

**FACTORS INFLUENCING SMALL SCALE FARMERS' PARTICIPATION IN  
MANAGEMENT OF GEM RAE IRRIGATION SCHEME IN NYANDO SUB-  
COUNTY, KISUMU COUNTY, KENYA**

**BY**

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the Award of Degree of Master of Arts in Project Planning and Management of the  
University of Nairobi**

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## DECLARATION

This research project report is my own original work and has not been presented for the award of any degree in any other university.

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

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## **DEDICATION**

I dedicate this research project report in memory of my late parents, Joshua Okal and Tabitha Adoyo and elder brother Fredrick Hezbon Okumu. I further dedicate the proposal to my siblings, Eddie, Frank, Mr. Jared, Fredah and Dorcas and my friend Dr. Loice Akinyi. Their passion for academic excellence and subsequent contributions and support in all feasible forms are greatly appreciated.

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## TABLE OF CONTENTS

	Page
<b>DECLARATION.....</b>	<b>ii</b>
<b>DEDICATION.....</b>	<b>iii</b>
<b>ACKNOWLEDGEMENT.....</b>	<b>iv</b>
<b>TABLE OF CONTENTS.....</b>	<b>v</b>
<b>LIST OF TABLES.....</b>	<b>ix</b>
<b>LIST OF FIGURES.....</b>	<b>x</b>
<b>LIST OF ABBREVIATIONS AND ACRONYMS.....</b>	<b>xi</b>
<b>ABSTRACT.....</b>	<b>xii</b>
<b>CHAPTER ONE: INTRODUCTION.....</b>	<b>1</b>
1.1 Background to the study.....	1
1.1.1 Gem Rae Irrigation Scheme .....	3
1.2 Statement of the problem .....	4
1.3 Purpose of the study .....	6
1.4 Objectives of the Study .....	6
1.5 Research questions .....	7
1.6 Significance of the study .....	7
1.7 Limitations of the study.....	8
1.8 Delimitations of the study .....	8
1.9 Basic assumptions of the study .....	9
1.10 Definitions of significant terms used in the study.....	9
1.11 Organization of the study.....	11

<b>CHAPTER TWO: LITERATURE REVIEW.....</b>	<b>12</b>
2.1 Introduction .....	12
2.2 Small scale farmers’ participation in management of irrigation schemes .....	12
2.3 Irrigation Water Users Association rules and small scale farmers’ participation in management of irrigation scheme.....	14
2.4 Knowledge and skills in irrigation and small scale farmers’ participation in management of irrigation scheme.....	15
2.5 Reliability of irrigation water and small scale farmers’ participation in management of irrigation scheme.....	17
2.6 Economic benefits and small scale farmers’ participation in management of irrigation scheme .....	17
2.7 Theoretical framework .....	18
2.7.1 Arnstein’s ladder of citizens’ participation.....	19
2.7.2 Theory of collection action .....	19
2.8 Conceptual framework.....	20
2.9 Knowledge gap .....	22
2.10 Summary of literature review .....	22
<b>CHAPTER THREE: RESEARCH METHODOLOGY.....</b>	<b>27</b>
3.1 Introduction.....	27
3.2 Research design .....	27
3.3 Target population.....	27
3.4 Sample size and sampling procedure.....	28
3.4.1 Sample size .....	28
3.4.2 Sampling procedure .....	28
3.5 Research instruments .....	28
3.5.1 Pilot testing .....	29

3.5.2	Validity of the research instruments .....	29
3.5.3	Reliability of the research instruments .....	29
3.6	Data collection procedures.....	30
3.7	Data analysis techniques .....	30
3.8	Operationalization of the variables .....	31
3.9	Ethical considerations .....	33
<b>CHAPTER FOUR: DATA ANALYSIS, PRESENTATION AND INTERPRETATION.....</b>		<b>34</b>
4.1	Introduction.....	34
4.2	Questionnaire return rate.....	34
4.3	Demographic analysis .....	34
4.3.1	Gender of the respondents.....	35
4.3.2	Age of the respondents.....	35
4.3.3	Highest level of education of the respondents .....	36
4.3.4	Years of irrigated farming experience of the respondents .....	36
4.4.	Influence of factors on small scale farmers’ participation in the management of Gem Rae Irrigation Scheme .....	37
4.4.1	Irrigation Water Users Association (IWUA) rules and small scale farmers’ participation in the management of Gem Rae Irrigation Scheme .....	37
4.4.2	Knowledge and skills in irrigation and small scale farmers’ participation in the management of Gem Rae Irrigation Scheme .....	39
4.4.3	Reliability of irrigation water and small scale farmers’ participation in the management of Gem Rae Irrigation Scheme .....	41
4.4.4	Economic benefits and small scale farmers’ participation in the management of Gem Rae Irrigation Scheme .....	43
4.5	Small scale farmers’ participation in the management of Gem Rae Irrigation Scheme .....	45

<b>CHAPTER FIVE: SUMMARY OF THE FINDINGS, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS.....</b>	<b>51</b>
5.1 Introduction .....	51
5.2 Summary of the findings .....	51
5.3 Discussion .....	52
5.3.1 Irrigation Water Users Association (IWUA) rules and the small scale farmers’ participation in the management of Gem Rae Irrigation Scheme .....	53
5.3.2 Knowledge and skills in irrigation on the small scale farmers’ participation in the management of Gem Rae Irrigation Scheme .....	54
5.3.3 Reliability of irrigation water on the small scale farmers’ participation in the management of Gem Rae Irrigation Scheme .....	55
5.3.4 Economic benefits and the small scale farmers’ participation in the management of Gem Rae Irrigation Scheme.....	55
5.4 Conclusions .....	56
5.5 Recommendations .....	57
5.6 Suggestion for further research .....	58
<b>REFERENCES.....</b>	<b>59</b>
<b>APPENDICES.....</b>	<b>67</b>
Appendix I: Letter of Transmittal .....	67
Appendix II: Research authorization .....	67
Appendix III: Questionnaire .....	68
Appendix IV: List of farmers in Gem Rae Irrigation Scheme.....	77



## LIST OF TABLES

Table 2.1	Summary of literature of review and knowledge gap.....	23
Table 3.1	Operationalization of variables.....	31
Table 4.1	Gender of the respondents.....	35
Table 4.2	Age of the respondents.....	35
Table 4.3	Highest level of education of the respondents.....	36
Table 4.4	Years of irrigated farming experience of the respondents.....	37
Table 4.5	Rating of influence of irrigation water users association rules on small scale farmers' participation in the management of Gem Rae Irrigation Scheme.....	38
Table 4.6	Rating of influence of knowledge and skills in irrigation on small scale farmers' participation in the management of Gem Rae Irrigation Scheme.....	40
Table 4.7	Rating of influence of reliability of irrigation water on and small scale farmers' participation in the management of Gem Rae Irrigation Scheme.....	41
Table 4.8	Rating of influence of economic benefits on small scale farmers' participation in the management of Gem Rae Irrigation Scheme.....	44
Table 4.9	Small scale farmers' participation in the management of Gem Rae Irrigation Scheme in Nyando Sub-County, Kisumu County.....	46

## LIST OF FIGURES

Figure 1	Conceptual framework.....	21
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## **LIST OF ABBREVIATIONS AND ACRONYMS**

<b>FAO</b>	Food and Agriculture Organization
<b>IMT</b>	Irrigation Management Transfer
<b>IWUA</b>	Irrigation Water Users Association
<b>MWI</b>	Ministry of Water and Irrigation
<b>PIM</b>	Participatory Irrigation Management
<b>SIS</b>	Smallholder Irrigation Scheme
<b>SRP</b>	Smallholder Rice Project

## ABSTRACT

Though its significance has been recognized in many previous studies, the desired levels of small scale farmers' participation have not been achieved and the low levels have continued to undermine the expected performance and sustainability of the small scale irrigation schemes. The purpose of this research study was to determine the factors influencing small scale farmers' participation in the management of Gem Rae Irrigation Scheme in Nyando Sub-County, Kisumu County, Kenya. The four objectives that the study sought achieve were: to establish the influence of Irrigation Water Users Association (IWUA) rules; to determine the influence of knowledge and skills in irrigation; to ascertain the influence of reliability of irrigation water and to assess the influence of economic benefits from irrigated agriculture on the small scale farmers' participation in the management of irrigation schemes. The cross-sectional study research design was used in the study. The target population in the study was the entire 480 farmers of Gem Rae Irrigation Scheme. The sampling procedure used used to get a sample of 144 respondents, that represented 30% of the target population, was simple random. The primary data was collected from the sampled respondents using researcher-administered questionnaires. The reliability analysis using the test re-test technique showed a coefficient of stability of 0.933 which was an excellent reliability. The data analysis of was conducted using descriptive statistics. The study found out that the farmers were disposed to participate in management of the scheme. The study equally established through descriptive statistics that the four factors; irrigation water users association rules, knowledge and skills in irrigation, reliability of irrigation water, and economic benefits from irrigated agriculture greatly influenced the small scale farmers' participation in the management of Gem Rae Irrigation Scheme by differing levels. The study concluded that the four factors greatly influenced small scale farmers' participation in the management of Gem Rae Irrigation Scheme and that there were variations in the extent of the influences of each factor. The study recommends development and implementation of strategies that enhance economic benefits from irrigated agriculture to the farmers in order to increase and sustain their participation in the management of the scheme, assurance of reliability of irrigation water, participatory development and formalization of IWUA rules to intensify the participation of farmers in the scheme management and tailor-made trainings and sensitization to address knowledge and skills gap in irrigation amongst farmers. The study suggested areas for further research that included research on the same subject in other parts of Kenya and comparative study of the farmers' participation in the management of small scale irrigation schemes fully funded by governments and others co-funded jointly by governments and beneficiary farmers.

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background to the study

Agriculture remains one of the important sectors with enormous contribution to socio-economic well-being of the world's population. In the African continent, the livelihoods of more than 60 percent of its population and 80 percent of its poor depend on the lowly productive agricultural sector. The low productivity of the African agricultural sector is attributed to the unreliable rainfall resulting in lower produce and the unpredictable weather conditions have worsened the case, subjecting the small scale farmers to adverse impacts of climate fluctuations (Todaro, 2012). The low performance of agricultural sector has continued to threaten the livelihoods of the majority of the population and created dangerous levels of food insecurity and poverty crisis (Ashley and Maxwell, 2011).

Irrigation is one of the strategic options that has been adopted in mitigating the water scarcity and dependence on rainfall for agricultural production. Over the years, the empirical experience has shown that irrigation increases yield of most crops by between 100 and 400 per cent (FAO, 2009). Irrigation has been taken as a remedy for inadequate food supplies, a cover against erratic rainfall situations, enhanced employment opportunities and secure incomes and promotion of cropping intensification and diversification. Given the importance of the irrigation, many governments have availed huge resources in establishing new schemes as well as repairing the existing ones to boost the socio-economic contribution of the agricultural sector (Todaro, 2012). Several governments have commenced the process of devolving the management roles in the schemes from government entities to beneficiary farmers. The devolution of management has been carried out through policies of irrigation management transfer (IMT) and participatory irrigation management (PIM) (Gomo, Mudhara and Senzanje, 2014). The IMT has been promoted by governments as a way of saving costs, improving maintenance of irrigation infrastructure and services, propagating self-dependence and increasing irrigation returns (Hassan, 2011). The introduction of PIM, with benefits of

regular payments for water use, equitable water delivery, reduced government financial burden, enhanced durability of irrigation facilities, decrease in wasteful use of water, is gaining considerable significance in irrigation management (Tanaka and Sato, 2005).

However, the execution of IMT policy in a number of countries has encountered major setbacks. Fujiie, Hayami and Kikuchi (2005) observed that service provision from of state irrigation systems worsened after the state entities reduced their operation and maintenance activities since the farmers could not fund the operation and maintenance costs from their incomes from irrigated farming. In South Africa, the over-reliance on government's support by small scale irrigation farmers, coupled with ineffective farmers' organizations, inadequate extension services, low levels of farmers' participation, poor maintenance strategies and under performance are recurring challenges affecting the farmers who have been tasked with management of schemes previously financed by government (Mnkeni, Chiduzo, Modi, Stevens, Monde, Van der Stoep, and Dladla (2010); Fanadzo (2012)).

Unfortunately, several small scale irrigation schemes cease to function soon after freeze of government support in their development and rehabilitation (Cousins, 2013). Fanadzo, Chiduzo and Mnkeni (2010) pointed out that the underperformance of these small scale irrigation schemes has been occasioned several factors including absence of farmers' participation in the schemes' activities. In India, Aref (2011) found that there were various reasons why active participation is very hard to achieve including farmer's lack of knowledge, confidence, capital and skills. The low levels of farmers' participation was observed to be caused by inadequate returns and insufficient capacity of farmers' organization. Also in India, Chandran and Chackacherry (2004) observed that farmers' participation in irrigation projects was influenced by availability of irrigation water and location of the farmland on the canal. Farmers who are far from irrigation water experience water scarcity and that had a negative impact on the farmers' participation.

In a study carried out in Nigeria, Adekunle, Oladipo and Busari (2015) established that the participation of the farmers was attributable to: access to financial resources and existence and effectiveness of Water Users Association (WUA) and reliability of

irrigation water. Bothoko and Oladele (2013) in their study concluded that the major determinants of farmers' participation in agricultural programmes were household size, effectiveness of rural development programme and availability of funds. In Ghana, Etwire, Dogbe, Wiredul, Maertey, Etwire, Robert and Wahaga (2013) found out that participation of farmers was influenced by financial resources and recommended that such financial resources were required to be availed to farmers whose major source of income was farming to ensure their participation in agricultural production and scheme management. There was also need for better markets for farm produce which would act as a motivation for farmers to participate in irrigated agriculture.

Despite the many development interventions from government and other financiers in the agricultural sector, management tasks have not been taken up by many small scale farmers in the developed projects. This state of affairs raise the following questions: In what situations are small scale farmers most likely to participate in management of irrigation schemes? Do factors that influence the farmers' participation in other contexts apply also to the context in this study and what are the extents of the influences? These are the questions that this study seeks to answer. It is argued that unless farmers achieve satisfaction from the irrigation schemes, there would be no motivation for them to participate in management of the schemes.

### **1.1.1 Gem Rae Irrigation Scheme**

Under the Smallholder Rice Project (SRP), the European Economic Commission financed the establishment of four cluster schemes in Wach Kano delta that included Gem-Rae, Oyani-Nyachoda, Kopudo and Alara in 1985. The water serving the schemes comes from Awach Kano River. It was expected that 350 acres in Gem Rae scheme would be put under rice irrigation. The management activities in the scheme are currently in the hands of the farmers through their organization, Gem Rae Water Users Association. The management of the scheme was transferred to the farmers by the Ministry of Agriculture from its inception in 1985. The scheme lies within larger Lake Victoria basin. The scheme receives 1250 mm of rainfall annually with April and November recording highest measurements. The scheme is in a flat region, part of Kano

plains and is prone to frequent flood waters. The soil type is mainly black clay soil that is ideal for rice cropping. Due to the perennial flooding, the area was turned into rice irrigation scheme since this was the only economically viable undertaking (Gem Rae Irrigation Water Users Association, 2017).

