

**INFLUENCE OF AGRICULTURAL GOVERNANCE ON FOOD SECURITY: A  
STUDY OF FARMERS IN BURA IRRIGATION AND SETTLEMENT SCHEME  
IN TANA- RIVER COUNTY, KENYA**

**HABIBA GUYATO RAMADHAN**

**A thesis submitted in Partial fulfillment of the requirements for the Degree of  
Environmental Studies (Community Development) of Pwani University**

**©MAY, 2017**

**DECLARATION**

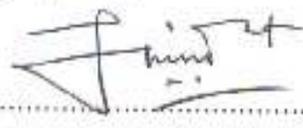
This thesis is my original work and has not been presented for an award of a Degree or Diploma in any other University or institution .

Signed .....  ..... Date ..... 13/09/017

Habiba Guyato Ramadhan  
REG NO: N50/PU/2188/13

**Declaration by Supervisors**

We confirm that this work has been done by the candidate under our guidance as the University supervisors

Sign .....  ..... Date ..... 16/9/17

Prof. Dr. Halimu Suleiman Shauri  
Department of Social Sciences  
Pwani University (PU) Kilifi

Sign .....  ..... Date ..... 17/9/2017

Dr. Annie Hilda Ong'ayo  
Department of Community Development  
Pwani University (PU) Kilifi

**DEDICATION**

I dedicate this work to my beloved husband, Osma Juma, my son Suheib and my parents Ramadhan Dabale and Asha for the support and encouragement.

## **ACKNOWLEDGEMENT**

To begin with, I thank the almighty God for giving me health, strength, courage and patience to have this thesis complete. I would also like to thank my supervisors Prof. Dr. Halimu Suleiman Shauri and Dr. Annie Hilda Ong'ayo for their maximum, untiring professional guidance and criticism in the entire study. Further I appreciate my sponsors, the Kenya Coastal Development Project (KCDP) for the financial support. I am thankful to the Dean, Dr. Maarifa Mwakumanya, staff and my fellow students in the School of Environmental and Earth Sciences for their significant support. I would like to thank the farmers in BISS for their willingness to take part in this study. I further express my sincere gratitude to my family for their encouragement and support. While unable to mention every person who contributed to the success of this work, I finally express my sincere gratitude to each one of them.

## ABSTRACT

Agricultural governance constitutes the augmentation of growth and development of agriculture and allied sectors. Agricultural governance is managed through a set of goals, policy implementation, stakeholder involvement and technology application for enhanced agricultural productivity. As a construct, it is adopted in the irrigation sub-sector which has greater potential to increase crop productivity and combat food insecurity. Despite the foregoing, documentation of its contributions to crop productivity for realization of food security in public irrigation schemes remains largely scanty. This study sought to analyze the influence of agricultural governance on household food security among tenant farmers in Bura Irrigation and Settlement Scheme (BISS). Descriptive survey design was used to carry out the study. Purposive and systematic random sampling techniques were used to obtain a sample of 4 key informants and 225 tenant farmers. A semi-structured interview schedule and a Focus Group Discussion (FGD) guide were used to collect the data. The collected data was analyzed using descriptive statistics with the help of the Statistical Package for Social Sciences (SPSS) and Minitab. Ordinal logistic regression was used to determine the influence of agricultural governance factors on food security while qualitative data was analysed thematically guided by the study objectives. The results indicated low status of the studied aspects of agricultural governance in the scheme whereas food security status of the farmers was generally poor. Regression results reveal that there is a significant relationship between food security and three of the studied aspects of agricultural governance; policy on land reallocation, achievement of the objective on improving food crop production in the scheme and on the farmer involvement in the functioning of the Kenya seed company presented with the p values  $< 0.05$  (0.03, 0.02 and 0.002). The study concludes that the implementation of agricultural governance in BISS was low. Food security situations among the residents in Bura irrigation and settlement scheme was a major concern. The main challenge in the production of both food and cash crop in BISS was water shortage. The study recommends establishing of strategies for ensuring full implementation of all the existing policies and setting up of new ones to enable the residents to achieve food security in BISS. There is need for farmers in BISS to adopt crop diversification to improve chances of securing food and income of the household. Food crop production in the scheme, Land tenure system and the extent of farmer involvement in the seed supply by Kenya Seed Company are the significant areas of concern to be emphasized. The study recommends that proper investment should be done in water department to finance the acquisition of modern equipment to ensure constant and efficient supply of water to all farms.

## TABLE OF CONTENTS

DECLARATION .....	<b>Error! Bookmark not defined.</b>
DEDICATION .....	ii
ACKNOWLEDGEMENT .....	iv
ABSTRACT .....	v
TABLE OF CONTENTS .....	vi
LIST OF TABLES .....	ix
LIST OF FIGURES .....	x
LIST OF ABBREVIATIONS AND ACRONYMS .....	xi
CHAPTER ONE .....	1
INTRODUCTION .....	1
1.1Background Information.....	1
1.2Statement of the Problem .....	3
1.3Purpose of the Study .....	4
1.4Objectives of the Study.....	4
1.5Research Questions .....	5
1.6Significance of the Study.....	5
1.7Scope of the Study.....	5
1.8Limitations of the Study .....	6
1.9Delimitations of the Study.....	6
1.10Assumptions of the Study.....	6
1.11Definition of Terms.....	7
CHAPTER TWO .....	10
LITERATURE REVIEW .....	10
2.1Introduction .....	10
2.2Status of Agricultural Governance Factors .....	10
2.4Challenges in Implementing Responsive Agricultural Governance to Food Security .....	21
2.5Summary of Literature Review and Knowledge Gaps .....	22
2.6Theoretical and the Conceptual Frameworks for the Study.....	24
CHAPTER THREE .....	33

RESEARCH METHODOLOGY .....	33
3.1 Introduction .....	33
3.2 Study Site .....	33
3.3 Research Design .....	34
3.4 Target Population .....	34
3.5 Accessible Population .....	34
3.6 Sampling Procedure .....	35
3.7 Sample Size .....	35
3.8 Instrumentation .....	36
3.9 Validity .....	37
3.10 Reliability .....	37
3.11 Data Collection Procedure .....	38
3.12 Data Analysis and Presentation .....	39
3.13 Ethical Considerations .....	40
CHAPTER FOUR .....	41
RESULTS AND DISCUSSIONS .....	41
4.1 Introduction .....	41
4.2 Demographic Characteristics of the Respondents .....	41
4.3 Status of Agricultural Governance Factors in BISS .....	45
4.4 Influence of Agricultural Governance Factors on Food Security .....	57
4.5 Challenges to Effective Implementation of Agricultural Governance .....	72
CHAPTER FIVE .....	82
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS .....	82
5.1 Introduction .....	82
5.2 Summary of the Study and the Key Findings Based on the Study Objectives .....	82
5.3 Conclusions .....	83
5.4 Recommendations .....	84
REFERENCES .....	85

APPENDICES .....	102
APPENDIX 1: INFORMATION SHEET .....	102
APPENDIX 2: INFORMED CONSENT .....	103
APPENDIX 3: INTERVIEW SCHEDULE .....	104
APPENDIX 4: FOCUSED GROUP DISCUSSION GUIDE .....	114
APPENDIX 5: KEY INFORMANTS INTERVIEW SCHEDULE.....	115
APPENDIX 6: LAUNCH OF COTTON PLANTING EXERCISE.....	117
APPENDIX 8: COST OF PRODUCING 1.5 ACRES OF SEED MAIZE IN BURA .....	119

