in Kenya?

Not at all [ ]

Low extent [ ]

Moderate extent [ ]

Great extent [ ]

Very great extent [ ]

14) To what extent do the following affect the performance of public irrigation projects in Kenya?

	Very great extent	Great extent	Moderate extent	Low extent	Not at all

Financial, labour or other contributions					
Laying out a system of enforcement of the use restrictions					
Preparing and agreeing on rules of restrained access to the resource					
Involving the farmers in planning, operation, management and maintenance					

15) In your view how does community participation affect the performance of public irrigation projects in Kenya?

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Availability of Sizable Land for Irrigation

16) To what extent does availability of sizable land for irrigation affect the performance of public irrigation projects in Kenya?

Not at all [ ]
Low extent [ ]
Moderate extent [ ]
Great extent [ ]
Very great extent [ ]

17) To what extent do the following affect the performance of public irrigation projects in Kenya?

	Very great extent	Great extent	Moderate extent	Low extent	Not at all
Land tenure issues					
Area of the land under irrigation					
Number of plot holders					
Number of farmers					

Scattering of the holdings					

Irrigation project performance

18) What is the trend of the following aspects of Irrigation project performance in your project for the last 5 years? Where, 5 = greatly improved, 4= improved, 3= constant, 2= decreased, 1 = greatly decreased

	1	2	3	4	5
Crop output/Yields					
Water distribution					
Acreage covered relative to target,					
Farmers access to water,					
Operation and maintenance schedule					

Thank you for participation