The farms in the scheme are owned by farmers and of variable sizes. The farmers have formed their organization within the scheme charged with overall responsibility of managing the all aspects in the scheme. There are 480 active members of the farmers' organization. The farmers mainly produce basmati rice for sale to Uganda businesspeople since its fetches higher price than other brands. Presently, the scheme is faced with challenges of inadequate irrigation water to meet the demand of all farmers at any cropping season resulting in illegal water abstraction, frequent breakdown of water conveyance and distribution structures, lack of cooperation from all farmers in provision of labour for repairs and low prices for the rice produce. According to the scheme management, the current irrigated area is approximately 100 ha and the limiting factor was irrigation water, inadequate irrigation infrastructure to supply water to all farms and high cost of labour for irrigation activities. A further 50 ha is occupied by out growers on the fringe of the scheme making use of excess water from scheme (Gem Rae Irrigation Water Users Association, 2017).

## **1.2 Statement of the problem**

While many governments, financiers and donors are allocating huge financial and other resources in irrigation development in order to address the imminent food insecurity occasioned by declining agricultural productivity, the level of small scale farmers' participation in the management of communal irrigation schemes remains low with reasons for such low levels of participation varying from one locality to another. The multitude of benefits of farmers' participation in management with the main being increased productivity have been observed by many scholars such as (Aref, 2011).

Save for Asia, Europe and partly southern Africa, there is no much literature on small scale farmers' participation in scheme management activities. In Tanzania, Hirschmann



(2003) pointed out that beneficiary farmers' feel of belonging to the scheme influenced their participation. In a Kenyan context, a study undertaken in Gichugu, Kirinyaga County by Kahuro (2012) established the factors that influenced farmers' participation in schemes' management to include: farmers' commitment to IWUA, farmers' knowledge and skills, reliability of water supply, quality of extension services and competing economic activities.

In spite of several studies having been undertaken on the subject of farmers' participation in the irrigation scheme management in other parts of the world, to my knowledge, these studies have not covered the determination of how the some factors influence the small scale farmers' participation in Gem Rae Irrigation Scheme in Nyando Sub-County, Kisumu County, Kenya and the extents of the influences. Following its establishment in 1985, the operations in the 350 acre Gem Rae Rice Irrigation Scheme stopped in 1997 because of El nino rainfall that caused the intake and main canal infrastructure to get clogged with heavy sediment from the higher areas of Nandi hills. The farmers to whom the management of the scheme was transferred to have not managed to put the entire scheme under production save for about 30 acres (Ong and Oregio 2002). Threatened by hunger, few farmers have cleared small portions of the scheme and were using residual water to grow rice. Ong and Oregio (2002) did not establish why the farmers had not fully unclogged the entire irrigation infrastructure to allow full usage of the scheme for irrigated farming and thus there exists a knowledge gap. It is this state of farmers' participation in the management of the scheme that necessitated the need to undertake the research study with the aim of determining how some factors influence the farmers' participation and thus fill the knowledge gap. There are many factors influencing farmer's participation that have been identified in other small scale irrigation schemes. However, the study was limited to the four factors that were investigated with respect to Gem Rae Irrigation Scheme to determine the extent of their influence on the farmers' participation in the scheme management.

### **1.3 Purpose of the study**

The purpose of the study was to determine the factors influencing small scale farmers' participation in the management of Gem Rae Irrigation Scheme in Nyando Sub-County, Kisumu County, Kenya.

### **1.4 Objectives of the Study**

The objectives of the study were:

- (i) To establish how Irrigation Water Users Association rules influence small scale farmers' participation in the management of Gem Rae Irrigation Scheme in Nyando Sub- County, Kisumu County.
- (ii) To determine how knowledge and skills in irrigation influences small scale farmers' participation in the management of Gem Rae Irrigation Scheme, Nyando Sub- County, Kisumu County.
- (iii) To ascertain how reliability of irrigation water influences small scale farmers' participation in the management of Gem Rae Irrigation Scheme, Nyando Sub- County, Kisumu County.
- (iv) To assess how economic benefits from irrigated agriculture influence small scale farmers' participation in the management of Gem Rae Irrigation Scheme, Nyando Sub- County, Kisumu County.

## **1.5 Research questions**

The study was undertaken to address the following questions:

- (i) How do an Irrigation Water Users Association rules influence small scale farmers' participation in the management of Gem Rae Irrigation Scheme in Nyando Sub- County, Kisumu County?
- (ii) How does knowledge and skills in irrigation influence small scale farmers' participation in the management of Gem Rae Irrigation Scheme in Nyando Sub- County, Kisumu County?
- (iii) How does reliability of irrigation water influences small scale farmers' participation in the management of Gem Rae Irrigation Scheme in Nyando Sub- County, Kisumu County?
- (iv) How does economic benefits from irrigated agriculture influence small scale farmers' participation by farmers in management of Gem Rae Irrigation Scheme in Nyando Sub-County, Kisumu County?

## **1.6 Significance of the study**

Irrigated agriculture continues to be promoted as a powerful solution for the hunger that is facing the ever growing world population due unreliable rainfall patterns. The knowledge of inadequate efficiency in state-managed irrigation schemes has prompted the desire to allocate management tasks to the beneficiary farming communities. Subsequently, a number of governments have taken policy initiatives of transferring responsibilities to farmers to manage their communal irrigation schemes. These policies require to be well formulated in order to deliver the expected results.

The findings of the study is expected to provide management of Gem Rae Irrigation Scheme and other stakeholders with a good knowledge and understanding of the factors that particularly influence the farmers' participation in the management activities at the scheme. With the adequate knowledge and understanding, the management of Gem Rae Irrigation Scheme and other stakeholders will employ appropriate measures to improve and sustain effective participation of the farmers with the goal of realizing the desired productivity and sustainability.

The study report hoped to form new knowledge to other irrigation schemes in the country and beyond on the effect of selected four factors and the small scale farmers' participation and subsequently provide them with opportunities for evaluating and improving their own management arrangements. It is equally hoped that the research study report will enhance existing knowledge and serve as reference to other researchers besides suggesting new research study areas that require further research by research scholars.

### **1.7 Limitations of the study**

Language barrier was a limiting factor since majority of respondents in the study location were not fluent in English and thus did not comprehend the questions. This was however addressed by translation of questions in the questionnaire from English to the local language, Luo during the interviews.

The study elicited suspicion on the sensitive topic of land and land ownership. This prompted some respondents to hesitate in responding to the questions and seek the purpose of the research. The purpose of the study was clarified to the respondents to their satisfaction and assurance given to them that the data collected was to be used only for the specified academic purpose.

The hostility of some of respondents to participate in the study limited the response rate with some respondents requesting for money for their time and responses to the questionnaire. The researcher clarified the purpose of the study and managed to secure interviews from majority of the respondents.

The sample was obtained from a relatively homogeneous population who lived in the same rural locality with same ethnicity and social class. Therefore, the results might not be generalized to other areas, particularly those in areas with greater diversity in ethnicity and social class.

### **1.8 Delimitations of the study**

The research study was limited to Gem Rae in Nyando Sub County in Kisumu County, Kenya and as such the study results would require to be generalized for other parts of the

country and other regions with reasonable caution. The study was also limited to the four objectives. The four objectives that the study was limited to were: to establish the influence of Irrigation Water Users Association (IWUA) rules; to determine the influence of knowledge and skills in irrigation; to ascertain the influence of reliability of irrigation water and to assess the influence of economic benefits from irrigated agriculture on the small scale farmers' participation in management of communal irrigation schemes.

### **1.9 Basic assumptions of the study**

It was assumed in the research study that the factors that influenced the small scale farmers' participation by farmers in management of Gem Rae Irrigation Scheme in Nyando Sub-County, Kisumu County were four and that the factors included: Irrigation Water Users Association rules, knowledge and skills in irrigation, reliability of irrigation water and economic benefits from irrigated agriculture.

It was also assumed that the respondents would fully comprehend the questions in order to provide accurate data and honest responses.

### **1.10 Definitions of significant terms used in the study**

#### **Irrigation Water**

#### **Users Association**

**(IWUA) rules** These are sets of guidelines and norms that have been formulated and mutually agreed by all farmers, who have organized themselves in an association in a given irrigation system, to guide, regulate and govern their conduct and relationships to ensure smooth operations of IWUA and facilitate attainment of the objectives of irrigation water provision and other services. It entails obedience to water distribution rules, payment of operation and maintenance charges, attendance of IWUA scheduled meetings and election of IWUA officials.

#### **Knowledge and**

**skills in irrigation** These refers to the theoretical or practical understanding and the cluster of competency developed by farmers through training or

experience in the operation maintenance and management of irrigation scheme. They involve use of effective and efficient water application methods, quality routine and preventive maintenance of canals and other water conveyance and distribution infrastructure, timely repair of breakdowns and damages in the irrigation scheme and operation of irrigation infrastructure.

**Reliability of irrigation water**

This is a situation where all farmers in a scheme or project receive irrigation water from the irrigation system when and where they need it and in adequate amount to sustain their crop during the entire crop growth. It entails availability of water in adequate quantities, allocation of water on time, fair supply of irrigation water to all eligible farmers.

**Economic benefits from irrigated agriculture**

These are benefits that can be quantified in monetary terms attributed to farming activities. They include input of irrigated agriculture to family income and food supplies, cost of labour and investments in irrigated agriculture.

**Farmers' participation**

This refers to the active and direct involvement of farmers, with shared needs and living in a defined geographic area, in decision making process and activities throughout the project life cycle of small scale irrigation schemes including needs identification, investment choices and irrigation management activities such as planning, evaluation, design, implementation, operation, maintenance, rehabilitation, resource mobilization and conflict resolution.

**Small scale**

**irrigation scheme** This is a system of irrigation where the beneficiary farmers take the lead role in the whole project cycle from initiation to operation, maintenance and management and finally determine how to sustain the benefits.

### **1.11 Organization of the study**

The study was organized into Chapters One to Five. Chapter One was introduction which comprised the background to the study on small scale irrigation development with focus on farmers' participation in management and current status of Gem Rae Irrigation Scheme. Further, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, limitations and delimitations of the study, basic assumptions of the study, definition of significant terms used in the study and organization of the study were discussed in this chapter.

Chapter Two provided literature reviewed on the perspectives of farmers' participation in management of small scale irrigation schemes, small scale farmers' participation in management of small scale irrigation schemes, scholarly literature on the four factors of Irrigation Water Users Association (IWUA) rules, knowledge and skills in irrigation, reliability of irrigation water and economic benefits from irrigated agriculture and their influences on small scale farmers' participation in management of irrigation schemes, theoretical framework, conceptual framework, knowledge gap and summary of literature review.

In chapter Three, research methodology that was employed was presented. It comprised the research design, target population, sample size and sampling procedure, research instruments, pilot testing, validity of the instruments, reliability of the instruments, data collection procedures, data analysis techniques, operationalization of the variables and ethical considerations. Chapter Four provided results of the data analysis, presentation and interpretation of results on the basis of the four objectives of the study. Chapter Five provided summary of the findings, discussions, conclusions and recommendations of the study and suggestions for further research.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter presents reviewed literature on the subject of small scale farmers' participation in the management of irrigation schemes. It highlights the knowledge and beliefs by various scholars on small scale farmers' participation in the irrigation management with respect to the challenges, successes, findings, conclusions and recommendations from all parts of the world. It further provides literature highlighting the relationship between the four independent variables and the dependent variable of study. The literature review is equally provided on theoretical framework, the conceptual framework and the knowledge gap. The chapter also provides a summary of the reviewed literature.

#### **2.2 Small scale farmers' participation in management of irrigation schemes**

During the last half century, irrigation has caused the farm produce to increase three fold. (FAO, 2011a). Nevertheless, progress in raising productivity has slowed in recent years (Bruinsma, 2009) and significant geographical disparities remain (FAO, 2011a). The continent of Asia (FAO 2011b). Here, the agricultural production increased rapidly from the 1960s due to the introduction of new technologies and subsequently driving economic growth and poverty reduction (Hazell, 2009). Population increase, reduced availability of arable land and reliable irrigation, subsistence farming to feed families (Joemat-Pettersson, 2009), technological advancement methods (Bembridge, 2000), have prompted the promotion as well as the trend of developing irrigation schemes only in small scale sizes.

A number of governments started Irrigation Management Transfer (IMT) in the early 1970s in order to manage the recurrent expenses and address the dissatisfaction with the underperformance of the schemes (Garces-Restrepo, Vermillion & Muñoz, 2007). The purpose of the IMT reform exercise was to secure better returns on investments in irrigation by means of devolving the control of the schemes to the beneficiary farmers



(Perret, 2002). It was observed that more participation would instill a feel of ownership and responsibility and thus promote the efficient utilization of the communal resources Garces-Restrepo *et al.* (2007). The inclination towards increased involvement of beneficiary communities in the development of small scale irrigation schemes is attributed to the observations that showed the small scale ones to be more viable and sustainable than large scale schemes. The small scale schemes in Ghana and Ethiopia have had their managements transferred to the farmers' organizations with the farmers actually executing various management activities (Jonah and Dawda, 2004; Awulachew, Merrey, van Koopen, Kamara, de Vries, Frits & Boelee, 2005)

There are several remedies that have been put forward as remedies for addressing the management problems facing small scale irrigation schemes including farmers' participation. The devolution of management of common pool natural resources has gained momentum all over the world and small scale irrigation schemes are not exception. The realization of the commensurate returns in irrigation schemes is assured in circumstances where farmers orderly participate in the management of their schemes. Farmers have a direct incentive, and the means, to reduce costs besides enhancing the service provision: IWUAs can reduce labor costs by offering labour at lower wages than government agencies; local beneficiary farmers provide closer supervision of staff than distant government agency supervisors; damages and break downs are minimized since farmers feel of much shareholding in the irrigation infrastructure. The produce is expected to be improved due to faster water delivery and repairs, farmers' yields are higher (Kuper, Dionnet, Hammani, Bekkar, Garinand Bluemling, 2009).

In Kenya, the government, just as it is changing in other parts of the world, the irrigation development has adjusted to conform to the new paradigm of bottom up approach. The new paradigm approach according to the Government of Kenya's Ministry of Water and Irrigation (MWI), treats the beneficiary communities as the main players in any developmental initiative in which they submit their needs and priorities for irrigation project and are fully in charge of all the project phases from initiation to management. The bottom up approach is embedded in the government irrigation policy, presently draft

form and which promotes the active involvement and participation of farmers and other relevant agencies in all project phases (MWI, 2003).

### **2.3 Irrigation Water Users Association rules and small scale farmers' participation in management of irrigation scheme**

In participatory irrigation management (PIM), the farmers are expected to address the irrigation issues within the scheme through their farmers' organizations such as Irrigation Water Users Association (IWUA). According to the findings of the study by Shahroudi and Chizari (2007) in North East Iran, it was found that farmers' organizations were considerable social units that could facilitate improved farmers' active involvement in scheme management activities.

The extent to which IWUAs are able to carry out the management functions of enforcing water supply regulations, planning repair activities, collecting fees for water supply and financial resources management depends on a number of factors including: farmers' involvement as this increases the feel of shareholding and accountability among the members as shown by studies in Nepal, Indonesia, Pakistan and Philippines (Morales and Mongcopa, 2008); transparent and accountable leadership as leaders who lack integrity may not have the moral authority to demand compliance to rules and regulations from members; existence of by-laws that are developed by the IWUA rather than seen to have been imposed from external parties; appropriate legislation so that they are recognized as the legitimate users and managers of the irrigation systems thus promoting legitimacy and effectiveness (Gyasi, Engel, and Frohberg, 2006). Chandrasekaran, Umashankar, Duraiswaminathan and Jayakumar (2005) found out that many of the farmers expressed excitement and readiness to contribute labour and other resources in communal undertakings since IWUA rules were created with their participation. The farmers participated in various irrigation management activities on their own choice.