## LIST OF TABLES

Table 1: Operational definition of the key variables .....	30
Table 2: Proportionate Sampling of Villages.....	36
Table 3: Demographic characteristics of the respondents .....	44
Table 4: Respondents' awareness of the agricultural governance factors in BISS.....	45
Table 5: Components of Agricultural governance factors in BISS .....	46
Table 6: Households' Maize yields for cash and food crops per 0.65 ha (1.6 acres) .....	49
Table 7: Extent of policy Implementation in BISS.....	50
Table 8: Farmer's involvement in the functioning of the respective stakeholders in BISS .....	53
Table 9: Households access of technology facilities .....	55
Table 10: Extent of Technology adoption among the farmers in BISS .....	56
Table 11: Variety of food crops obtained directly from the farm in each cropping season .....	57
Table 12: Quantity of food harvested and stored for consumption .....	60
Table 13: Stakeholder involvement and the magnitude of food security concerns .....	64
Table 14: Cultivated Land size in relation to land mechanization.....	66
Table 15: Maize yields in Kgs in relation to the use of farm inputs.....	67
Table 16: Covariates coefficients for the logistic regression model.....	69
Table 17: Challenges on implementation of cash crop and food crop policy.....	74
Table 18: Challenges of implementing the vegetable cultivation policy.....	75
Table 19: Challenges facing famer participation in scheme operations .....	77
Table 20: Challenges facing technology adoption in BISS .....	80

**LIST OF FIGURES**

Figure 1: Conceptual framework depicting the influence of the agricultural governance factors on food security.....	28
Figure 2: Household income from cash crop produced once annually.....	61
Figure 3: Daily amount of money in KES spent on food consumption in the household .....	62
Figure 4: Average number of meals consumed in the household a day .....	68
Figure 5: Challenges of achievement of the set objectives in BISS .....	72

**LIST OF ABBREVIATIONS AND ACRONYMS**

AFC	Agricultural Finance Co-operation
AfDB	African Development Bank
AFFM	African Fertilizer Financing Mechanism
ASDS	Agricultural Sector Development Strategy
ASK	Agricultural Society of Kenya
AU	African Union
BISS	Bura Irrigation and Settlement Scheme
CAADP	Comprehensive African Agricultural Development Program
CAP	Common Agriculture Policy
CBD	Convention on Biological Diversity
CBOs	Community Based Organizations
EAC	East African Community
ERC	Ethical Review Committee
ERS	Economic Recovery Strategy
FAO	Food and Agriculture Organization
FFHWK	Freedom from Hunger Walk Kenya
FGDs	Focus Group Discussions
GATT	Global Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GoK	Government of Kenya
GPAFS	Global Partnership for Agriculture and Food Security
GSE	General Systems Theory

GTP	Global Trade Policy
HHS	Household Hunger Scale
HLTF	High Level Task Force on the Food Security Crises
IFAD	International Foundation for Agricultural Development
IFPRI	International Food Policy Research Institute
IPPC	International Plant Protection Convention
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
KALRO	Kenya Agricultural and Livestock Research Organization
KIIs	Key Informant Interviews
KSC	Kenya Seed Company
MDGs	Millennium Development Goals
MOA	Ministry of Agriculture
NACOSTI	National Commission for Science, Technology and Innovation
NDMA	National Drought Management Authority
NEPAD	New Partnership for Africa's Development
NGOs	Non-Governmental Organizations
NIB	National Irrigation Board
PAFO	Pan African Farmers Organization
PU	Pwani University
SADC	South African Development Community
SDGs	Sustainable Development Goals
SRA	Strategy for Revitalization of Agriculture
UNCTAD	United Nations Conference on Trade and Development

UNEP	United Nations Environmental Programme
WB	World Bank
WDR	World Development Report
WEF	World Economic Forum
WFP	World Food Programme
WTO	World Trade Organization

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background Information

Agricultural governance plays a significant role in determining agricultural productivity for enhanced food security. This is enhanced through capitalizing on increasing yields as opposed to mere cropland expansion (Rachel, 2012). It also has the ability to improve the operation of institutions for the attainment of basic service provision to the poor, eradicating poverty and promoting development thus making agriculture more responsive to the development agenda (Birner, 2007). Agricultural governance is widely accepted as the means to ensuring productivity in the agricultural sector in general (Qureshi *et al.* 2015). The significant role that governance plays in contributing to development has been recognized by international development partners (World Bank, 2007a). In fact, it has been mainstreamed in all development sectors of both developed and developing countries (Dasgupta and Roy, 2011).

Governance of the agriculture sector has witness the establishment of government managed public irrigation schemes which play significant role in social economic contributions (Ngigi, 2002;Girma, 2011). Investments in the irrigation infrastructure through the government initiated programs have increased the agricultural production potentials and despite that a switch from low value subsistence production to high value market oriented production (Huang *et al.* 2006). Increase in yields per hectare and the expansion of area under cultivation is also witnessed and this has enhanced an increased farm yields, increased household income, employment opportunities and foreign exchange (Awulachew *et al.* 2005; Singh *et al.* 2009; Girma, 2011). ). Further the government investment in irrigation infrastructure is a vehicle to move the poor people from ill-being to well-being (Dereje and Desale, 2016). It has direct contributions into the food security realm as the poor farmers are able to increase their income, diversify the income base and therefore reducing the

vulnerability caused by the seasonality of agricultural production as well as external shocks (Ibid).

Agricultural yields have increased significantly as improvements in irrigation technology and management have been developed and implemented through government policies and international programs (Birendra *et al.* 2011; TWDB, 2001;2011). However, lack of global policy to enhance a comprehensive agricultural governance system for international policy action and agenda in agriculture, irrigation and food security has greatly contributed to food insecurity concerns with only 20 percent of land kept under irrigation globally (Birner and Von Braun, 2016; FAO, 2011). The agricultural sector per capita production has not kept pace with the increased food demands coined with the growing population of the world and therefore food insecurity remains a leading challenge for the 21<sup>st</sup> Century (Birendra *et al.* 2011; Miruka *et al.*2012; Qureshi *et al.* 2015). Food insecurity continues to pose threats to both social and economic pillars of society compounded by unemployment, malnutrition and displacement of a significant population of the world (Food and Agricultural Organization (FAO) 2014a; World Economic Forum (WEF), 2014; Mckeen, 2011a). Indeed, it is a challenge to the ever expanding human population in the context of competing land and water uses, environmental degradation, inequitable resource distribution and attainment of the goal of world zero hunger by 2050 (WEF, 2014).

Globally, about 870 million people fail to access sufficient food, of these 805 million are estimated to be chronically undernourished(FAO, 2012; 2015). This is despite the huge global actions against hunger such as the Millennium Declaration and the World Food Summit (FAO, 2012; International Foundation for Agriculture Development(IFAD), 2011). Regionally, Africa hosts 28 out of the 35 countries that require external assistance of food (FAO, 2013). In fact, one out of four persons in Sub-Saharan Africa is undernourished (FAO, 2006; FAO, 2012; African Development Bank (ADB), 2012). In Kenya, about half of the

Kenyan population is food insecure, among whom around 3.5 million go hungry or are malnourished (Olielo, 2013).

Tana River County, among other counties including Wajir, Mandera, Moyale, Marsabit, Turkana and Mwingi are the food crises zones in Kenya (Olielo, 2013; Government of Kenya (GoK), 2012a). Bura Irrigation and Settlement Scheme found in Hirimani ward of Bura Sub-county in Tana River County is not exceptional to food crisis. This area is ever prone to droughts and seasonal flooding which greatly undermines the food production system. This contributes to perennial food crisis and people's displacement in the area. Consequently, the vegetation conditions in the county continue to deteriorate with Bura and Galole Sub-Counties in the moderate drought band but close to the severe category (GoK, 2014).

This alarming situation of food insecurity calls for good governance of the agricultural sector especially in developing and less developed countries which still depend on agriculture for the biggest percentage of their economy (World Bank, 2007a). Agricultural governance in its respective dimensions includes; the set objectives, involvement of stakeholders in the form of public institutions the implemented policies and technology adoption. These agricultural governance factors contribute greatly to agricultural productivity for realization of food security. Thus, the need to assess the implication of these components on food security among tenant farmers in BISS

## **1.2 Statement of the Problem**

Achievement of food security is a concern to many partners such as FAO and IFAD organizations concerned in food and agriculture related agendas. This concern has been addressed through ensuring effective functioning of institutions realized through attainment of the set goals, policy implementation, the application of technology and scientific innovations and active participation of all stakeholders. In Kenya this is witnessed through

the established public irrigation schemes with operational governance systems including the National Irrigation Act which defines the operations of a National Irrigation Board.

Bura Irrigation and Settlement Scheme, one of the public irrigation schemes in Kenya, has a governance system in place operating through the NIB which is meant to ensure effective implementation of policies, adherence to acts and regulations, ensuring application of technology and providing support services to the tenant farmers for increased food and cash crop productivity. However, the community that is settled in Bura Irrigation and Settlement Scheme continues to experience food insecurity due to erratic food production from the scheme. Nonetheless information on the influence of agricultural governance on agricultural productivity and food security among tenant farmers in the public irrigation and settlement schemes is limited. Importantly, it is anticipated that a better understanding of the elements of agricultural governance including; the set targets, policies, stakeholders and technology adoption might offer a better explanation of household food security among tenant farmers in public irrigation schemes.

### **1.3 Purpose of the Study**

The purpose of the study was to assess the influence of agricultural governance on food security among farmers in Bura Irrigation and Settlement Scheme in Tana River County, Kenya.

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

The research was guided by the following objectives:

- i) To establish the status of agricultural governance factors in Bura Irrigation and Settlement Scheme
- ii) To establish the influence of agricultural governance factors on food security among farmers within Bura Irrigation and Settlement Scheme

- iii) To establish challenges to the implementation of responsive agricultural governance to food security among farmers in Bura Irrigation Scheme

### **1.5 Research Questions**

- i) What is the status of agricultural governance in Bura Irrigation and Settlement Scheme?
- ii) What is the influence of agricultural governance factors on food security among farmers in Bura Irrigation and Settlement Scheme?
- iii) What are the challenges to the implementation of agricultural governance that is responsive to food security among farmers in Bura Irrigation and Settlement Scheme?

### **1.6 Significance of the Study**

The policy makers and stakeholders may use the findings of the study as useful tool for introducing reforms in the governance of the agricultural sector especially in public irrigation schemes. The study might also provide insights on the roles that the stakeholders play in determining household food security and therefore trigger prioritization of reforms in the agricultural sector for the realization of food security among farmers. The study may also provide useful knowledge and frameworks for guiding future research in this field of agricultural governance and its influence on food security, which is still nascent.

### **1.7 Scope of the Study**

The study was carried out among the tenant farmers found in BISS. This is because these farmers interact directly with the agricultural activities in the scheme and therefore they could provide useful information for the research. It was then extended to involve four specialists from the governing institutions in the scheme as these group was anticipated to provide reliable information on issues of governance ranging from the goals of the scheme, implementation of policies and stakeholders involved in the running of the scheme. The

research focused only on assessing agricultural governance and its influence on food security among tenant farmers in Bura Irrigation Scheme.

### **1.8 Limitations of the Study**

Busy schedule during farming activities were considered possible limitations to farmers' participation in this research. To address this, farmers were visited at their farms in a bid to collect information without disrupting their farming activities. Where the farmers were not found at the residential village, it was prudent then to pick on the next person in the sample frame.

Key informants could also limit the study out of a busy schedule in the day they were required for the research. To overcome this, the researcher looked for another appointment and requested for a representative in some cases.

### **1.9 Delimitations of the Study**

The study focused only on studying the influence of agricultural governance on household food security among tenant farmers within the BISS and not any other group of people found in the scheme region. This group was anticipated to provide useful information required for this study.

### **1.10 Assumptions of the Study**

The study was based on the assumptions that:

- i. The targeted respondents for the study were available all through during data collection process to give out the information required in this study
- ii. The derived sample size of this study was the actual representation of the tenant farmers and organizations found in Bura irrigation scheme.

## **1.11 Definition of Terms**

### **Active involvement**

It is defined as a direct and interactive participation processes since planning, decision making to implementation by all the concerned people and entities (Green, 2013).

This study defines active involvement as the ability to engage a person, group of people or institutional experts directly and maximally to a program or a project as from planning face, decision making process, ownership and implementation face.

### **Agricultural Governance**

Agricultural governance may be defined as the augmentation of growth and development of agriculture and allied sectors and managing the processes through an effective functioning of institutions, the application of technology and scientific innovations, providing support services, the implementation of policies, adherence to acts and regulations and active participation of all involved stakeholders (Dasgupta & Roy, 2011; Das, 2015).

In line with the definition above, this study conceptualize agricultural governance to denote the set goals in the agriculture sector attained through the implementation of the established policies by the key stakeholders to enhance service provision to the public.

### **Agricultural governance factors**

This study conceptualizes agricultural governance factors to denote the established mechanisms and platforms in the forms of global goals, technology and innovation, policy frameworks and the organizations which form the building blocks of the strengthened and redesigned agriculture system.

### **Food accessibility**

Is conceptualized in terms of economic access measured by the household income and the physical access measured using the food variety and food stored after harvest

**Food availability**

Food availability denotes the ability to access food that is socially and morally accepted at any given time. This dimension of food security is determined by the income purchasing power, local market trends and the local production status (Boon, 2009).

In this study, food availability means presence of food obtained either directly from the farm or from the market.

**Food Security**

Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (Boon, 2009; FAO, 2010; GoK, 2012).

This study draws food security from these definitions and denotes food security as the presence of two main components or variables; food availability and food stability. Therefore in this study, food security means the ability to acquire a stable access to the available food.

**Food stability**

Food stability is the access and availability of the required food by the respective group at any given time (Boon, 2009)

Food stability in this study denotes the ability to acquire sufficient amount of food in a household over a given period of time.