Mati, Hatibu, Phiri and Nyanoti (2007) in a set of studies asserted that community guidelines and regulations on agricultural water management exist by way of articles of association, by-laws and customary laws. The guidelines are majorly founded on indigenous knowledge and social values. The guidelines have increased the small scale

farmers' access to irrigation water through establishment of IWUAs for operation and maintenance. This arrangement has ensured equity of water distribution and prompt conflict resolution. Mati *et al.*, (2007) recommended that the overall responsibility of agricultural water management should be left to farmers' organization and governments only intervene to offer advisory services on registration in accordance with the rules.

The inability of IWUAs to execute payment regulations made it easier for farming community to abscond settling their water dues in irrigation schemes in Ghana (Jonah and Dawda, 2014). Also in South Africa, the management committee in an irrigation scheme experienced difficulties in denying the non-members the opportunity to draw water from the scheme (Muchara, Ortmann and Mudhara, 2014).

#### **2.4 Knowledge and skills in irrigation and small scale farmers' participation in management of irrigation scheme**

Generally people will shy away from involvement in group activities when they have insufficient knowledge on the activities (Svubure, Ahlers, and van der Zaag, 2007). Knowledge and skills are important aspects of human capital that need to be enhanced as the technological environment changes to allow farmers intensify and diversify production. Extension service providers are relied upon to impart knowledge in irrigation water management methods which may involve new operation procedures and techniques, equipment and production methods. The study by Vilas and Goldey (2005) showed that the main constraints to participation in farmers' organizations are lack of technical advice from rural extension officers and other institutions responsible for providing technical advice.

In studies of IWUAs carried out in Turkey, Kiymaz, Ozekici and Hamdy (2007) demonstrated that lack of sufficient knowledge in irrigation issues like water saving, when and how much to irrigate and environment led to problems of efficient use of water in the fields by farmers. This could lead to low productivity of water and hence affect crop yields. Availability of water in abundance has been reported to encourage its excessive application by farmers (Machethe, Mollel, Ayisi, Mashatola, Amin and Vanasche (2004). Farmer training has been demonstrated to improve productivity and

income levels in many countries (Fanadzo, 2012). Machethe *et al.*, (2004) recommended practical training in water management and irrigation scheduling for both farmers and extension agents. Adekunle *et al.* 2015 in their study revealed the great extent of influence exerted by the farmers' inadequate knowledge on their participation in scheme management. Muchara *et al.* (2014) established that farmers who are knowledgeable and skilled courtesy of trainings tend to take up management roles in their schemes.

In South Africa, the absence of knowledge and skills by majority of small scale farmers was worsened by non-existent field training (Bembridge, 2000). However, in instances where field training was offered, the trainings were largely inappropriate for the farming circumstances (Fanadzo, 2012). The inability of farmers in Zimbabwe to control and properly use the irrigation infrastructure was occasioned by inadequate knowledge (Mutambara and Munodawafa, 2014). According to Regner, Salman, Wolff and Al-Karablieh (2006), lack of necessary irrigation management training of farmers is one of the main problems in managing water successfully.

The lack of efficiency in managing the irrigated farms has resulted in poor yields (Makurira, Mul, Vyagusa, Uhlenbrook and Savenije, 2007). The passive farmers' involvement in the management of the irrigation scheme activities has led to the overreliance on the state agencies thus inhibiting the devolution of management of irrigation to the beneficiary farming communities. (Fanadzo, 2012). Sufficient knowledge and expertise allows utilization of available opportunities by local farmers (Snyder and Cullen (2014)) and encourages a participation which leads to empowerment of farmers and their farmer organizations (Levidow, Zaccaria, Maia, Vivas, Todorovic, & Scardigno, 2014). In Zimbabwe, Nhundu,K., Mushunje, Zhou, & Aghdasi, (2015) found out that the farmers' participation in management of irrigation scheme activities was more amongst those farmers who had acquired much education since they were aware of the good results of their participation.

## **2.5 Reliability of irrigation water and small scale farmers' participation in management of irrigation scheme**

Management problems in small scale irrigation schemes are more pronounced in cases where the irrigation water is sufficient to cater for the needs of all farmers (Albinson and Perry 2002). The scheme management failures in addressing water issues have frequently resulted in illegal abstraction coupled with destruction of water conveyance structures (Albinson and Perry 2002), thus affecting the irrigation performance. There is usually high water demand during the dry period when irrigation is at the peak and crops are fetching maximum returns. Water supply during this period is therefore critical. As Pazvakawambwa & van der Zaag (2001) observed after a study of Nyanyadzi smallholder scheme in Zimbabwe, the underperformance was the result of lack of constant supply of irrigation water.

It has been observed that the community's need for and reliance on a particular natural resources prompts the community to preserve the resource (Sserunkuuma, Ochom and Ainembabazi, 2009). The study by Muchara *et al.* (2014) indicated that farmers who lack steady water supplies were more likely to put in more efforts in participation to address their worse situation. The results indicated that the farmers were aware that their situation could be reversed by their involvement.

## **2.6 Economic benefits and small scale farmers' participation in management of irrigation scheme**

People's participation in community activity is dictated by the economic benefits to be gained from the participation. Given that returns are derived from investments, people will generally invest where the expected returns are more than the investments (Svubure, *et al.*, 2007). Secure food supplies coupled with additional monetary income from sale of farm produce are economic returns that accrue from irrigated agriculture (Mckay and Keremane, 2006). The people's choice to engage in communal projects is dictated by the benefits that are likely to be obtained through their active participation (Ben-Ayed (2002).

Smallholder farmers participate in irrigation for two basic reasons; to improve their food security and generate income to meet their financial needs. In making the decision to

concentrate their efforts in irrigation then they have to make comparisons with other available alternatives because irrigation is a labour intensive form of agriculture (Rijn, 2004). Apart from engaging in irrigation, smallholder farmers are faced with the following choices; engaging in rain-fed agriculture, livestock rearing, hiring out their labour, formal and informal employment, waiting for remittances from working relatives among others. Smallholder farmers are known to engage in almost all of these activities in varying intensities. It is not uncommon to find irrigation being carried out by some farmers on part time basis as they also divide their time between other income earning activities. The enthusiasm with which irrigation projects start and the seemingly successful take off period often turns to declining yields, diminishing returns, and growing indebtedness of farmers (Gichuki, Gichuki and Matsuoka, 2010). This partly explains the loss of interest by farmers, the diversification to other enterprises and the eventual failure of projects.

The results in Kpong Irrigation Scheme in Ghana showed that farmers who were satisfied with the benefits they obtained from the scheme participated more actively in the management process (Anaglo, Nasiru, Manteau, Amoah and Boateng, 2014). Muchara *et al.* (2014) in their research study concluded that farmers' level of participation in irrigation management activities was directly proportional to the income received. These findings were consistent with studies by Maleza and Nishimura (2007) who indicated the returns obtained from irrigation activities caused motivation for farmers to participate more in activities in the irrigation schemes.

## **2.7 Theoretical framework**

The concept of public participation has become a key ingredient in project implementation. The impacts of implementation of public participation on public policy and development programmes have been noted to be varying due to public perceptions and expectations (Hickey and Mohan 2004; Cooke and Kothari 2001). This research study was guided by two underlying theories, Arnstein Ladder of Participation and Theory of Collection Action, supporting participation of beneficiary community in the

community based projects and in this case, the small scale farmers' participation in the management of irrigation scheme.

### **2.7.1 Arnstein's Ladder of Participation**

Olson (1965) showed that the individual member's participation is the building block of the communal success. One of the theories of citizens' participation is the one advanced by Arnstein (1969). The significance of Arnstein's work recognizes that public participate in activities at various levels that range from manipulation, therapy of citizens, consultation, partnership and citizen control. The model is equally subdivided into main three extremes of citizens' power: non-participation, tokenism and citizen power. The three forms comprise a ladder of eight rungs of citizens' participation. Non-participation includes forms of participation such as manipulation and therapy. These two forms are not regarded as genuine citizens' participation. Tokenism includes informing, placation and consultation, which provide minimal opportunity for citizens' participation. Lastly, citizen power involves partnership, delegation of power and control: citizens can try to reach a compromise, make tradeoffs and can have a stake in the decision-making process. Taylor (1998) terms the ladder as a lovely piece of conceptual analysis of public participation showing that participation can be take many forms and that there various degrees of participation.

The theory of Arnstein's Ladder of Citizens' Participation is relevant in the identification of extent of the small scale farmers' participation in the management of Gem Rae Irrigation Scheme. The theory facilitates understanding of the present status of farmers' involvement in the scheme management and explains the levels of the participation. By comparing the stages and rungs of Citizens' Participation on the Arnstein's Ladder with the activities undertaken by small scale farmers in Gem Rae Irrigation Scheme, it will be possible to understand the extent of farmers' participation.

### **2.7.2 Theory of Collection Action**

The Theory of Collective Action (Olson, 1965), which has proved to be applicable to a broad range of social and economic situations, assumes that cooperation must be explained by the individual's cost-benefit calculus rather than that of the group because

the group as a whole is not rational but can only consist of rational individuals. Groups often seek public goods that are available, once they have been generated, to everyone, including those who did not contribute to producing them. Because individuals potentially can receive the benefits of public goods without having contributed to their production, they have an incentive to let others pay for them. Ostrom (1990) stated that benefits obtained from communal undertakings are more when members combine their efforts as compared to the benefits when members work individually. Hardin (1968) pointed out that people are likely to overuse the naturally occurring resources for their own gain resulting in complete depletion of the resource and thus creating tragedy for all. However, Ostrom (2007) argued that rational behavior can be obtained at group or individual levels. He pointed out that either the group or individual may choose to act for the benefit of his own or the entire group depending on certain circumstances. The three assumptions are that members have good understanding of the returns to be obtained from their participation, the choices are made individually and at the same time by members and that there is no influence from outside the group to force consensus on the group (Ostrom, 2010).

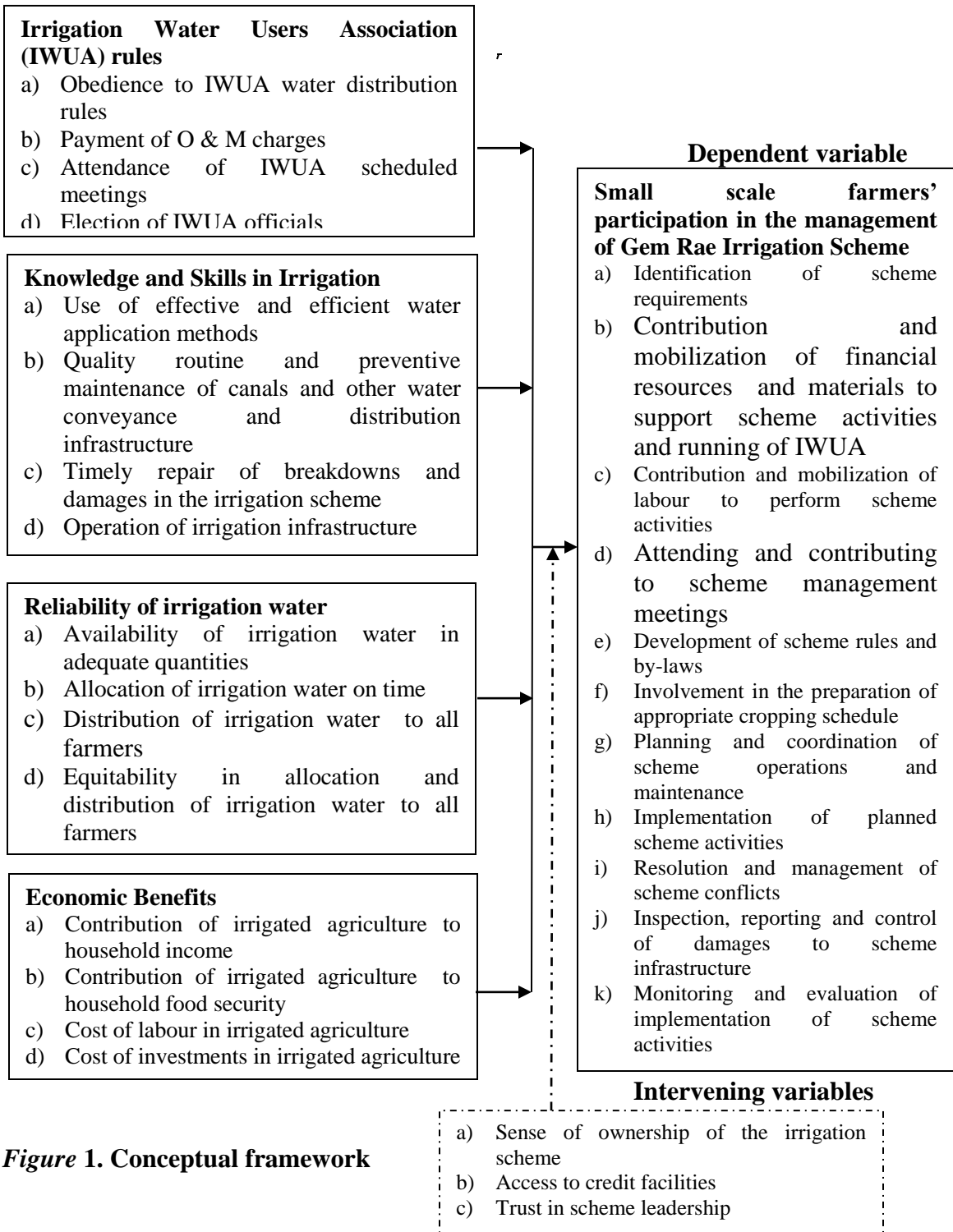
This theory is relevant in this study of small scale farmers' participation in management of Gem Rae Irrigation Scheme since farmers in the scheme are expected to share and cooperate in the utilization of the scheme resources in order to obtain the maximum benefits. It is also expected that farmers will be influenced by some factors to get involved in the management tasks in the scheme. However, the problems of damaged irrigation infrastructure, insufficient water can equally occur when the farmers do not actively participate to address them in the scheme. Thus the theory of collective action will facilitate a good understanding and analysis of the farmers' participation in the management tasks in the scheme.

## **2.8 Conceptual framework**

Conceptual framework is a graphical representation of the variables of the study (Mugenda and Mugenda, 2003). The influence between the independent variables and the dependent variable is as shown in the conceptual framework in Figure 1.



**Independent variables**



**Figure 1. Conceptual framework**

The four independent variables that were investigated in the study are; irrigation water users association (IWUA) rules, knowledge and skills in irrigation, reliability of irrigation water and economic benefits. The dependent variable is small scale farmers' participation in the management of Gem Rae Irrigation Scheme. The intervening variables that are equally likely to influence the small scale farmers' participation in the management of Gem Rae Irrigation Scheme include: sense of ownership of the irrigation scheme, access to credit facilities and trust in scheme leadership.

## **2.9 Knowledge gap**

Whereas the influences of farmer's participation in management of smallholder irrigation schemes is well documented in literature in other countries, comparatively fewer research has been undertaken to determine the factors influencing farmers' participation in the management of smallholder irrigation schemes in Gem Rae, Nyando, Kenya and especially the extent of the influences. Addressing this knowledge gap is important considering the significant investments of financial and other resources in irrigation infrastructure, the objectives of the irrigation schemes in enhancing food supplies and improving the living standards of the majority of rural population and the responsibilities of management that are being transferred from state agencies to the farmers.

## **2.10 Summary of literature review**

This chapter has given literature reviewed from existing secondary sources as per the variables of the research, theoretical framework and the conceptual framework. In the literature reviewed, many researchers have highlighted the influences of farmers' participation in management roles in small scale irrigation schemes. The influences identified are IWUA rules, farmers' knowledge and skills, reliability of irrigation water, economic benefits, among other factors. It has been indicated that where reliability of irrigation water was not assured, the farmers' participation was relatively low. Farmers' participation in operation and maintenance activities was found to be much more when the income and other economic benefits obtained from the irrigation activities was much more than in other competing economic activities.

The impact of farmers’ participation in irrigation development and management has been studied by many researchers because of the noble contributions of irrigation to food supplies and improvement of rural livelihoods. The transfer of management of irrigation schemes have achieved good results in some cases while at the same time have also recorded massive failures in other cases. In Africa, a number of small scale projects have collapsed even through measures were put in place to facilitate the transfer of the management roles from the public agencies to the beneficiary farming communities. The transfer of the management roles did not achieve the desired goal of enhancing the performance of the schemes and ensuring sustainability of the projects. This state of affairs is largely attributed to the earlier models of project development and participation adopted by governments in an effort to fast track irrigation development. A number of academicians favour small scale irrigation development and management approach since it facilitates orderly devolution to farmers of responsibilities for operation and maintenance (Gyasi, *et al.*, 2006). The factors that have been reported to influence the participation of small scale farmers in management activities in the irrigation schemes have been outlined in this literature review and include IWUA rules, knowledge and skills in irrigation, reliability of irrigation water and economic benefits from irrigated agriculture.

**Table 2.1: Summary of literature review and knowledge gap**

<b>Variable</b>	<b>Author (Year)</b>	<b>Title of study</b>	<b>Findings</b>	<b>Knowledge gap</b>
Irrigation Water Users Association rules.	Shahroudi and Chizari (2007)	Farmers’ Participation in Irrigation Water Management in Northeast Iran.	It was found that farmers’ organizations were considerable social capitals that could improve the level of farmers’ participation in irrigation water management.	The study findings may not be applicable to other contexts such as irrigation projects and the knowledge gap is proposed to be filled through this proposed new study.

	Chandrasekaran, <i>et al.</i> (2005).	Water Users Association for Sustainable Water Management. Experiences from the Irrigation Sector, Tamil Nadu, India.	The study established that farmers participated in irrigation management activities where the IWUA rules were formulated with their participation.	The study findings show the relationship between the farmers' participation in irrigation management and IWUA rules but do not provide the extent of the relationship, the issue that will be addressed by this proposed new study.
Knowledge and skills in irrigation.	Aref, F. (2011)	Farmers' Participation in Agricultural Development: The Case of Fars Province, Iran.	Farmer's lack of knowledge and skills were cited as reasons for not achieving active participation of farmers in management of irrigation schemes.	The study results may not be true for a small scale irrigation scheme in a different context such as Kenyan.
	Kahuro, G.W (2012).	Factors Influencing Farmers' Participation in Operation and Maintenance of Smallholder Irrigation Projects in Gichugu Division, Kirinyaga East District, Kenya.	The study findings established that farmers' knowledge and skills influenced the farmers' participation in operation and maintenance of smallholder irrigation projects in Gichugu, Kirinyaga County, Kenya.	The study findings may not be applicable to other areas such as Gem Rae irrigation Scheme and the knowledge gap is proposed to be filled through a new study

Reliability of irrigation water.	Chandran and Chackacherry (2004).	Factors Influencing Farmers' Participation in Irrigation Management.	Farmers' participation in irrigation projects was influenced by availability of irrigation water and that water shortage had a negative impact on their participation.	The study failed to address the level of influence the reliability of irrigation water had on the farmers' participation and this aspect will be addressed in this study
	Adekunle <i>et al.</i> (2015).	Factors affecting farmers' participation in irrigation schemes of the Lower Niger River Basin and Rural Development Authority, Kwara State, Nigeria	The study established that the farmers' participation was dependent on availability of water, access to financial resources and existence of water users association	The study findings did not establish the extent of influence of the factors on farmers' participation and this aspect will be addressed in this proposed study

Economic benefits from irrigated agriculture	Vilas and Goldey(2005)	A Comparison of Farmers' Participation in Farmers' Organization and Implications for Rural Extension in Minas Gerais.	The study found out farmers are more predisposed to participate in irrigation management when the management offers additional benefits to them such as tractor services and sale of inputs.	The study findings did not measure the extent of influence of economic benefits on farmers' participation and findings may not be applicable to the Kenyan context and these aspects will be addressed in this proposed study
	Muchara <i>et al.</i> (2014).	Collective Action and Participation in Irrigation Water Management: A Case Study of Mooi River Irrigation Scheme in Kwazulu-Natal Province, South Africa.	The study established that farmers who receive more income from irrigation farming tend to participate more in irrigation management activities than those who receive less.	The study results used Tobit and Ordered Probit models for assessing determinants of participation while the proposed study will employ use of descriptive statistics in the analysis of determinants of participation

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter describes the methodology that is proposed for the research exercise. The chapter includes a proposed research design, target population, sample size and sampling procedure, research instruments, pilot testing, validity of the instruments, reliability of instruments, data collection procedures, data analysis techniques, operationalization of the variables and ethical considerations.

#### **3.2 Research design**

Research design is a plan according to which research participants are obtained and how information is collected from them. In the research design the researcher describes what he/she is going to do with participants in order to be able to reach a conclusion about the research problem (Welman, Kruger, Mitchell, 2005). The study adopted cross-sectional survey research design. In a cross-sectional survey, the information gathered about the independent variable, Y and the dependent variable (s), X represents what is going at one instance in time (Olsen and St. George, 2004). The cross-sectional survey research design was chosen because of the nature of research questions that required data to be obtained from respondents at a single point in time.

#### **3.3 Target population**

Population refers to an whole set of individuals, events or objects exhibiting same features (Mugenda and Mugenda, 1999). It is universal set of all subjects to which a researcher wishes to study and generate findings. The researcher selected the entire active membership of the Gem Rae Irrigation Scheme as the target population for this study. The target population was the entire 480 small scale farmers in Gem Rae Irrigation Scheme, Nyando, Kisumu County (Gem Rae Irrigation Water Users Association, 2017).

### **3.4 Sample size and sampling procedure**

A sample is a smaller group or sub-group obtained from the accessible population (Mugenda and Mugenda, 1999). This sub-group was carefully selected so as to be representative of the whole population with the relevant characteristics. Each member or case in the sample is referred to as subject, respondent or interviewee. Sampling is a procedure, process or technique of choosing a sub-group from a population to participate in the research study (Ogula, 2005).

#### **3.4.1 Sample size**

The respondents in this study were selected from the target population of farmers at Gem Rae Irrigation Scheme through simple random sampling since the population was homogenous. In order to comply with to Borg and Gall (2003), 144 farmers out of the target population of 480 farmers was selected as a sample. The sample was 30% of the target population and this was considered adequate for the research study.

#### **3.4.2 Sampling procedure**

Simple random sampling was utilized in this study because the population was homogenous and procedure provided every farmer a chance to be part of the sample and the degree of sampling error was equally low. First, the researcher visited Gem Rae Irrigation Scheme management who provided the list of 480 farmers in the scheme. The second stage was to assign numbers to the 480 farmers and lastly the 144 numbers were randomly picked to obtain a sample.

### **3.5 Research instruments**

The primary data in the research study was collected through researcher-administered questionnaires since the questionnaires were are cheap, easy to administer, collect a lot of information and are fast (Cockburn and Mackenzie (2000). The 144 questionnaires contained closed-ended questions. The questionnaire consisted of a section on demographic profile on gender, age, highest of education level and years of experience in irrigated agriculture and other sections dealing with questions prepared thematically on the basis of the research questions.



### **3.5.1 Pilot testing**

Pilot testing involves undertaking a study on small portion of population to gauge the research design and instruments (Orodho, 2004). It involves pretesting of the instruments to assess their validity and reliability. The pilot testing was done by collecting data through questionnaires from 14 respondents, being 10% of the sample, from the neighboring Nyachoda Irrigation Scheme where small scale farmers also participate in scheme management. The data was analyzed to gauge the understanding of the questionnaires by the respondents. However, the results from the pilot test in Nyachoda Irrigation Scheme were not incorporated in results obtained from Gem Rae Irrigation Scheme.

### **3.5.2 Validity of the research instruments**

The validity of instrument represents the extent to which the measurements obtained truly shows the results (Mugenda and Mugenda, 1999). The validation was carried out by experts from the University of Nairobi in terms of the three types of validity in data. First, the experts checked the level to which the instrument tackled the researcher's listed questions and objectives. Secondly, the construct validity was checked by determining the extent to data yielded from the instrument made sense and actually conformed to the theories. Thirdly, the experts looked at the criterion related validity, which acted as a gauge used to determine the response in every environmental situations (Mugenda & Mugenda 1999).

### **3.5.3 Reliability of the research instruments**

Reliability is the extent to which a study yields same results over time where there is a same characteristics of sample compared to the population under study (Golafshani, 2003). Same test on two separate occasions to 14 respondents from the neighboring Nyachoda Irrigation Scheme. The test- pre-test sample was taken as 10% of the sample. This conformed to Mugenda and Mugenda (1999) who recommend between 1 to 10% depending on the sample study. The two separate occasions were two weeks apart. The computed coefficient of stability from the tests on the two occasions was 0.933 which was interpreted to be of excellent reliability (Cooper and Schindler, 2008). Based on the

confirmed reliability, the questionnaire was subsequently used in collection of primary data from study area, Gem Rae Irrigation Scheme.

### **3.6 Data collection procedures**

Data collection means the activity undertaken by the researcher to obtain particular details in order to arrive at some conclusion (Kombo and Tromp, 2006). The questionnaires were used to gather the primary data from the respondents.

The University of Nairobi offered a letter of introduction to the researcher. The National Commission for Science, Technology and Innovation provide research permit that allowed the researcher to undertake the research in the area without hindrance. Equally at the scheme, the researcher sought permission from the scheme management before commencement of the data collection exercise. The research used the researcher-administered questionnaires to collect data from the sampled farmers. Six trained research assistants administered the questionnaires with close supervision from the researcher. The respondents were guided through the questionnaires and responses recorded by the research assistants.

### **3.7 Data analysis techniques**

Data analysis refers to the computation of certain measures along with searching for patterns of relationship that exists among data-group (Kothari, 2004). The returned questionnaires were edited for accuracy, completeness and those with major discrepancies will be discarded. Accurate and completed questionnaires were numbered and coded. The data from respondents were organized thematically. Data was analyzed quantitatively through descriptive statistics. Microsoft Excel was used to compute descriptive statistics of frequency, percentages and statistical measures of central tendency of means and standard deviations.

### 3.8 Operationalization of the variables

The measurement of variables in this research was undertaken as reported in Table 3.1.

**Table 3.1: Operationalization of variables**

Objective	Variable	Type of variable	Indicators	Measurement	Scale of Measurement	Data analysis technique
	Small scale farmers' participation in the management of Gem Rae Irrigation Scheme	Dependent	<ul style="list-style-type: none"> <li>a) Identification of scheme requirements</li> <li>b) Contribution and mobilization of financial resources and materials to support scheme activities and running of IWUA</li> <li>c) Contribution and mobilization of labour to perform scheme activities</li> <li>d) Attending and contributing to scheme management meetings</li> <li>e) Development of scheme rules and by-laws</li> <li>f) Involvement in the preparation of appropriate cropping schedule</li> <li>g) Planning and coordination of scheme operations and maintenance</li> <li>h) Implementation of planned scheme activities</li> <li>i) Resolution and management of scheme conflicts</li> <li>j) Inspection, reporting and control of damages to scheme infrastructure</li> <li>k) Monitoring and evaluation of implementation of scheme activities</li> </ul>	Level of participation as shown by farmers' attendance register in the scheme activities	Ordinal	Descriptive statistics: Frequencies, Percentages, Measures of central tendency (mean and standard deviation)

To establish how Irrigation Water Users Association rules influence small scale farmers' participation in the management of Gem Rae Irrigation Scheme	Irrigation Water Users Association (IWUA) rules	Independent	<ul style="list-style-type: none"> <li>a) Obedience to IWUA water distribution rules</li> <li>b) Payment of operation and maintenance charges</li> <li>c) Attendance of IWUA scheduled meetings</li> <li>d) Election of IWUA officials</li> </ul>	Level of compliance to IWUA rules	Ordinal	Descriptive statistics: Frequencies, Percentages, Measures of central tendency (mean and standard deviation)
To determine how knowledge and skills in irrigation influence small scale farmers' participation in the management of Gem Rae Irrigation Scheme	Knowledge and Skills in irrigation	Independent	<ul style="list-style-type: none"> <li>a) Use of effective and efficient water application methods</li> <li>b) Quality routine and preventive maintenance of canals and other water conveyance and distribution infrastructure</li> <li>c) Timely repair of breakdowns and damages in the irrigation scheme</li> <li>d) Operation of irrigation infrastructure</li> </ul>	Level of Efficient and effective operation and maintenance of the irrigation system	Ordinal	Descriptive statistics: Frequencies, Percentages, Measures of central tendency (mean and standard deviation)
To ascertain how reliability of irrigation water influences small scale farmers' participation in the management of Gem Rae Irrigation Scheme	Reliability of irrigation water	Independent	<ul style="list-style-type: none"> <li>a) Availability of irrigation water in adequate quantities</li> <li>b) Allocation of irrigation water on time</li> <li>c) Distribution of irrigation water to all farmers</li> <li>d) Equitability in allocation and distribution of irrigation water to all farmers</li> </ul>	Level of irrigation water-related complaints and conflicts	Ordinal	Descriptive statistics: Frequencies, Percentages, Measures of central tendency (mean and standard deviation)

To assess how economic benefits from irrigated agriculture influence small scale farmers' participation in the management of Gem Rae Irrigation Scheme	Economic benefits from irrigated agriculture	Independent	a) Contribution of irrigated agriculture to household income b) Contribution of irrigated agriculture to household food supplies c) Cost of labour in irrigated agriculture d) Cost of investments in irrigated agriculture	Level of contribution of economic benefits from irrigated agriculture to the household	Ordinal	Descriptive statistics: Frequencies, Percentages, Measures of central tendency (mean and standard deviation)
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### 3.9 Ethical considerations

The researcher and research assistants endeavored to uphold the highest ethical standards while administering the research instruments. Prior permission to administer the questionnaires was sought and obtained from the Gem Rae Irrigation Scheme management. The voluntary participation and consent was sought and obtained by the researcher before the conducting the interviews and completing the questionnaires. The respondents were assured of proper use of the data for only for the intended academic purpose and protection of the confidentiality of respondents. The data obtained from the respondents were analyzed without fabrication. The findings of the study has been presented and communicated honestly. The relationships that have been discovered from the results have been disclosed truthfully.

## **CHAPTER FOUR**

### **DATA ANALYSIS, PRESENTATION AND INTERPRETATION**

#### **4.1 Introduction**

This chapter presents the data analysis, the presentation and the interpretation of the results. The primary data collected were analyzed using descriptive statistics of frequencies, percentages, means and standard deviation, and the correlation and regression analysis. Tables were utilized to present the results from data analysis and the interpretation was done according to the four research objectives.