**Governance**

Governance has been defined as the exercise of economic, political, and administrative authority to manage a country's affairs at all levels (Birner, 2007). It is also the exercising and facilitating of authority within a framework defined and protected by law with the goal of providing common public goods and services as efficiently as possible (Kuafman, Kray, and Mastruzzi, 2007; Dasgupta & Roy, 2011; Das, 2015). In this study governance is defined as the exercising of authority within the limits of the established laws and guidelines to influence public.

**Passive involvement**

Passive involvement denotes an indirect participation which has limited interaction in some earlier processes but until the late process for finalizing the already structured plans and decision (Green, 2013).

This term is conceptualized as a process of engaging people and experts indirectly into the outcome of a programme and failing to recognize such people into other programme phases but only into the later stage of implementing the plans and decisions made.

**Policies** are the guidelines, rules, regulations, laws and principle that guide set of action (The Food Security Projects of the Nova Scotia Nutrition Council and Atlantic Health Promotion Research Centre, 2005). This is the accepted definition for this study.

**Stakeholders** are defined as any established group or individuals who can affect or are affected by the achievement of organization's objectives (Fontain, Haarman and Sahmid, 2006). It also means those groups who are vital to the survival and success of a corporation (Freeman, 2004). Accordingly, stakeholders in this study constitutes the established public institutions in the form of ministries, parastatol and commercial entities, the Non-governmental Organizations (NGOs), Community Based Organizations(CBOs), private investors and individuals concerned in running the agriculture sector.

**Tertiary education**

It is a level or stage of studies beyond secondary school (Brunner, Santiago, Guadila, Gerlach and Velho, 2006). This is the accepted definition for this study.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

The chapter examines the status of agricultural governance factors by analyzing the objectives of agricultural governance, the established policies, the stakeholders and institutions involved in the implementation of the governing policies in the agricultural sector and above all the technology adopted in promoting agricultural productivity. Studies on the influence of agricultural governance on food security are also reviewed to establish gaps and challenges in the implementation of agricultural governance that is responsive to food security. Further, a summary of knowledge gaps and the literature reviewed in this chapter is presented. The chapter concludes by discussing the theory and the conceptual framework adopted for the study.

#### **2.2 Status of Agricultural Governance Factors**

Agricultural governance factors denotes the objectives or targets in the agriculture sector, the established policies, rules, laws and regulations for attaining the sector's set targets (World Bank, 2007a). It also involves the concerned stakeholders pooling resources for the realization of agriculture for development agenda (Ibid). It extends to the use of technology in the agriculture sector geared towards maximizing production (Dasgupta & Roy, 2011). This section highlights these factors based from the global to regional trends. Further the section provides a critic on the functionality and implementation of the agricultural governance factors in place in order to establish the status of the respective agricultural governance factors.

##### **2.2.1 Objectives of agricultural governance**

In the attempt to understand the objectives of agricultural governance, IFAD (2011) reports that the structures governing food production and the agricultural sector commit all nations

of the world to prioritize the realization of food security. This is not just as a pillar for all forms of development but also a fundamental right to decent human life. In this regard, the global, regional and national objectives of agricultural governance may take the forms of either: 1) direct alleviation of hunger, 2) improving nutrition, health and safety 3) food production, conservation and distribution, 4) improved technology and scientific knowledge, 5) market reforms, 6) reforming agrarian systems and 7) addressing problems of food importing and exporting countries to ensure equity (Biermann, 2009; IFAD, 2011). Achievement of this objective remains largely doubted with a good population of the world experiencing food related challenges in almost all the continents with estimates indicating that one among nine people in the world go without food every day (FAO, 2015). This indicates poor status on the achievement of the set objective in governance of the agricultural sector. Consequently, the world remains ill prepared for managing global agriculture, food system and nutrition deficiency in the twenty first century (Von Braun et al., 2014).

BISS in the Coastal Kenya is not exceptional with regard to these aims. Consequently, increasing food and cash-crop production (maize and cotton, respectively) is among the set goals for the project establishment (Ruigu, 1988; National Irrigation Board (NIB), 2015). However, limited and non-focused attempts have been made to document the attainment of this objective in the scheme. Accordingly, the present study focuses on the achievement of this objective in the scheme.

### **2.2.2 Policies Implemented in Agricultural Governance**

Policies can take the form of treaties, conventions, declarations and strategies implemented through established institutions and bodies at the global, regional, national and local levels. The Global treaties include the United Nations' (UN) Declaration on Human Rights in 1948, the International Covenant for Social, Cultural and Economic rights of 1976, the Rio Declaration of 1992 and the UN Millennium Declaration of the year 2000. These are all aimed at making food security a fundamental right, a state mandate, a pillar for sustainable

development and a reference for halving the number of people suffering from hunger by 2015 (Das, 2015; African Union (AU), 2014). Others such as, the Global Trade Policy (GTP), Common Agriculture Policy (CAP) for the support and protection of farming activities and the International Plant Protection Convention (IPPC), the Convention on Biological Diversity (CBD) and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). These treaties promote the conservation of all forms of life including crops, livestock and wildlife from which man derives his or her food either directly or indirectly (Qureshi et al. 2015; Miruka *et al.* 2012). Significant to note is the Millennium Development Goals (MDGs) which has bounded agricultural sector towards attainment of MDG 1 (Page, 2013). All these frameworks were established through international congregations such as the world food summits of 1996; 2002 and 2008 (Kibaara, Gitao Kimenju, Nyoro, Brtrup & Zimmermman, 2009; Page, 2013).

In Africa, the policies governing agriculture draw its foundation from the African development agendas discussed in several African Union (AU) assemblies. In these assemblies, great concern is attached to the less productivity of the agricultural sector in the region as compared to the rest of the world (FAO,2006; AU, 2014). Some of these policies include the Export-led Growth Policy introduced around 1980 aiming to encourage export through maximized cash crop production for the export over domestic production (Pirkle, Poliquin, Sia, Kouakou & Sagn, 2015), Comprehensive African Agriculture Development Programme (CAADP) established as a strategic framework for agriculture development in Africa, the African Fertilizer Financing Mechanism (AFFM) and the Africa's Agricultural Transformation and Food Security agenda in the 2015-2025 decade (Poulton, Berhanu, Chisinga, Cooksy, Fredrick & Loada, 2014; AU, 2014).

These policy frameworks for African countries were derived from the Maputo Declaration (2006), Abuja Declaration (2010), and the Malabo Declaration (2014) which emphasize on;

pursuits towards agribusiness and agro-industries development for enhancing smallholders' livelihoods, food security and nutrition, job creation and poverty alleviation and the increased use of fertilizers in African for sustainable agricultural production (Poulton *et al.* 2014). Further, through these policy frameworks, agricultural sector is considered as a priority for policy formulation as observed with the policy of increased budgetary allocation to the agricultural sector in all African Countries (Miruka *et al.* 2012; Kibaara *et al.* 2009). These declarations also provide a platform for African States to adopt, implement and evaluate progress on international policies such as the MDGs, now Sustainability Development Goals (SDGs).

Agricultural governance policies and laws in Kenya are anchored within instruments such as the Kenya Constitution of 2010 and the Acts of Parliament such as the Agriculture, Irrigation and Water Acts (GoK, 2010b) with the specific agricultural policies being the Economic Recovery Strategy for Employment and Wealth Creation (ERS) (GoK, 2003), Strategy for the revitalization of agriculture (SRA, 2004-2014), the Kenya's Vision 2030 and the Agriculture Sector Development Strategy (ASDS, 2010-2020) (GoK, 2010a; Miruka *et al.* 2012). It is through these strategies that Kenya applied the CAADP policy that brought in the prioritization of the agriculture sector in budget allocation and the utilization of idle land for agricultural productivity (World Bank, 2007a).

Implementation of these policies as from the global to the local level is rendered ineffective in responding to the world food insecurity and undernourishment (Birner and Von Braun, 2016). This is largely due to lack of a global nutrition policy to guide partners concerned in the governance of agriculture and food system, a factor that indicates poor status on the functionality of the policies in place (Ibid). Policy failure in Africa has turned the continent into being a food deficit region as opposed to food exporter region of the world (Franz and Bruntrup, 2011). The established policies suffers ownership qualities as they fail to focus on

the smallholders farmers who constitutes the majority in the sector and this has led to poor agricultural policy implementation in almost all regions of the world (Alila & Atieno, 2006).

The governance of BISS has its foundations from the national irrigation act of 2012 which lays down policy execution in relation to land allocation and ownership and also on water management (GoK, 2012). From this act, BISS has land allocation policy in which tenant farmers are assigned 0.625ha held in two plots for cash crop and food crop production in every season and an additional 0.05ha for a vegetable garden respectively (Ruigu, 1988; National Irrigation Board, 2015). Literature reviewed reveals gaps on how well the established institutions in BISS have implemented this policy to transform tenant farmers livelihoods more so in response to their food needs.

### **2.2.3 Stakeholders in Agricultural Governance**

Stakeholders such as the established ministries, parastatal bodies, NGOs, CBOs and the commercial entities are of significant value in the governance of agriculture sector for realization of food security. Globally, the concerned entities includes; United Nations organizations such as Food and Agricultural Organization (FAO), World Food Programme (WFP), International Foundation for Agricultural Development (IFAD), United Nations Conference on Trade and Development (UNCTAD) and United Nations Environmental Programme (UNEP) (Dasgupta & Roy, 2011). These organizations are responsible for stabilizing world agricultural prices, managing international cereal reserves, mobilizing resources to fight against hunger and above all co-operating with the organizations responsible for agricultural development loans and International Trade Policy. The organizations are further concerned with ensuring that the measures undertaken to finance agriculture are coherent with the food security and respond to food emergencies (Mckeen, 2011a). More to note is the World Bank (WB), the World Trade Organization (WTO) and the African Development Bank (ADB) which provide funding for development projects (Das,

2015). Nonetheless, specialized agencies such as the UN High Level Task Force on the Food Security Crises (HLTF), the Global Partnership for Agriculture and Food Security (GPAFS) of the UN and the Global Food Security Response Program of the World Bank have been established to address food crisis (Dasgupta & Roy, 2011).

Stakeholders in Africa include but not limited to the AU which boosts member states' agricultural productivity by supporting adoption of strategies and programs on agriculture. The South African Development Community (SADCs) involved in agricultural research and information, East African Community (EAC), the Pan African Farmers Organization (PAFO) which provides support services to farmer organizations and the New Partnerships for Africa's Development (NEPAD) without forgetting the African Union Commission, Economic Commission for Africa which all constitutes the key entities governing agriculture in Africa and its sub-regions (FAO, 2006; Dasgupta & Roy 2011; Das, 2015). In Kenya, the agricultural sector is governed by state ministries particularly the Ministry of Agriculture, Livestock and Fisheries, National Drought Management Authority (NDMA), Research Institutes such as Kenya Agricultural and Livestock Research Organization (KALRO), Regional Development Authorities, Agricultural Society of Kenya (ASK) and the Kenya National Federation of Agricultural Producers (GoK, 2010a; 2003 ).

The capabilities and functionality of these institutions to deal with global dimensions of agriculture and food system is however outpaced due to the sectors' dynamics and complexity (Pearberg, 2002). Institutional arrangements of the key partners and stakeholders experiences poor coordination and resilience in operation and this results into poor service delivery in time of demands, emergencies and crisis (World Bank, 2007a; Birner and Von Braun, 2016). This has resulted into prevalent food insecurity situation to a significant population of the world (World Bank, 2007a).

Agricultural governance in BISS has constantly shifted several times between ministries in chronological order as follows: Ministries of Agriculture, Regional Development, Land

Reclamation, Regional and Water development and back to Agriculture, Water and Irrigation until 2005 when it was taken back to the Ministry of Agriculture under the National Irrigation Board (Ruigu, 1988; National Irrigation Board, 2015). However, there is limited publication on the key players and entities running agriculture activities in BISS despite its takeover by NIB.

#### **2.2.4 Application of Technology in Agricultural Production**

Technological advancement is not only of great significance in poverty alleviation and economic uplift in a nation but also a vehicle for realizing agricultural productivity that is responsive to food security (FAO, 2009b). In fact, it was the key driver to the achievement of MDG 1 of halving the proportion of people living in absolute poverty by 2015 and also for reducing the number of hungry people in the world (Ibid). Evidently, the adoption of high-yielding varieties of rice and wheat strengthened through the expansion of irrigation infrastructure doubled cereal production in Asia in the period between 1970 and 1995 (Dorward, Keddy, Morrison & Urey 2004). Further, as yields increased, income and wage levels among farmers increased more and more and so did the reduction in food price (Dorward *et al.* 2004; FAO, 2003).

The need for technological application into the food producing sector continues to be more and more crucial in the world. This is especially with increased population of people who are losing direct attachment to the food producing sector in the rural settings out of extensive urbanization (FAO, 2009a). Technology brings in investment in agriculture enhanced through increased yields, improved food conservation for reducing post-harvest losses and food wastage to the farmers (Pan Africa Chemistry Network (PACN), (2012).It enhances application of crop protection measures such as the use of insecticides, fungicides and herbicides which ensures reliable food supply (Ibid)). Further, hybridization and assisted selection techniques are of great importance in ensuring high yielding variety of crops whereas biotechnology plays a role in the provision of disease tolerant crop variety. Modern

machineries have also contributed to agricultural sector efficiency and growth therefore strengthens its capacity to respond to the global food demands (Graves, Matthews, & Waldie, 2004).

In an IFAD (2001) report, it is mentioned that technology in the developing countries of the world contributed to an increase in the average cereal yields by 2.7% per annum in the period between 1966 and 1982. This is strengthened through the adoption of high yielding variety of crops that are disease resistant and tolerant to harsh climatic conditions. Additionally, the application of technology in irrigation advancement doubles the cropping and lengthens the growing season resulting into efficient production and mitigation against price volatility and its impacts (Graves *et al.* 2004). Further, despite the small share of cultivatable land in China for example, agricultural productivity is realized through the efforts made in technological progress. It is worth noting that the yields in agricultural productivity were generally low and stagnant before the introduction of better machines, synthetic fertilizers, improved plant and animal breeding, pesticides and most recently biotechnology (Ibid). Despite these great contributions of technology to agricultural productivity low agricultural productivity remains a common phenomenon in almost all continents of the world largely due to slow adoption of technology into the agricultural production (Pearberg, 2002). This is contributed to the insufficient investment in research and development especially in low income countries' farmers (Birner and Von Braun, 2016).