#### **4.2 Questionnaire return rate**

The questionnaire return rate refers to the percentage of sampled respondents that returns the questionnaires completely filled (Bryman and Bell, 2007). The study had a target sample of 144 respondents who were farmers in Gem Rae Irrigation Scheme. The researcher completely filled questionnaires for 102 (71%) of the respondents. These 102 completely filled questionnaires were subjected to data analysis. The remaining 42 (29%) questionnaires were not filled for a variety of reasons which included non-availability of respondents during the period of data collection even after several call backs.

The excellent response rate of 71% was achieved by the researcher through researcher's personal liaison with the scheme management who facilitated the identification and location of the respondents (Mugenda and Mugenda, 2003). Further, once a respondent was identified and located, the researcher explained to each respondent the reasons for the research study and the study's expected value to the scheme and other stakeholders and thus achieved enhanced acceptance of the interviews and cooperation with respondents.

#### **4.3 Demographic analysis**

The research study sought to determine the demographic profile of the respondents. It was necessary for the researcher to determine the demographic characteristics of the farmers who were the respondents since their characteristics explained the group

dynamics, the capacity to provide reliable data and the ability and opportunity to participate in group activities such as management of irrigation scheme.

#### 4.3.1 Gender of the respondents

The questionnaires required the respondents asked to indicate their gender. The information on gender guided the researcher on the conclusions made from the study.

**Table 4.1: Gender of the respondents**

Gender of the respondents	Frequency	%
Male	48	47
Female	54	53
Total	102	100

As shown in Table 4.1, 48 (47%) respondents of out of the total 102 respondents were reported to be of male while 54 (53%) respondents were female. The results showed that distribution of the farmers in the research study by gender was largely equal. Both gender participated in the management activities of the scheme.

#### 4.3.2 Age of the respondents

The respondents' age was regarded an important factor since it determined the farmers' participation in the scheme management functions.

**Table 4.2: Age of the respondents**

Age of the respondents	Frequency	%
Between 18 and 25 years of age	0	0
Between 26 and 35 years of age	32	31
Between 36 and 45 years of age	9	9
Between 46 and 65 years of age	61	60
Total	102	100

As per the results as shown in Table 4.2, those respondents who were between 18 and 25 years of age were 0 (0%), 26 and 35 years of age were 32 (31%), 36 and 45 years of age were 9 (9%), while those who were between 46 and 65 years of age were 61 (60%). From

the results, more than half of the farmers are relatively older people, between 46 and 65 years of age. The proportion of younger population, between 18 and 35 years of age, was relatively small, at 31%.

#### 4.3.3 Highest level of education of the respondents

The education level attained by the respondents was considered a significant factor since it determines the farmers' competency in execution of the scheme management functions.

**Table 4.3: Highest level of education of the respondents**

Highest level of education of the respondents	Frequency	%
No formal education	52	51
Kenya Certificate of Primary Education (KCPE)/ Certificate of Primary Education (CPE)	28	27
Ordinary (KCSE) /Advanced level	22	22
Diploma	0	0
University Degree	0	0
Total	102	100

The results in Table 4.3 showed that the half of the respondents, 52 (51%), had no formal education. Also, 28 (27%) of the respondents attained KCPE/CPE level of education, 22 (22%) had "O" Level / KCSE qualification while none of the respondents had neither a diploma nor a university degree qualification. The study results revealed that majority of the farmers either had no formal education or attained KCPE/CPE level of education.

#### 4.3.4 Years of irrigated farming experience of the respondents

The researcher also determined the duration the respondents have practiced irrigated farming. This was significant since it had effect on the respondents' knowledge and skills in the management functions in the scheme.



**Table 4.4: Years of irrigated farming experience of the respondents**

Years of irrigated farming experience of the respondents	Frequency	%
Less than 2 years	0	0
3-5 years	26	25
6-9 years	0	0
10-15 years	7	7
More than 15 years	69	68
Total	102	100

As shown in Table 4.4, 0 (0%) respondents had less than 2 years of irrigated farming experience, 26 (25%) respondents had 3-5 years of irrigated farming experience, 0 (0%) respondents had 6-9 years of irrigated farming experience, 7(7%) respondents had 10-15 years of irrigated farming experience, while those who had more than 15 years of irrigated farming experience were 69 (68%). Majority of the farmers were experienced in irrigated farming.

#### **4.4 Influence of factors on small scale farmers' participation in Gem Rae Irrigation Scheme**

The research study was meant to establish the factors influencing the small scale farmers' participation in the management of Gem Rae Irrigation Scheme and the how the factors influenced their participation. The objective was analyzed by examining the selected four factors: Irrigation Water User Association rules, knowledge and skills in irrigation, reliability of irrigation water and economic benefits from irrigated agriculture. Likert scale was used to measure the rate of influence of the four factors on the participation of farmers in the management of Gem Rae Irrigation Scheme where 5= very great extent; 4= great extent; 3= moderate extent; 2= little extent and 1= not at all.

##### **4.4.1 Irrigation Water Users Association (IWUA) rules and small scale farmers' participation in the management of Gem Rae Irrigation Scheme**

The study sought to determine the influence of Irrigation Water User Association (IWUA) rules on the small scale farmers' participation in the management of Gem Rae Irrigation Scheme.

**Table 4.5: Rating of the influence of Irrigation Water Users Association (IWUA) rules on small scale farmers' participation in the management of Gem Rae Irrigation Scheme**

Irrigation Water Users Association (IWUA) rules	5=Very great extent	4=Great extent	3=Mode rate extent	2=Little Extent	1= Not at all	Min	Max	Mean	Standard Deviation	N
a) Obedience to IWUA water distribution rules	31 (30.4%)	25 (24.5%)	7 (6.9%)	39 (38.2%)	0 (0%)	2	5	3.470	1.279	102
b) Payment of Operation & Maintenance charges	45 (44.1%)	30 (29.4%)	17 (16.7%)	10 (9.8%)	0 (0%)	3	5	4.078	1.000	102
c) Attendance of IWUA scheduled meetings	26 (25.5%)	36 (35.3%)	28 (27.4%)	12 (11.8%)	0 (0%)	2	5	3.745	0.971	102
d) Election of IWUA officials	33 (32.4%)	41 (40.2)	19 (18.6%)	9 (8.8%)	0 (0%)	2	5	3.960	0.933	102

The study results as presented in Table 4.5 revealed that majority of the respondents, 56 (54.9%), reported that obedience to IWUA water distribution rules influenced their participation in the management of Gem Rae Irrigation Scheme by a great extent to very great extent. Majority of the respondents, 75 (73.5%), indicated that payment of operation and maintenance charges influenced their participation in the management of Gem Rae Irrigation Scheme by a great extent to very great extent. Again, nearly all the respondents, 62 (60.8%) indicated that attendance of IWUA scheduled meetings influenced their participation in the management of Gem Rae Irrigation Scheme by a great extent to very great extent. Lastly, 74 (72.6%) of the respondents indicated that election of IWUA officials influenced their participation in the management of Gem Rae Irrigation Scheme by a great extent to very great extent.

According to study results as reported in Table 4.5, majority of the respondents, a mean of 3.784, reported that obedience to IWUA water distribution rules greatly influenced their participation in the management of Gem Rae Irrigation Scheme. The standard deviation of 0.961 demonstrated that the opinions of the respondents on the influence were very varied. From study findings, it was revealed that payment of operation and maintenance charges greatly influenced the participation of the respondents in the management of Gem Rae Irrigation Scheme as evidenced by a mean of 3.912. A standard deviation of 0.489 gave evidence that there was agreement in the opinions of the respondents on the influence. Further, majority of respondents, a mean of 4.039, reported that that the attendance of IWUA scheduled meetings the greatly influenced their participation in the management of Gem Rae Irrigation Scheme. However, a standard deviation of 0.843 showed that the opinions of the respondents on the influence were more widely spread. The study also established that election of IWUA officials greatly influenced their participation in the management of Gem Rae Irrigation Scheme with a mean of 4.157. It was also evident that respondents had varied opinions on the influence which were indicated by a standard deviation of 0.920.

#### **4.4.2 Knowledge and skills in irrigation and small scale farmers' participation in the management of Gem Rae Irrigation Scheme**

The research study was undertaken to determine the influence of knowledge and skills in irrigation on the small scale farmers' participation in the management of Gem Rae Irrigation Scheme.

**Table 4.6: Rating of the influence of knowledge and skills in irrigation on the small scale farmers' participation in the management of Gem Rae Irrigation Scheme**

Knowledge and Skills in Irrigation	5=Very great extent	4=Great extent	3=Mode rate extent	2=Littl e Extent	1= Not at all	Min	Ma x	Mean	Stand ard Devia tion	N
a) Use of effective and efficient water application methods	29 (28.5%)	60 (58.8%)	8 (7.8%)	5 (4.9%)	0 (0%)	2	5	4.108	0.743	102
b) Quality routine and preventive maintenance of canals and other water conveyance and distribution infrastructure	16 (15.7%)	25 (24.5%)	37 (36.3%)	19 (18.6%)	5 (4.9%)	1	5	3.274	1.091	102
c) Timely repair of breakdowns and damages	51 (50.0%)	38 (37.3%)	13 (12.7%)	0 (0%)	0 (0%)	2	5	4.372	0.702	102
d) Operation of irrigation infrastructure	29 (28.4%)	34 (33.3%)	30 (29.4%)	9 (8.8%)	0 (0%)	2	5	3.814	0.951	102

In accordance with the results of the study as reported in Table 4.6 show that 89 (87.3%) respondents indicated that use of effective and efficient water application methods influenced their participation in the management of Gem Rae Irrigation Scheme by a great extent to very great extent. Further, 41 (40.2%) respondents indicated that quality routine and preventive maintenance of canals and other water conveyance and distribution infrastructure influenced by a great extent to very great extent the participation of respondents in the management of Gem Rae Irrigation Scheme. 89 (87.3%) respondents indicated that timely repair of breakdowns and damages influenced their participation in the management of Gem Rae Irrigation Scheme by a great extent to very great extent. 63 (61.8%) respondents indicated that operation of irrigation infrastructure influenced their

participation in the management of Gem Rae Irrigation Scheme by a very great extent to very great extent.

From Table 4.6, majority of the respondents, a mean of 4.108, reported that use of effective and efficient water application methods greatly influenced their participation in the management of Gem Rae Irrigation Scheme. The opinions of the respondents on the influence were quite varied as shown by a standard deviation of 0.743. The study also showed that quality routine and preventive maintenance of canals and other water conveyance and distribution infrastructure moderately influenced the participation of the respondents in the management of Gem Rae Irrigation Scheme as evidenced by a mean of 3.274. The opinions of the respondents on the influence were very widely spread as shown by a standard deviation of 1.091. Further, respondents reported that the timely repair of breakdowns and damages greatly influenced their participation in the management of Gem Rae Irrigation Scheme with a mean of 4.372. However, a standard deviation of 0.702 showed that the opinions of the respondents on the influence were quite widely spread. The findings of the study also showed that respondents reported that operation of irrigation infrastructure greatly influenced their participation in the management of Gem Rae Irrigation Scheme. This was indicated by a mean of 3.814. The standard deviation of 0.951 showed that opinions of the respondents on the influence were very widely varied.

#### **4.4.3 Reliability of irrigation water and small scale farmers' participation in the management of Gem Rae Irrigation Scheme**

The study sought to determine the influence of reliability of irrigation water on the small scale farmers' participation in the management of Gem Rae Irrigation Scheme.

**Table 4.7: Rating of the influence of reliability of irrigation water on the small scale farmers' participation in the management of Gem Rae Irrigation Scheme**

Reliability of irrigation water	5=Very great extent	4=Great extent	3=Mode rate extent	2=Little Extent	1= Not at all	Min	Max	Mean	Standard Deviation	N
a) Availability of irrigation water in adequate quantities	37 (36.3%)	40 (39.2%)	19 (18.6%)	6 (5.9%)	0 (0%)	2	5	4.058	0.888	102
b) Allocation of irrigation water on time	29 (28.5%)	46 (45.0%)	27 (26.5%)	0 (0%)	0 (0%)	3	5	4.019	0.744	102
c) Distribution of irrigation water to all farmers	37 (36.3%)	34 (33.3%)	16 (15.7%)	15 (14.7%)	0 (0%)	2	5	3.911	1.054	102
d) Equitability in allocation and distribution of irrigation water to all farmers	49 (48.0%)	21 (20.6%)	27 (26.5%)	5 (4.9%)	0 (0%)	2	5	4.117	0.967	102

As per results of the study as indicated in Table 4.7, 77 (75.5%) respondents reported that availability of irrigation water in adequate quantities influenced their participation in the management of Gem Rae Irrigation Scheme by a great extent to very great extent. Equally, 75 (73.5%) respondents indicated that allocation of irrigation water on time influenced their participation in the management of Gem Rae Irrigation Scheme by a great extent to very great extent. Additionally, 71 (69.6%) respondents indicated that distribution of irrigation water to all farmers influenced their participation in the management of Gem Rae Irrigation Scheme by a great extent to very great extent. Lastly, 70 (68.6%) respondents indicated that equitability in allocation and distribution of irrigation water to all farmers influenced their participation in the management of Gem Rae Irrigation Scheme by a great extent to very great extent.

According to study results presented in Table 4.7, majority of the respondents reported that availability of irrigation water in adequate quantities greatly influenced their participation in the management of Gem Rae Irrigation Scheme, with a mean of 4.058. The opinions of the respondents on the influence were widely dispersed as revealed by a standard deviation of 0.888. The study also showed that allocation of irrigation water on time greatly influenced the participation of the respondents in the management of Gem Rae Irrigation Scheme as evidenced by a mean of 4.019. There was variation in the opinions of the respondents on the influence as shown by a standard deviation of 0.744. Further, respondents reported that the distribution of irrigation water to all farmers moderately influenced their participation in the management of Gem Rae Irrigation Scheme as demonstrated by a mean of 3.911. The opinions of the respondents on the influence were very widely spread as demonstrated by a standard deviation of 1.054. The study also established that equitability in allocation and distribution of irrigation water to all farmers greatly influenced their participation in the management of Gem Rae Irrigation Scheme with a mean of 4.117. It was also evident that respondents had varied opinions on the influence which were indicated by a standard deviation of 0.967.

#### **4.4.4 Economic benefits from irrigated agriculture and small scale farmers' participation in the management of Gem Rae Irrigation Scheme**

The research study was undertaken with an aim to determine the influence of economic benefits from irrigated agriculture on the small scale farmers' participation in the management of Gem Rae Irrigation Scheme.

**Table 4.8: Rating of the influence of economic benefits from irrigated agriculture on the small scale farmers' participation in the management of Gem Rae Irrigation Scheme**

Economic benefits from irrigated agriculture	5=Very great extent	4=Great extent	3=Moderate extent	2=Little Extent	1=Not at all	Min	Max	Mean	Standard Deviation	N
a) Contribution of irrigated agriculture to household income	49 (48.0%)	38 (37.3%)	6 (5.9)	9 (8.8%)	0 (0%)	2	5	4.245	0.916	102
b) Contribution of irrigated agriculture to household food supplies	24 (23.5%)	60 (58.9%)	9 (8.8%)	9 (8.8%)	0 (0%)	2	5	3.970	0.826	102
c) Cost of labour in irrigated agriculture	43 (42.2%)	24 (23.5%)	17 (16.7%)	18 (17.6%)	0 (0%)	2	5	3.902	1.138	102
d) Cost of investments in irrigated agriculture	41 (40.2%)	40 (39.2)	15 (14.7%)	6 (5.9%)	0 (0%)	2	5	4.127	0.875	102

As shown in Table 4.8, 87 (85.3%) respondents indicated that contribution of irrigated agriculture to household income influenced their participation in the management of Gem Rae Irrigation Scheme by a great extent to very great extent. 84 (82.4%) respondents indicated that contribution of irrigated agriculture to household food supplies influenced their participation in the management of Gem Rae Irrigation Scheme by a great extent to very great extent. 67 (65.7%) of the respondents indicated that cost of labour in irrigated agriculture influenced their participation in the management of Gem Rae Irrigation Scheme by a great extent to very great extent. Lastly, 81 (79.4%) respondents indicated that cost of investments in irrigated agriculture influenced their participation in the management of Gem Rae Irrigation Scheme by a great extent to very great extent.



As per study results reported in Table 4.8, majority of the respondents, a mean of 4.245, reported that contribution of irrigated agriculture to household income greatly influenced their participation in the management of Gem Rae Irrigation Scheme. The standard deviation of 0.916 was a demonstration that the opinions of the respondents on the influence were quite dispersed. The study also showed that contribution of irrigated agriculture to household food supplies greatly influenced the participation of the respondents in the management of Gem Rae Irrigation Scheme as evidenced by a mean of 3.970. The opinions of the respondents on the influence were more widely spread as shown by a standard deviation of 0.826. Further, respondents reported that cost of labour in irrigated agriculture moderately influenced their participation in the management of Gem Rae Irrigation Scheme as evidenced by 3.902 mean score. A standard deviation of 1.138 showed that the opinions of the respondents on the influence were very widely spread. The findings of the study also showed that respondents reported that cost of investments in irrigated agriculture moderately influenced their participation in the management of Gem Rae Irrigation Scheme as evidenced by 4.127 mean score. The standard deviation of 0.875 showed that opinions of the respondents on the influence were widely varied.

#### **4.5 Small scale farmers' participation in management of Gem Rae Irrigation Scheme**

The study sought to determine the small scale farmers' participation in the management of Gem Rae Irrigation Scheme in Nyando Sub-County, Kisumu County, Kenya. The study results from the respondents were as reported in Table 4.9.

**Table 4.9 Small scale farmers' participation in the management of Gem Rae Irrigation Scheme in Nyando Sub-County, Kisumu County**

Small scale farmers' participation in the management of Gem Rae Irrigation Scheme, Nyando, Kisumu County	5=Very great extent	4=Great extent	3=Moderate extent	2=Little Extent	1=Not at all	Min	Max	Mean	Standard Deviation	N
a) Identification of scheme requirements	69 (67.6%)	33 (32.4%)	0 (0%)	0 (0%)	0 (0%)	4	5	4.676	0.470	102
b) Contribution and mobilization of financial resources and materials to support scheme activities and running of IWUA	17 (16.7%)	54 (52.9%)	15 (14.7%)	7 (6.9%)	9 (8.8%)	1	5	3.627	1.116	102
c) Contribution and mobilization of labour to perform scheme activities	36 (35.3%)	39 (38.3%)	9 (8.8%)	9 (8.8%)	9 (8.8%)	1	5	3.824	1.254	102
d) Attending and contributing to scheme management meetings	52 (51.0%)	34 (33.3%)	9 (8.8%)	0 (0%)	7 (6.9%)	1	5	4.314	1.108	102
e) Development of scheme rules and by-laws	63 (61.8%)	23 (22.5%)	9 (8.8%)	0 (0%)	7 (6.9%)	1	5	4.323	1.109	102

f) Involvement in the preparation of appropriate cropping schedule	33 (32.4%)	39 (38.2%)	30 (29.4%)	0 (0%)	0 (0%)	3	5	4.029	0.789	102
g) Planning and coordination of scheme operations and maintenance	33 (32.4%)	30 (29.4%)	39 (38.2%)	0 (0%)	0 (0%)	3	5	3.941	0.842	102
h) Implementation of planned scheme activities	24 (23.5%)	48 (47.1%)	30 (29.4%)	0 (0%)	0 (0%)	3	5	3.941	0.728	102
i) Resolution and management of scheme conflicts	41 (40.2%)	30 (29.4%)	24 (23.5%)	0 (0%)	7 (6.9%)	1	5	3.960	1.125	102
j) Inspection, reporting and control of damages to scheme infrastructure	37 (36.3%)	24 (23.5%)	41 (40.2%)	0 (0%)	0 (0%)	3	5	3.960	0.878	102
k) Monitoring and evaluation of implementation of scheme activities	15 (14.7%)	47 (46.1%)	20 (19.6%)	20 (19.6%)	0 (0%)	2	5	3.568	0.960	102

As shown in Table 4.9, 102 (100%) respondents indicated their participation in the identification of scheme requirements of Gem Rae Irrigation Scheme was by a great extent to very great extent. 71 (69.6%) respondents reported that their participation in contribution and mobilization of financial resources and materials to support scheme activities and running of IWUA at Gem Rae Irrigation Scheme was by a great extent to very great extent. 76 (73.6%) respondents reported that their participation in contribution and mobilization of labour to perform scheme activities in Gem Rae Irrigation Scheme

was by a great extent to very great extent. 86 (84.3%) respondents reported that their participation in attending and contributing to scheme management meetings in Gem Rae Irrigation Scheme was by a great extent to very great extent. 86 (84.3%) respondents reported that their participation in development of scheme rules and by-laws in Gem Rae Irrigation Scheme was by a great extent to very great extent. 72 (70.5%) respondents indicated their participation in the involvement in the preparation of appropriate cropping schedule in Gem Rae Irrigation Scheme was by a great extent to very great extent. 63 (61.7%) respondents indicated their participation in the planning and coordination of scheme operations and maintenance in Gem Rae Irrigation Scheme was by a great extent to very great extent

From Table 4.9, 72 (70.5%) respondents indicated their participation in implementation of planned scheme activities in Gem Rae Irrigation Scheme was by a great extent to very great extent. 71 (69.6%) respondents reported that their participation in resolution and management of scheme conflicts in Gem Rae Irrigation Scheme was by a moderate extent to very great extent. 61 (59.8%) respondents indicated their participation in inspection, reporting and control of damages to scheme infrastructure in Gem Rae Irrigation Scheme by a great extent to very great extent. 62 (60.8%) the respondents indicated their participation in monitoring and evaluation of implementation of scheme activities in Gem Rae Irrigation Scheme was by a great extent to very great extent.

According to study results as presented in Table 4.9, majority of the respondents reported that identification of scheme requirements influenced their participation in the management of Gem Rae Irrigation Scheme by a very great extent with 4.676 as mean score. There was agreement in opinions of the respondents on the influence as revealed by a standard deviation of 0.470. The study also showed that contribution and mobilization of financial resources and materials to support scheme activities and running of IWUA greatly influenced the participation of the respondents in the management of Gem Rae Irrigation Scheme as evidenced by a mean of 3.627. There was a very wide variation in the opinions of the respondents on the influence as shown by a standard

deviation of 1.116. Further, respondents reported that the contribution and mobilization of labour to perform scheme activities greatly influenced their participation in the management of Gem Rae Irrigation Scheme with a mean of 3.824. A standard deviation of 1.254 showed that the opinions of the respondents on the influence were very widely spread. The study also established that attending and contributing to scheme management meetings greatly influenced their participation in the management of Gem Rae Irrigation Scheme with a mean of 4.314. It was also evident that respondents had very widely varied opinions on the influence which were indicated by a standard deviation of 1.108.

Equally, the study also showed that development of scheme rules and by-laws greatly influenced the participation of the respondents in the management of Gem Rae Irrigation Scheme as evidenced by a mean of 4.323. There was a very wide variation in the opinions of the respondents on the influence as shown by a standard deviation of 1.109. Further, the respondents reported that involvement in the preparation of appropriate cropping schedule greatly influenced their participation in the management of Gem Rae Irrigation Scheme with a mean of 4.029. A standard deviation of 0.789 showed that the opinions of the respondents on the influence were widely spread. The study also established that planning and coordination of scheme operations and maintenance greatly influenced their participation in the management of Gem Rae Irrigation Scheme with a mean of 3.941. It was also evident that respondents had widely varied opinions on the influence which were indicated by a standard deviation of 0.728.

The study additionally showed that resolution and management of scheme conflicts greatly influenced the participation of the respondents in the management of Gem Rae Irrigation Scheme as evidenced by a mean of 3.960. There was wide variation in the opinions of the respondents on the influence as shown by a standard deviation of 1.125. The respondents reported that the inspection, reporting and control of damages to scheme infrastructure s greatly influenced their participation in the management of Gem Rae Irrigation Scheme with a mean of 3.960. A standard deviation of 0.878 showed that the opinions of the respondents on the influence were widely spread. Lastly, the study

established that monitoring and evaluation of implementation of scheme activities moderately influenced the respondents' participation in the management of Gem Rae Irrigation Scheme with a mean of 3.568. It was also evident that respondents had more varied opinions on the influence which were indicated by a standard deviation of 0.960.

## **CHAPTER FIVE**

### **SUMMARY OF THE FINDINGS, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Introduction**

This chapter presents the summary of the research findings, the discussion of the findings, the conclusions made and recommendations made from the study. The areas for further research are also suggested and presented. The study aimed to establish how Irrigation Water Users Association (IWUA) rules, knowledge and skills in irrigation, reliability of irrigation and economic benefits from irrigated agriculture influence the small scale farmers' participation in the management of Gem Rae Irrigation Scheme.

#### **5.2 Summary of the findings**

The findings of the study are based on a cross-sectional survey conducted on sample of 144 respondents obtained from the whole population of 480 farmers in Gem Rae Irrigation Scheme. The researcher utilized the questionnaires to gather the primary data from the respondents. The respondents were farmers randomly selected from Gem Rae Irrigation Scheme.

The research findings showed that Irrigation Water Users Association (IWUA) rules influenced the small scale farmers' participation in the management of Gem Rae Irrigation Scheme. Majority of the respondents rated the influence of IWUA rules on their participation in the management of the scheme as great with average frequency of 67 (65.4%) of the respondents and mean of means of 3.813.

The study established that knowledge and skills in irrigation influenced the small scale farmers' participation in the management of Gem Rae Irrigation Scheme. Majority of the respondents rated the influence of knowledge and skills in irrigation on their participation in the management of the scheme as great with average frequency of 71 (69.1%) of the respondents and mean of means of 3.892.

The study findings showed that reliability of irrigation water influenced the small scale farmers' participation in the management of Gem Rae Irrigation Scheme. Majority of the respondents rated the influence of reliability of irrigation water on their participation in the management of the scheme as great with average frequency of 73 (71.8%) of the respondents and mean of means of 4.026.

The study found out that economic benefits from irrigated agriculture influenced the small scale farmers' participation in the management of Gem Rae Irrigation Scheme. Majority of the respondents rated the influence of economic benefits from irrigated agriculture on their participation in the management of the scheme as great with average frequency of 80 (78.2%) of the respondents and mean of means of 4.061.

The findings of the study revealed that the all the four factors of Irrigation Water Users Association (IWUA) rules, knowledge and skills in irrigation, reliability of irrigation and economic benefits from irrigated agriculture influenced the small scale farmers' participation in the management of Gem Rae Irrigation Scheme. From the results, economic benefits from irrigated agriculture was rated the as highest factor that influenced the small scale farmers' participation in the management of Gem Rae Irrigation Scheme followed by reliability of irrigation water, knowledge and skills in irrigation and Irrigation Water Users Association (IWUA) rules in that order.

### **5.3 Discussion**

This section is composed of sub-sections that include: Irrigation Water Users Association (IWUA) rules and the small scale farmers' participation in the management of Gem Rae Irrigation Scheme, knowledge and skills and the small scale farmers' participation in the management of Gem Rae Irrigation Scheme, reliability of irrigation water and the small scale farmers' participation in the management of Gem Rae Irrigation Scheme and economic benefits from irrigated agriculture and the small scale farmers' participation in the management of Gem Rae Irrigation Scheme.



### **5.3.1 Irrigation Water Users Association rules and the small scale farmers' participation in the management of Gem Rae Irrigation Scheme**

This study found that Irrigation Water Users Association (IWUA) rules influenced the small scale farmer's participation in the management of Gem Rae Irrigation Scheme. The farmers had varied opinions regarding the extent of influence; the influence ranging from moderate influence to very great influence. All the farmers sampled in this study reported the influence of IWUA rules on their participation in the management of Gem Rae Irrigation Scheme. Indeed, the existence of IWUA rules suggested an assurance of orderly conduct of all members of the farming community and thus enhanced the farmers' willingness to identify with the scheme in the first instance and subsequently participate in the management of Gem Rae Irrigation Scheme. The farmers' participation in the management of the scheme was attributed to the IWUA rules that ensured fair and equal treatment of the farmers in the scheme. The IWUA rules secured the farmers' cooperation with the scheme management and their participation in the scheme management activities since the management exercised their authority under the rules. The findings agree with those of Chandrasekaran *et al.*, (2005) who found out that many of the farmers expressed excitement and readiness to contribute labour and other resources in communal undertakings since IWUA rules were created with their participation. However, beyond the relationship, this study has further established that Irrigation Water Users Association (IWUA) rules influenced small scale farmer's participation in the management of Gem Rae Irrigation Scheme by a great extent. The study results showed that farmers participated in various irrigation management activities in Gem Rae Scheme at varying degrees.

The requirement to abide by the IWUA rules by farmers was the likely prompt for the participation of majority of the small scale farmers in scheme management activities with the aim of achieving compliance as well as raising their concerns regarding the rules from within. The farmers who comply with the IWUA rules are likely to demand the same compliance from other farmers and usually such farmers register more participation in the scheme management to ensure the required compliance is achieved by entire membership. They are motivated to participate in management in order to ensure equal

treatment to all farmers with regard to the IWUA rules. The findings of this study concur the findings of Shahroudi and Chizari (2007) who established that farmers' organizations were considerable social units that could facilitate improved farmers' active involvement in scheme management activities.

### **5.3.2 Knowledge and skills in irrigation on the small scale farmers' participation in the management of Gem Rae Irrigation Scheme**

The findings of the research revealed that that knowledge and skills in irrigation influenced the small scale farmer's participation in the management of Gem Rae Irrigation Scheme by a moderate to a very great extent. Farmers who have knowledge and skills in irrigation are likely to be motivated by their knowledge and skills status to get involved in management roles and other activities in the scheme than those without the knowledge and skills in irrigation. Farmers who have the knowledge and skills in irrigation are most times compelled to apply them at any single opportunity and serve in different roles in the scheme. These findings were consistent with the findings by Aref (2011) that that lack of knowledge and skills was the reason for absence of active participation in Iran. Equally, Nhundu *et al.* (2015) found out that the farmers' participation in management of irrigation scheme activities was more amongst those farmers who had acquired much education since they were aware of the good results of their participation.

Though the populations in the studies were different, this study and that of Kahuro (2014) yielded the same result that knowledge and skills influenced the small scale farmer's participation in the scheme management activities. This study confirmed the earlier result obtained by Kahuro (2014) and this was attributed to the two studies being undertaken in the Kenyan context, use of same random sampling method, data collection procedures of researcher administered questionnaires and data analysis techniques of descriptive analysis.

### **5.3.3 Reliability of irrigation water on the small scale farmers' participation in the management of Gem Rae Irrigation Scheme**

The major attraction to engage in irrigation farming was inadequate rainfall and thus the influence of reliability of irrigation water on the farmers' participation in the management of the scheme was rated the highly by the farmers. The findings of the study revealed that the reliability of irrigation water for cropping was a major motivation for farmers' participated in the scheme activities. The findings of this study compare well with the findings of Chandran and Chackacherry (2004) that farmers' participation in irrigation projects was influenced by availability of irrigation water and that shortage had a negative impact on their participation. Additionally, in their study of schemes in Lower Niger River Basin in Nigeria, Adekule *et al.* (2015) established that farmers' participation was dependent on availability of water among other factors and the findings are in harmony with the findings of this study.