The reviewed literature on technology reveals that there is lack of information on how application of technology in BISS is contributing to agricultural productivity for enhanced food security. Whether or not farmers in BISS apply technology and the rate of technology adoption among famers in the scheme is the area of concern for this study.

### **2.3 Agricultural Governance Factors and Food Security**

Agricultural governance plays a crucial role in determining food security. It does this through the establishment of goals and policies implemented by the involved stakeholders who pool

resources for the realization of food security. Apparently, direct alleviation of hunger is mentioned as one among the international goals of agricultural governance (IFAD, 2011). Indeed, the international treaties, conventions and the laws established to govern the agriculture sector provide frameworks for conserving the food producing resource such as crops, marine resources and wild life and therefore act as platforms for responding to food insecurity (Page, 2013; AU, 2014). For instance Common Agriculture Policy (CAP) for the support and protection of farming activities, the International Plant Protection Convention (IPPC) and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) promote the conservation of all forms of life from which man derives his or her food either directly or indirectly (Qureshi et al. 2015). More significant to note are the Kenyan strategies including Economic Recovery Strategy for Employment and Wealth Creation (ERS)(GoK, 2003) and the Strategy for the revitalization of agriculture (SRA, 2004-2014) which brought to awake the CAADP policy that emphasized on the prioritization of the agriculture sector in budget allocation and the utilization of idle land for agricultural productivity and alleviation of hunger to the vulnerable citizens (World Bank, 2007a).

Policies bring in resource utilization in the forms of land use and budgetary allocation contributing to establishment of mega projects targeted for responding to hunger (World Bank, 2007a). The established projects out of such platforms include Zero Hunger Challenge introduced through the WFP and Improved Global Governance for Hunger Reduction Program introduced by FAO, WFP and IFAD. Programs and projects implemented in Kenya include the Agricultural Sector Development Support Program (ASDSP)that seeks to increase productivity and market flows of crop, livestock and fisheries produce, Njaa Marufuku Kenya (GoK), Freedom from Hunger Walk Kenya (FFHWK Council), the Galana – Kulalo Irrigation Project (Flagship project under Kenya’s Vision 2030), Kenyans for Kenya introduced by the Kenya Red Cross Society and the public irrigation schemes established by the government of Kenya in partnership with the multilateral institutions such

as the World Bank with Bura Irrigation Scheme being an example (Alila & Atieno, 2006; GoK, 2010a; Miruka *et al.* 2012 ).

Contrary, policies have the capacity to increase the challenges of food insecurity as indicated through low levels of income among local farmers as a result of poor marketing of farm produce in developing countries at the advantage of improved market for industrial products from developed world resulting from the marketing policies (Pirkler *et al.* 2015). Further, these policies have led to prioritized cash crop production for the export at the expense of food crops for domestic consumption, a factor that reflects greater risks of food insecurity during food price fluctuations as the demand for import increases more than normal (Das, 2015). Notably, the global trade policies (export and import policies) were instrumental in contributing to the 2007/8 food crisis (The Food Security Projects of the Nova Scotia Nutrition Council and Atlantic Health Promotion Research Centre, 2005).

Coherence among the international organizations dealing with agriculture provides a step towards alleviating global hunger (Manzoor, 2011). Consequently, Stakeholders in the concerned organizations and institutions are involved with establishment of programs and initiatives in response to food security either directly or indirectly. Such programs include Zero Hunger Challenge (WFP) and Improved Global Governance for hunger Reduction Program (Das, 2015). In addition, these organizations manage the international cereals, a factor that facilitates food security circles globally (Mckeon, 2011b). Important to note is the WTO and IFAD concerned with financing of agricultural projects for enhanced food security (Ibid). Africa has the Comprehensive Africa Agricultural Development Program of the AU implemented through NEPAD to provide framework for guiding sector development and food security in the continent (World Bank, 2009; Miruka *et al.* 2012).

More important to note for this study are the concerns of stakeholders in global institutions such as the World Bank, FAO, the Global Environmental Facility (GEF) and the Global

Water Partnership which incorporate issues of water governance for food security and sustainable agriculture into their policies and priority frameworks in their collaboration with other partners and the member countries (FAO, 2014b). These institutions transform the agriculture sector towards responding to the world's food crisis through establishing initiatives and frameworks for managing the scarce water resource (Ibid).

Applied technology further strengthens the role of agricultural governance in responding to food security. Consequently, investment in scientific research and innovations such as the green revolution contributed to a historical increase in food production during the time of wide spread hunger and malnutrition in the 20<sup>th</sup> century. In fact, it provided a positive move to sustainable solution to the global hunger and malnutrition (World Bank, 2009). The green revolution, a technological response to the worldwide food shortage in the period after World War II(WWII), introduced new plant variety and altered agricultural practices for increased crop yields (Ray, Mueller, West & Foley, 2013). More important in the advancement of technology is the capacity to reduced post- harvest loses, boosted yields per acre, expansion of cultivatable land in sustainable manner and the sustainable use of water resource (Suri, 2011).Generally, agricultural governance enhances investments in agriculture and stakeholder participation for the eradication of hunger (FAO, 2012; 2014a; IFAD, 2011). Despite this great significance of agricultural governance factors, no attempt has been made to identify and document how these factors are figured out in BISS.

The advanced literature demonstrates the roles that the agricultural governance factors plays in food security realm. These include institutions' capacity to initiate projects and programs for hunger eradication and despite that water management aimed at responding to the worlds' food crisis. Policies have been mentioned having the power to either alleviate hunger or worsen the food insecurity challenges. However information on how well the studied agricultural governance factors; goals, stakeholders, policies and technology are all

harmonized towards achievement of the set targets has not been addressed. This research therefore attempted to address this gap through analyzing the influence of agricultural governance on food security. Specifically the research focused on how the established institutions and stakeholders in BISS implement the established policies and facilitate technology adoption in an effort to achievement the set targets and in this case the goal to eradicate hunger among farmers in BISS.

#### **2.4 Challenges in Implementing Responsive Agricultural Governance to Food Security**

Despite the establishment of policies and the implementation geared through involvement of several stakeholders in agricultural activities, the ability of these structures to attain the goal of transforming agriculture sector into a viable tool for food security is incapacitated. This is felt due to several challenges from the global, regional, national and the local level. These challenges have brought in their wake great impacts that are felt in developing countries of the world especially in the changing world of globalization and environmental crisis (Page, 2013; Biermann, 2009).

The general challenges at all the levels include lower budgetary allocation to the sector, limited extension services at the grass roots, uncontrolled pest and diseases, declining soil fertility in most areas of the world, inadequate preparedness strategies and inadequate markets and infrastructure (Page, 2013). More important to note is unfavorable climatic conditions with insufficient resources for mitigation measures without forgetting incapacitated institutions that cannot facilitate the decisions and conclusions made (GoK, 2010a). The challenges extend to political instability and misguided economics which are advanced as the main challenges behind persistent famine in Kenya (Shauri, 2011).

Under-utilization of land, poor communication of new technology and the low absorption of new technology among farmers and lack of markets further challenges the ability to govern the sector effectively for enhanced productivity and attainment of world zero hunger (Mirukaet *al.* 2012; European Commission-Standing Committee on Agriculture Research,

2009). Inability of most national budgets to align with the agricultural policies partly due to poor economic status of the less developed and developing countries and partly due to misguided economy has resulted into under investment or disinvestment in agriculture a factor that further limits the ability of agriculture sector to respond to the ever increasing demand for food in an increasing population of the world (World Bank, 2007a; Miruka *et al.* 2012).

Monopoly of power brought in through governance of the sector in the marketing of agricultural produce through a monopolized market sector has further brought in market failures in the agriculture sector (World Bank, 2007a). The practicing farmers at both large scale and small scale therefore suffer from losses and even big debts out of the inability to service the loans from their creditors (Alila & Atieno, 2006). More so, government involvement in agriculture for realization of agriculture for development agenda has brought yet another challenge of political process where agricultural development priorities go with the political ideology of the day (World Bank, 2007a). Such challenges greatly undermine effective governance of the agricultural sector and thus minimize agricultural productivity resulting into food insecurity.

The advanced publications mentioned several challenges influencing agricultural governance in the global world. This included low budgetary allocation, insufficient resources, incapacitated institutions, political instability and market failure among the few to mention. However, the challenges facing agricultural governance for enhanced food security in BISS remains largely unaddressed. The research therefore focused into this area to cover this knowledge gap.

## **2.5 Summary of Literature Review and Knowledge Gaps**

From literature reviewed, agricultural governance exists at the global, regional, national and local levels. It involves implementation of policies through the identified institutions and stakeholders aimed at attaining the international development goals and agendas.

Combination of these elements, policies and stakeholders in several institutions together with provision of technology are advanced to be the main drivers to agricultural productivity that is responsive to food security in the world.

However, several challenges render governance of the agricultural sector inefficient as a result of the aforementioned limiting factors. This inefficiency has both direct and indirect influence on food security status, an issue that raises concern for research in the entire field of agricultural governance and food security, which is the focus of this study. Decentralization and devolution of governance are other issues in governance of agricultural sector and its productive capacity which are nascent in Kenya warranting a study of its own.

Indeed, from the reviewed literature, eradication of hunger is mentioned among the international goals of agricultural governance. However, limited and non-focused attempts have been made to document the attainment of this goal in BISS. Accordingly, the present study focused on the influence of agricultural governance on food security in BISS with the great concern being hunger eradication as one of the goals of agricultural governance.

The global institutions have been figured instrumental in establishing programs and projects aimed at eradicating hunger. However information on how well the established institutions have implemented the advanced policies in eradicating hunger is not articulated. This study therefore studied how the established institutions in BISS implement the policies in place to transform tenant farmers livelihoods more so in response to their food needs.

Several institutions among them; the World Bank, World Food Programme, Food and Agricultural Organization (FAO), NGOs, CBOs and ministries, have been recognized as the key stakeholders governing agriculture. However, the key players and entities running agriculture activities in BISS remain undocumented.

Despite the studied roles of agricultural governance factors in food security, information on how the studied agricultural governance factors; goals, stakeholders and policies, are harmonized towards achievement of the set targets has not been addressed. This research therefore attempted to address this gap through analyzing the influence of agricultural governance on food security. Specifically the research focused on advancing how the established institutions and stakeholders in BISS implement the established policies towards goal achievement and in this case the goal to eradicate hunger among the tenant farmers in BISS.

Despite the documentation of several challenges influencing agricultural governance in the global world, the challenges facing agricultural governance for enhanced food security in BISS remains largely unaddressed. The research therefore focused into this area to cover this knowledge gap.

## **2.6 Theoretical and the Conceptual Frameworks for the Study**

This section explains the theory adopted for this study as advanced from literature and extends to explaining the conceptual framework that indicates the relationship between dependent and the independent variable of the study and the intervening factors to this relationship.

### **2.6.1 General Systems Theory (GSE)**

The General Systems Theory is attributed to Ludwig Von Bertalanffy, a biologist who proposed the theory in 1940's. It draws its foundation in the field of Biology, particularly Darwin's work on the evolution of species. The theory holds that biological organisms are open systems because they constantly evolve and adapt to the needs of their immediate environment (Bertalanffy, 1968; 1973; 1975). In the field of Social Sciences, the theory focuses on the relationship between parts. It looks into the arrangement and relations between parts and how they interact with each other to determine the properties of a system as a

whole (Kast & Rosenzweig, 1972). Accordingly, systems consist of a number of interrelated and interconnected parts that once put together make the behavior of the whole system different and distinct than the behavior of its individual parts.

The theory has seven key tenets, (Kast & Rosenzweig, 1972) that are useful for this study:

i) The concept of openness

It refers to the ability to import energy from the surrounding environment and bring about change over time. This concept holds that the behavior of the whole is a response to the threats and resources available in the environment. Agricultural productivity as a whole is a response to the set goals, existing policies, institution, the levels of stakeholder participation and technology adoption. These elements import energy to bring in change in the form of food security to the farmers.

ii) Teleology or purposive

The behavior of a system is purposeful. The system is said to have a goal that it serves to achieve. In this study, agricultural governance as a system has development agenda as its main goal advanced from literature, among such agendas is attainment of food security. The theory holds that the purpose of control in a system is to achieve strategic objectives thus the analysis of the agricultural governance process as an element controlling agricultural activities in Bura Irrigation Scheme for the attainment of efficient food availability and food stability (food security) among tenant farmers in the scheme.

iii) Interrelatedness of sub-systems

The theory holds the notion of a system as a set of interrelated sub-systems and because of the interrelatedness of the sub-systems; the behavior of the whole system is greater than the sum of its parts. To understand a system, we must focus on the interrelationships between parts and linkages. The theory warns the system designers of unintended consequences if they fail to appreciate the linkage and focus exclusively on the parts. The set goals,

institutions, policies, stakeholders and the applied technology are considered as the sub-systems which are all related to determine effectiveness of agricultural governance.

iv) Input –transformation-output process

A system is considered as a constant process of taking inputs and transforming them into outputs. The inputs are acquired from the environment and the output goes back to the environment in a constant exchange.

These elements of governance; set targets, policies, stakeholders, and technology are viewed as an input meant to bring out the output, food security, to the environment with the environment herein being the community in BISS.

v) Feedback

It is defined as that which allows a system to attain its desired steady state. It involves taking corrective actions after an error has occurred or before it occurs, forward control and error control feedback respectively. The system anticipates what might occur and takes corrective action before the disturbance can affect the system or else take corrective measures after the occurrence of the error.

Policies and regulations kept in place by the governing authority in BISS to ensure productivity and food sufficiency to the community is seen as the feedback component as established in this theory.

vi) Homeostasis

It is the ability of a system to achieve a state of dynamic equilibrium. The system does not return to its original state but returns to a state that maximizes its chances of survival and growth. This state may or may not be the state from which the system initially started.