Though the studies of Chandran and Chackacherry (2004) and Adekule *et al.* (2015) yielded the same findings as those in this study, the findings did not establish the extent of the influence of reliability of irrigation on the small scale farmer's participation in the management. Based on the results of the study, this study further established that the reliability of irrigation had great influence on the small scale farmer's participation in the management of Gem Rae Irrigation Scheme and this was attributed to the adverse and direct impact the reliability of irrigation water would likely have on the farming activities and returns.

### **5.3.4 Economic benefits from irrigated agriculture and the small scale farmers' participation in the management of Gem Rae Irrigation Scheme**

The influence of economic benefits from irrigated agriculture on the small scale farmers' participation in the management of Gem Rae Irrigation Scheme as rated by the farmers was established to be the most dominant compared to the influence of other factors. Although the populations and regression models used were different, a comparison of the findings in this study with the work done by Muchara *et al.* (2014) can be made as well as a contrast. Muchara *et al.* (2004) assessed the determinants of the farmers' participation. The findings of Muchara *et al.* (2014) using the Tobit and Ordered Probit

models showed that the farmers' degree of participation in irrigation management activities was directly proportional to the income received from their participation in irrigated agriculture. The findings on the relationship on relationship farmers' level of participation in irrigation management activities and income received are consistent with the findings in this study. However, Muchara *et al.* (2014) found out from their study that the significant determinant of farmers' participation was water scarcity while the findings in this study showed that dominant factor of farmers' participation was economic benefits from irrigated agriculture. The differences in the dominant factor of farmers' participation from the studies would likely be attributed to the probable differences in socio-economic status and poverty levels of the sampled populations. Farmers with high poverty levels are more likely to rate the economic benefits higher than other factors such as reliability of water.

The study results suggested that if farmers obtain more economic benefits from irrigated agriculture, then they are inclined to participate in the scheme management activities. Farmers with higher economic benefits from irrigated agriculture are likely to get more involved in management activities of the scheme through commensurate contribution of resources such as finance and labour as their investments. The results are consistent with that from Etwire *et al.* (2013) which recommended that for active participation of farmers, the financial resources were required to be availed to farmers whose major source of income was farming to ensure their participation in agricultural production and scheme management.

#### **5.4 Conclusions**

- (i) According to the study findings, it was concluded that IWUA rules influences the small scale farmer's participation in the management of Gem Rae Irrigation Scheme. Thus it can be concluded from the study that IWUA rules influences the participation of small scale farmer's participation in the management of irrigation schemes.

- (ii) From the findings of the study, the decision of small scale farmers to participate in the management of Gem Rae Irrigation Scheme was influenced by their knowledge and skills in irrigation. Thus, it is concluded that knowledge and skills in irrigation influences the small scale farmer's participation in the management of Gem Rae Irrigation Scheme.
- (iii) The findings of the study led to the conclusion that the reliability of irrigation water influences the small scale farmer's participation in the management of Gem Rae Irrigation Scheme.
- (iv) As per the findings of the study, a conclusion is made that economic benefits from irrigated agriculture influences small scale farmer's participation in the management of Gem Rae Irrigation Scheme.

### **5.5 Recommendations**

- (i) The study recommends that the participatory establishment of Irrigation Water Users Association (IWUA) rules with active involvement of all farmers to secure the acceptance and ownership of the rules and enhance their participation in the management of the scheme. The government requires to support IWUAs with proper legislation, financing and technical capacity to enhance the development of the necessary by-laws and enforcement structures.
- (ii) The study recommends that Gem Rae Irrigation Scheme and other similar schemes undertake enhanced farmers' sensitization and training on the irrigation to enhance their knowledge and skills in irrigation. It is recommended that the national service provider, National Irrigation Board and other stakeholders make efforts to execute capacity building programs for the community-managed irrigation schemes and thus improve their willingness and capacity to participate in management activities in the scheme.
- (iii) Since irrigation farming is dependent on reliable irrigation water, whose absence or inadequacy would cause failure of crops and subsequent less returns or zero returns, it is recommended that the management of Gem Rae Irrigation Scheme

undertakes activities that ensure access to reliable irrigation water by the small scale farmers to secure and sustain their participation in the management of the schemes.

- (iv) The study recommends that Gem Rae Irrigation Scheme management secures reliable markets for the farmers' produce to ensure predictable and profitable returns that motivate the farmers to participate in the scheme management activities. The scheme management needs to search for strategic financial and marketing partners that will enable the farmers to finance and expand their irrigation farming and align their cropping patterns and schedules with the market needs in order to obtain commensurate economic returns from their investments in irrigated farming.

#### **5.6 Suggestion for further research**

- (i) It is suggested that other factors be investigated in further research studies to establish their influence on the small scale farmers' participation in the management of Gem Rae Irrigation Scheme.
- (ii) This study was limited to a community-managed irrigation scheme in Gem Rae, Nyando Sub-County, Kisumu County and thus there is need for a further study of the small scale farmers' participation in the management of irrigation schemes in other parts of Kenya. This would facilitate further understanding of the issues in the irrigation sector in the entire country.
- (iii) Project financiers particularly governments are majorly concerned with providing full funding for the development and rehabilitation of irrigation infrastructure and transferring the management to the beneficiary farmers. There is a shift in the development strategy that advocates for partial financial contribution from beneficiary farmers in order to secure their participation, ownership and sustainability of the developed infrastructure. There is thus need for a comparative study of the farmers' participation in the management of projects fully funded by government and other projects funded jointly by government and community.

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## **APPENDICES**

### **Appendix I: Letter of transmittal**

## **Appendix II: Research authorization**





### Appendix III: Questionnaire

#### FACTORS INFLUENCING SMALL SCALE FARMERS' PARTICIPATION IN THE MANAGEMENT OF GEM RAE IRRIGATION SCHEME IN NYANDO SUB-COUNTY, KISUMU COUNTY, KENYA

The questionnaire will be divided into three parts: Part A- Demographic Profile; Part B- Small scale farmers' participation in the management of Gem Rae Irrigation Scheme; Part C- Influence of selected factors on the small scale farmers' participation in management of Gem Rae Irrigation Scheme.

#### Part A: Demographic Profile

##### 1. Gender

<b>Gender</b>	<i>Tick where applicable</i>
Male	
Female	

##### 2. Age

<b>Age</b>	<i>Tick where applicable</i>
18-25 years	
26-35 years	
36-45 years	
46- 65 years	

##### 3. Level of education

<b>Highest Level of education</b>	<i>Tick where applicable</i>
No formal education	
Kenya Certificate of Primary Education (KCPE)/ Certificate of Primary Education (CPE)	
Ordinary (KCSE) /Advanced level	
Diploma	
University Degree	

4. Years of irrigated farming experience

<b>Years of irrigated farming experience</b>	<i>Tick where applicable</i>
Less than 2 years	
3-5 years	
6-9 years	
10-15 years	
More than years	

**Part B: Irrigation Water Users Association (IWUA) Rules**

1. Kindly indicate the extent to which the following activities influence your participation in the management of Gem Rae Irrigation Scheme:

5=Very great extent; 4= Great extent; 3=Moderate extent; 2=Little extent; 1= Not at all

<b>Irrigation Water Users Association (IWUA) rules</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
a) Obedience to IWUA water distribution rules					
b) Payment of O & M charges					
c) Attendance of IWUA scheduled meetings					
d) Election of IWUA officials					

2. Please list other activities regarding IWUA rules that influence your participation in the management of Gem Rae Irrigation Scheme and indicate the extent of their influence.

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**Part C: Knowledge and Skills in Irrigation**

1. Kindly indicate the extent to which the following activities influence your participation in the management of Gem Rae Irrigation Scheme:

5=Very great extent; 4= Great extent; 3=Moderate extent; 2=Little extent; 1= Not at all

<b>Knowledge and Skills in Irrigation</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
a) Use of effective and efficient water application methods					
b) Quality routine and preventive maintenance of canals and other water conveyance and distribution infrastructure					
c) Timely repair of breakdowns and damages					
d) Operation of irrigation infrastructure					

2. Please list other activities regarding knowledge and skills in irrigation that influences your participation in the management of Gem Rae Irrigation Scheme and indicate the extent of their influence.

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**Part D: Reliability of Irrigation Water**

1. Kindly indicate the extent to which the following activities influence your participation in the management of Gem Rae Irrigation Scheme:

5=Very great extent; 4= Great extent; 3=Moderate extent; 2=Little extent; 1= Not at all

<b>Reliability of irrigation water</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
a) Availability of irrigation water in adequate quantities					
b) Allocation of irrigation water on time					
c) Distribution of irrigation water to all farmers					
d) Equitability in allocation and distribution of irrigation water to all farmers					

2. Please list other activities regarding reliability of irrigation water that influences your participation in the management of Gem Rae Irrigation Scheme and indicate the extent of their influence.

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**Part E: Economic Benefits from Irrigated Agriculture**

1. Kindly indicate the extent to which the following activities influence your participation in the management of Gem Rae Irrigation Scheme:

5=Very great extent; 4= Great extent; 3=Moderate extent; 2=Little extent; 1= Not at all

<b>Economic Benefits from Irrigated Agriculture</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
a) Contribution of irrigated agriculture to household income					
b) Contribution of irrigated agriculture to household food supplies					
c) Cost of labour in irrigated agriculture					
d) Cost of investments in irrigated agriculture					

2. Please list other activities regarding economic benefits that influence your participation in the management of Gem Rae Irrigation Scheme and indicate the extent of their influence.

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**Part F: Small Scale Farmers' Participation in the Management of Gem Rae Irrigation Scheme in Nyando Sub-County, Kisumu County**

1. Kindly indicate the extent to which you participate in the following activities in Gem Rae Irrigation Scheme.

5=Very great extent; 4= Great extent; 3=Moderate extent; 2=Little extent; 1= Not at all

<b>Small scale farmers' participation in the management of Gem Rae Irrigation Scheme, Nyando, Kisumu County</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
a) Identification of scheme requirements					
b) Contribution and mobilization of financial resources and materials to support scheme activities and running of IWUA					
c) Contribution and mobilization of labour to perform scheme activities					
d) Attending and contributing to scheme management meetings					
e) Development of scheme rules and by-laws					
f) Involvement in the preparation of appropriate cropping schedule					
g) Planning and coordination of scheme operations and maintenance					
h) Implementation of planned scheme activities					
i) Resolution and management of scheme conflicts					
j) Inspection, reporting and control of damages to scheme infrastructure					
k) Monitoring and evaluation of implementation of scheme activities					



**Appendix IV: List of farmers in Gem Rae Irrigation Scheme**

<b>S.No.</b>	<b>Farmer's Name</b>	<b>Gender</b>
1.	Pamela Odhiambo	Female
2.	Petronala Ongaro	Female
3.	Fredrick Amoum	Male
4.	JACOB Ayodo	Male
5.	Tobias Ambogo	Male
6.	Charlies Ochieng'	Male
7.	Kennedy Agembo	Male
8.	James Ochieng'	Male
9.	Monica A. Kere	Female
10.	Eunice Otieno	Female
11.	Alex Ogallo	Male
12.	Lilian Anyango Ouma	Female
13.	Benard Korea	Male
14.	Grace Atieno Ongoro	Female
15.	Grace A Olang	Female
16.	Winnie Atieno Ongaro	Female
17.	Syprose Obara	Female
18.	Hughes Ochieng	Male
19.	Mary Atieno Ochieng	Female
20.	James Omondi Aomo	Male
21.	Annah Ouma Agostino	Female
22.	Eunice Akoth	Female
23.	George Ouru	Male
24.	Dickens Jaoko	Male
25.	Wyclife Owino	Male
26.	Monica Odhiambo	female
27.	Tabither Ochieng	female

28.	Alphonse Adoyo	Male
29.	Malaki Ouma Olang	Male
30.	Penina Amuom	female
31.	Mary A Ochieng	female
32.	Mary Adoyo	female
33.	Joab Otieno	Male
34.	Anna Adhiambo Onyango	female
35.	Frora Atito Nyagol	female
36.	Julia Akeyo Otieno	female
37.	Risper A Akuku	female
38.	Vivian Tracy Juma	female
39.	Billy Opiyo Ongaro	Male
40.	Alex Oketch Ajowi	Male
41.	Grace Akinyi Odhiambo	female
42.	Kennedy Odhiambo Amuom	Male
43.	Patricia Achieng Okeyo	female
44.	Quinter Awino Ouma	female
45.	Juliana Adoyo Amuom	female
46.	Tom Onyango Ongaro	Male
47.	Rose Atieno Danga	female
48.	Wilkister Awiti Omollo	female
49.	Lawrence Ongaro Obumba	Male
50.	Maurice Otieno Amuom	Male
51.	Gladys Achieng Agembo	female
52.	Jane Akinyi Otieno	female
53.	Agnes Akinyi Onyango	female
54.	Mary Osure Okore	female
55.	Rose Atieno Otieno	female
56.	Dinah Akinyi Apiyo	female

57.	Jacinter Atieno Owuor	female
58.	Lydia Atieno Tindi	female
59.	Wilfrada Owuob Oremo	female
60.	Beryl Atieno Onyango	female
61.	Valentine Ochieng Ongaro	Male
62.	David Otieno Lawi	Male
63.	Lilian Anyango Ouma	female
64.	Kingsley Odhiambo Ongaro	Male
65.	Conslata Anyango Osimbo	female
66.	James Amoum Okoko	Male
67.	Phyvince Ayoche Otieno	Male
68.	Moses Odhiambo Agola	Male
69.	Peres Atieno Minudi	female
70.	Nashon Okech Donse	Male
71.	Linet Achieng Oyieko	female
72.	Benson Kwach Owili	Male
73.	Benjamin Okoth	Male
74.	John Otieno Mudho	Male
75.	Josephine Akoth Akungu	female
76.	Mkoma Felix Omondi	Male
77.	Pesila Modi Ochong	female
78.	Kennedy Ogembo Ochong'	Male
79.	David Odhiambo Kwach	Male
80.	Victor Odhiambo Odiénya	Male
81.	Calleb Okoth Amuom	Male
82.	Gordon Ondiek Okello	Male
83.	Secilliah Adhiambo Ondiek	female
84.	Erick Basil Ochieng'	Male
85.	Yunia anyango Owala	female

86.	Tom Otieno Ombwa	Male
87.	Paul Ojwang Ndia	Male
88.	James Mkoma Okoth	Male
89.	Tabitha Juma Okoth	female
90.	Pamela Atieno Omburo	female
91.	Jafred Omware	Male
92.	Patrick Otieno Dulo	Male
93.	Benard Otieno Okwanyo	Male
94.	Syprose Atieno Nyawang'a	female
95.	Maurice Odhiambo Omware	Male
96.	Erick Onyango Olielo	Male
97.	Thomas Onyango Ogolla	Male
98.	Jecktone Akuku Odhong	Male
99.	Gladys Akinyi Akach	female
100.	Calleb Otieno Okang	Male
101.	Jecktone Okeyo Tindi	Male
102.	Joshua Juma Oduar	Male
103.	Gordon Odhiambo	Male
104.	Tobias Ouma Okumu	Male
105.	Monica Adhiambo Gone	female
106.	Eunice Akoth Oriare	female
107.	Lucas Otieno Maina	Male
108.	Loice Akoth Ochieng	female
109.	Janet Omollo Obiero	female
110.	Jane Atieno osano	female
111.	Justus Henry Okombo	Male
112.	Hellen Akinyi Okombo	female
113.	Rose Akinyi Omondi	female
114.	Eunice Atieno Ochieng	female

115.	Lilian Achieng Okoth	female
116.	Esther Adhiambo Juma	female
117.	Festo Ojienda Odero	Male
118.	Ruth Odhiambo	female
119.	Joyce Atieno	female
120.	Benard Odhiambo Ogoya	Male
121.	Sara Awuor Otieno	female
122.	John Odhiambo	Male
123.	Gladys Chepchir Cherep	female
124.	Tabither Otieno Otieno	female
125.	Roseline A Ongaro	female
126.	Aloys Obango Dinda	Male
127.	Aggrey Nyamuok Onyango	Male
128.	Caren Atieno Odingo	female
129.	Mary Atieno Akoko	female
130.	Tom Otieno Mudho	Male
131.	Rose Anyango Olare	female
132.	James Ouma Ogada	Male
133.	Norah A Oloo	female
134.	Lilian Achieng Odoyo	female
135.	Thomas Odhiambo Oloo	Male
136.	Samson Onyango Kwach	Male
137.	Masela Okech	female
138.	Agnes Atieno Kwach	female
139.	Sabastien Odongo Ongaro	Male
140.	Eunice Adhiambo Okite	female
141.	Jane Auma Odiénya	female
142.	Florence Adhiambo Otieno	female
143.	Hellen Akoth Obuya	female

144.	Paul Odhimbo Akoko	Male
145.	Joseph Shikuku Otuo	Male
146.	Joshwa Oloo Ogada	Male
147.	Patrisia Akoth Odhiambo	female
148.	Raphael S. Juma	Male
149.	John Atiang' Obongo'	Male
150.	Caroline Odhiambo	female
151.	Pius Otieno Kwach	Male
152.	Mary Akinyi	female
153.	Florence adhiambo Odiko	female
154.	Judith Awour Owino	female
155.	Denis Migitha	Male
156.	Dickson O. Omuom	Male
157.	Philister A. Oloo	female
158.	Monica Adoyo	female
159.	Joseph Bengo Okombo	Male
160.	John Aluala Obewa	Male
161.	Margaret Akinyi Owalla	female
162.	Paul Kitoto Kwach	Male
163.	Pamela Onyango Opuodho	female
164.	Benard Onyango Opuodho	Male
165.	Jecinter Achieng Onyango	female
166.	Joseph Okunga Oliech	Male
167.	Gidion Otieno Omoro	Male
168.	Ezekiel Otieno Owaka	Male
169.	Domnic Ombonya Omollo	Male
170.	Cephas O Okongo	Male
171.	Rodgers Omondi Osano	Male
172.	Janet Achieng Omondi	female

173.	Elizabeth Agong	female
174.	Charlis Okeyo Amuom	Male
175.	Leonard Oloo Amilo	Male
176.	Atieno Okumu Loice	female
177.	Owino Okumu Hezbon	Male
178.	Meshack Abungu	Male
179.	Tobias Owino Odoyo	Male
180.	Sophia Orano	female
181.	Bazil Kute	Male
182.	Monica Ogembo Ogada	female
183.	David Ongaro Okello	Male
184.	Maurice Odhiambo Omware	Male
185.	Solomon Danga Ogada	Male
186.	Masela Achieng Ongenge	female
187.	Moses Ochieng Bana	Male
188.	Hesbon Nyabola	Male
189.	Judith Ongoro	female
190.	Grace Okello	female
191.	Henry Omondi	Male
192.	Linet Owino Olang	female
193.	Evalin Akeyo Juma	female
194.	Silvans Ayoo Odwar	Male
195.	Josiah Otieno Adhanja	Male
196.	Joachim Okello	Male
197.	Janet Awino	female
198.	Wilkista Okello	female
199.	David Ojwang Agimba	Male
200.	John Pap	
201.	John Agimba Ochong	Male

202.	Jacob Odiénya Nyanungo	Male
203.	George Omondi Lusi	Male
204.	Gidion Kwach Akungu	Male
205.	Sofia Achieng Owalla	female
206.	Jacob Otieno Abur	Male
207.	Benson Otieno Ogada	Male
208.	Caren Anyango George	female
209.	Magret Olare Otwo	female
210.	David Hongo	Male
211.	Joshua Otieno India	Male
212.	Reuben Osimbo	Male
213.	David Okwaro Ogada	Male
214.	Martin Barzil Odhiambo	Male
215.	Moses Omondi Agembo	Male
216.	Syprose Atieno Odiénya	female
217.	Rose Akoth Ochieng'	female
218.	Reuben Magak Okoth	Male
219.	Damaris Odumbe	female
220.	Samwel Ouko	Male
221.	Daniel Odhiambo	Male
222.	Phares Ogallo	Male
223.	Damar Atieno osimbo	Male
224.	Christine Otuga	female
225.	Monicah Achieng' Munga	female
226.	Pamela Auma Atulo	female
227.	Selestine Aoko Odhiambo	female
228.	Erastus gone obongo'	Male
229.	Benard Okoth Okeyo	Male
230.	Paul Ochieng Wamwara	Male



231.	florence Akoth jalango'	female
232.	Edward Kola Mrenga	Male
233.	Hellen Ogutu Ogone	female
234.	George Akoth Odoyo	Male
235.	Stephene Onyango Ogada	Male
236.	Caleb Okello Ochieng'	Male
237.	Maurice Ochieng' Apiyo	Male
238.	Grace Atieno Otieno	female
239.	Mary Akongo'	female
240.	Felix Odhiambo	Male
241.	Calleb Omondi	Male
242.	Norah Ojwang'	female
243.	Isaiah Omondi Amenya	Male
244.	Alex Juma Otuo	Male
245.	Amos Ogega Arach	Male
246.	Felix Odhiambo Otieno	Male
247.	Reonard Odhiambo Luci	Male
248.	Eva A. Amimo	female
249.	Gladys Agembo	female
250.	David Adoda	Male
251.	David Jowi Arach	Male
252.	Ruth O. Agembo	female
253.	Elsa Auma Odongo	female
254.	Emma Awour Atieno	female
255.	Leonida Clare Otieno	female
256.	Joshua Omondi ayoche	Male
257.	quinter Achieng' Awino	female
258.	Mike Otieno Omogo	Male
259.	George Odhiambo Mbuya	Male

260.	George Omondi Agembo	Male
261.	Paul Agembo	Male
262.	Mathews Onyango	Male
263.	Phoebe Guya Agembo	Female
264.	Pauline Anyango Odhiambo	Female
265.	Nicholous Odhiambo	Male
266.	George Okoth Odoyo	Male
267.	Susan Adoyo Arach	Female
268.	Maurine Atieno Kola	Female
269.	Erick Owaka adie	Male
270.	Samuel Otieno Angonga'	Male
271.	Rose Achieng' Otieno	Female
272.	Mary Atieno Okune	Female
273.	Elsa Aoko Luci	Female
274.	Benter Akinyi Ajuoga	Female
275.	Peter Milago	Male
276.	David Amimo	Male
277.	Elisha Olando	Male
278.	Silpher Owuocha	Female
279.	Beatrice Anyago Owili	Female
280.	Denis A. Agola	Male
281.	Emily Awino Atito	Female
282.	sylvanus opepo	Male
283.	Joseph Ayoo	Male
284.	Gerphas Adie	Male
285.	John Atieno Oloo	Male
286.	John Odongo Onuonga'	Male
287.	Margaret Obongo'	Female
288.	Lawrence Otieno	Male

289.	Jemima A. Atiang'	Female
290.	John Ouma Agola	Male
291.	Jared Odhiambo	Male
292.	Caroline Awuor	Female
293.	Vivian Awuor Odiero	Female
294.	Henry Ogaga Okwanyo	Male
295.	Owino Isaiah Orondo	Male
296.	Pamela Adhiambo Liech	Female
297.	Lorna Atieno Olingo	Female
298.	Washington Afwata Osana	Male
299.	Alice Awuor Otieno	Female
300.	Barnabas Ochieng Otuo	Male
301.	Benson Ouma Juma	Male
302.	Rosebela Osuri Otieno	Male
303.	Hulda Akeyo Ogada	Female
304.	Carren Nyamolo Okelo	Female
305.	Grace Akinyi Amilo	Female
306.	Siprose Atieno Odieny	Female
307.	Teresa Ondiek	Female
308.	Charles Owino Opiyo	Male
309.	Milka Auma Ochieng	Female
310.	Jane Okello	Female
311.	Mary Auma Opuge	Female
312.	Edwin Ouma Amuom	Male
313.	Margret Adhiambo Atiang'	Female
314.	Mary Ndalo	Female
315.	Jane Miruka	Female
316.	Ruth Juma	Female
317.	Salina Maina	Female

318.	Wyclife Ouru	Male
319.	Mary Atieno Onyango	Female
320.	Paul Munga'	Male
321.	Mary Ouma Adongo	Female
322.	Ruth Onyango	Female
323.	Mary Akinyi Adoda	Female
324.	Monica Abuto	Female
325.	Peres Oremo	Female
326.	Hellen Odhiambo	Female
327.	Jacob Owaka	Male
328.	Albert Omondi	Male
329.	Geofry Owino	Male
330.	Denis Opiyo	Male
331.	Evans Onyango	Male
332.	Paul Otieno	Male
333.	Millicent Anyango Muga	Male
334.	David Ochieng' Juma	Male
335.	Janeth Ochieng'	Female
336.	Philip Owino Juma	Male
337.	Sospeter Amollo	Male
338.	Mary Akinyi Amilo	Female
339.	Ruth Anyango Otieno	Female
340.	Penina Achieng'	Female
341.	Dorine Achieng' Oloo	Female
342.	Edwin Onyango Juma	Male
343.	Erick Juma	Male
344.	Paulina Atieno Juma	Female
345.	Owuor Veronica	Female
346.	Lilian Akinyi Juma	Female

347.	Paulina Oga Obumba	Female
348.	Millicent Aluoch	Female
349.	Ishah Ogingo	Male
350.	Musa Mbata	Male
351.	Sophy Atieno Orawo	Female
352.	Pamela Ogalo	Female
353.	Esau Otieno	Male
354.	Hillary Omondi	Male
355.	Stephene Okongo'	Male
356.	Gladys Afwata	Female
357.	Grace Atieno Otieno	Female
358.	Jacinta Akinyi Odongo	Female
359.	Siprine Adhiambo Twala	Female
360.	Agnes Apiyo Obewa	Female
361.	Pamela Atieno Omburo	Female
362.	Christine Auma Agengo	Female
363.	Benter Omollo	Female
364.	Easther Achieng' Otieno	Female
365.	George Otieno Deya	Male
366.	Susan Awuor Otieno	Female
367.	Domine Akinyi Amwom	Female
368.	Alfred Otieno Odhiambo	Male
369.	Pamela Ogalo	Female
370.	Sulmena Duya Juma	Female
371.	Eunice Ogelo	Female
372.	Sara Evance Juma Auma	Female
373.	Florence Anyango Ombiri	Female
374.	Monica Anyango Aluoch	Female
375.	Milka Achieng Otieno	Female

376.	Jane Anyuka	Female
377.	Penina Atieno Olero	Female
378.	Nicholaz Atinda Oloro	Male
379.	Elizabeth O Odhiambo	Female
380.	Mitamita Martin Edwards	Male
381.	Risper Akoth Ouko	Female
382.	Dishon O Olwal	Male
383.	Dorcas Mita Amboko	Female
384.	Willis Otieno Olwal	Male
385.	Roy Owino	Male
386.	Filgona A Mgenya	Female
387.	Elisha Kembo	Male
388.	Jacob O Oloo	Male
389.	John K Nyakoe	Male
390.	Gordon Obura	Male
391.	Willian Ochieng	Male
392.	Filmon Audi	Male
393.	Thomas Abung	Male
394.	Michael Agidi	Male
395.	Kambarage Magero	Male
396.	Phelemon Oyoo	Male
397.	George Odoyo	Male
398.	Philip Juma	Male
399.	Benter Atieno	Female
400.	Gordon Bonde	Male
401.	Maurice Ouma	Male
402.	Samuel Juma	Male
403.	Joel Juma	Male
404.	Paul Oyoo	Male

405.	Elija Owino	Male
406.	Crisphen Obala	Male
407.	Peres Akinyi	Female
408.	Hellen Makuri	Female
409.	Festus Awili	Male
410.	Reagan O. Sawo	Male
411.	Mary Akeyo Muga	Female
412.	Petonaca Auma	Female
413.	Washington Oyoo	Male
414.	Shadrack O Otieno	Male
415.	Alice A Apamo	Female
416.	Phoebe A Abok	Female
417.	Philip Ochola Ndinya	Male
418.	Samson O Ajwang	Male
419.	Jane Adoyo Oguta	Female
420.	Samson O Sawo	Male
421.	Blastus Alai	Male
422.	Solomon G Onguka	Male
423.	Edward Rao	Male
424.	Julius Nyawara	Male
425.	Damaris Awino Okelo	Female
426.	Ondijo Sao	Male
427.	George Otieno Ondijo	Male
428.	Benter Owiti Okutu	Female
429.	siprian A. Kopiyo	Female
430.	Mary Awiti Dudi	Female
431.	Rose Adhiambo Okungu	Female
432.	Margaret Adhiambo Osumba	Female
433.	George Boyudeh Kopiyo	Male

434.	Mary Mohamed	Female
435.	Caroline Ochieng	Female
436.	Grace A. Juma	Female
437.	Mildred Ouru	Female
438.	Jared Ochieng	Male
439.	Millicent A. Aoko	Female
440.	Peter Owuor	Male
441.	Wyclife Otieno	Male
442.	Beline Atieno Ombewa	Female
443.	George Odoyo	Male
444.	Paul Otieno Orimba	Male
445.	Domtila Ayoo Bolo	Female
446.	Collins Ouma Okito	Male
447.	Kennedy Otieno Okito	Male
448.	Addah Adhiambo Odhiambo	Female
449.	Janet Akumu	Female
450.	Musa Aura	Male
451.	David Osiany Sawo	Male
452.	Mornica Achieng	Female
453.	Calleb Otio Aura	Male
454.	Elly Nyakore	Male
455.	Kefas O. Amolo	Male
456.	Hellen A.Ojuang'	Female
457.	Rovin O. Nyabondo	Male
458.	Hellen Okwaro	Female
459.	John Ochieng Ogwang	Male
460.	Margaret Nyarath	Male
461.	Leonard Onyango	Male
462.	Ben Anyuka	Male



463.	John Ajuang	Male
464.	Alfred Kisia Ateto	Male
465.	Washington Munga	Male
466.	Samson Alosi Gilo	Male
467.	Elsa Atieno Omondi	Female
468.	Jane Achola Omwai	Female
469.	Mary Nyatere Opiyo	Female
470.	Charles Okinyi	Male
471.	Tabitha Omiti	Female
472.	Agness Akinyi Ogina	Female
473.	Justo Ochieng Osenya	Male
474.	James Okuku	Male
475.	Dorine Ateto	Female
476.	Safira Juma Ogogo	Female
477.	Arthur Olang	Male
478.	John Omwai Ongocho	Male
479.	Isaiah Goro Otieno	Male
480.	Edith Akeyo Ajwang	Female