Despite existing challenges and trends over a long period of time in the scheme, governing authority has to ensure maximum production in the scheme and food sufficiency to the settled population. The latter is equivalent to the principle of homeostasis.

vii) Equifinality

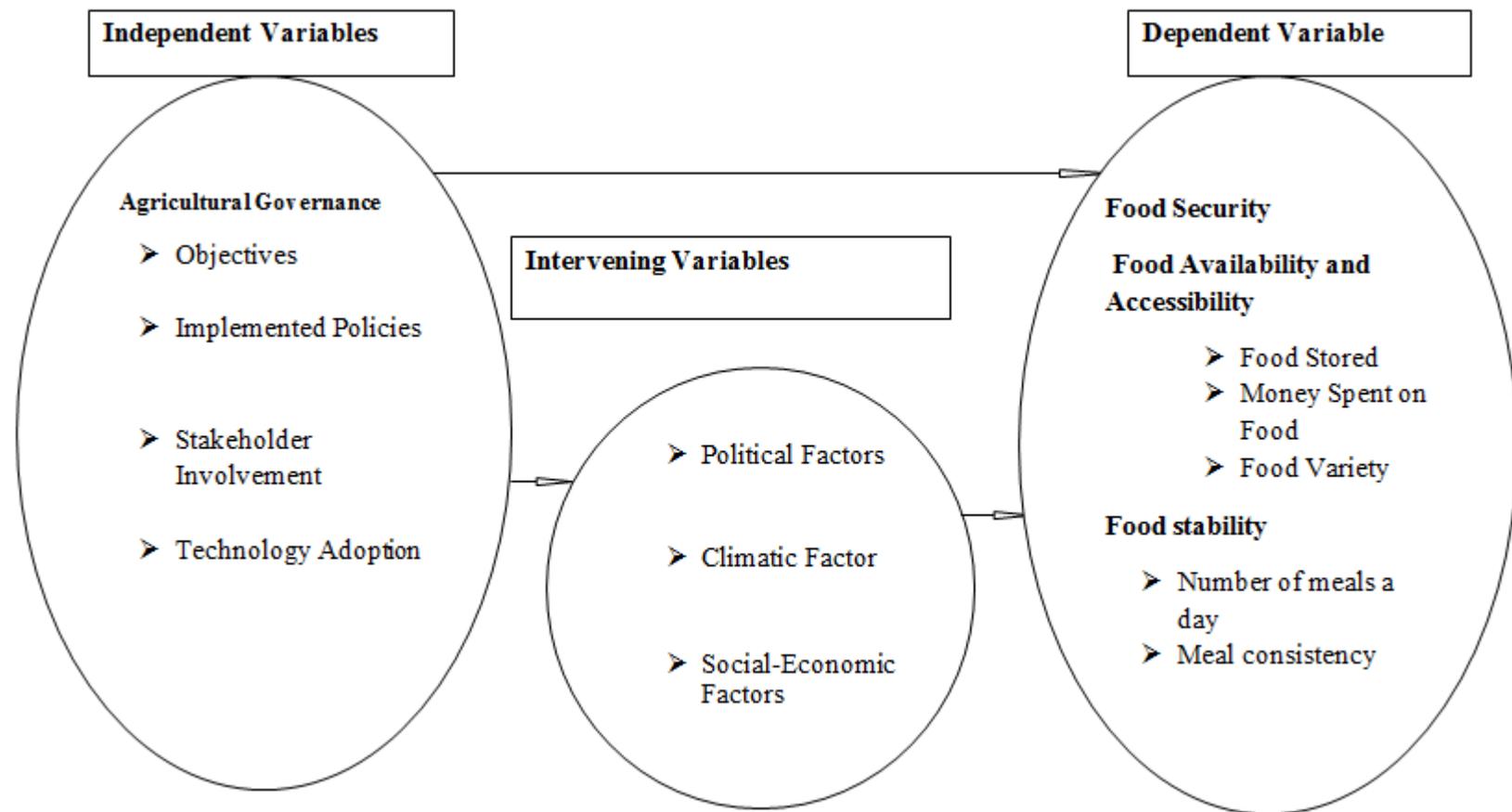
This refers to the ability of a system to attain the same final result from many different initial conditions.

The governing authority in BISS needs to look for solutions in every case and introduce changes that are most effective in attaining the goal of ensuring food supply to the community. This can include but not limited to issues related to donor funding from Non-governmental organizations and financial institutions for promoting food production or providing offer on farm inputs for the wellbeing of the farmers in attaining food security.

However, the general systems theory is criticized for giving false analogy by equating organisms with societies. This criticism is addressed by the fact that the theory draws rigorous homology between disciplines (Bertalanffy, 1968). Consequently, the theory is selected on the merits that it pursues an intellectual reconciliation between human world and the natural world (Kast & Rosenzweig, 1972). Indeed, hunger was in history known to be a natural phenomenon defined by the biological and geographical conditions but in the modern world, human behaviors define these natural settings (Shepherd, 2012).

### **2.6.2 Conceptual Framework**

The theoretical framework of General Systems Theory was conceptualized as a relationship where agricultural governance which comprise of interrelated subsystems in the forms of the set objectives, policies implemented, the involvement of stakeholders and technology establish outcomes that will ensure food security to the community. The diagrammatic presentation of the variables is as shown in Figure 1.



*Figure 1: Conceptual framework depicting the influence of the agricultural governance factors on food security*

This figure constitutes the independent and the dependent variables of the study, agricultural governance and food security respectively together with the intervening variables of the study. The variables interact to bring in the resultant outcome to the community. However the intervening variables include political factors, climatic factors and social economic status, mediates this interaction of the independent variable and the dependent as they tend to influence both the dependent and the independent variables of the study. Accordingly, these mediating factors in this study were controlled by conducting the study to a homogeneous population of respondents who are exposed to the same political status in the same climatic conditions and have the same social economic status.

Further, explanation of the dependent and the independent variables of study are provided in Table 1 which carries the operational definitions of the key variables, observational indicators and the respective measurement scales.

**Table 1**

*Operational definition of the key variables*

Key variable	Definition	Observational indicators	Measurement scale			
			Nominal	Ordinal	Ratio	Interval
objectives	Are the end results that a system targets to achieve and in this case the aim to increase food and cash-crop production among the settled farmers in the scheme	Types of crops cultivated in the scheme	✓			
		Increase in food crop Increase in cash crop		✓		
Policy implementation	The ability to establish and implement guidelines, rules, regulations, laws and principle that guide set of action	List of operating rules and regulations in the scheme	✓			
		Policy implementation i.e. 0.625ha and the 0.05ha & other rules		✓		
Stakeholders	Organization, group or individual who can	Organizations providing	✓			

	affect or is affected by the achievement of a system	services to the farmers				
Involvement	A process in which stakeholders influence policy formulation, investment choice and establish the necessary sense of ownership	Functions of the respective stakeholders	✓			
		Farmers' involvement		✓		
Agricultural Technology adoption	The ability to apply technical innovations , new changes and practices in the farming activities	Access to tractors Access to farm inputs (fertilizers, herbicides, pesticides and insecticides ) Access to credit facility	✓			
Food availability	Presence of food in a household obtained either directly from the farm or from the market	Variety of food stuffs in the farms Variety of food stuffs in the local market	✓			

		Quantity of food in kilograms stored for household consumption in a cropping season			✓	
		Amount of money in Kenyan currency spent on meals per person per day in a household				
Food Stability	Ability to acquire sufficient amount of food in a household over a given period of time	Number of meals in a day in a household			✓	
		Consistency of the meal in a year				
		Reasons for the meal trend in the household	✓			
		Reasons for the stored quantity				

## CHAPTER THREE

### RESEARCH METHODOLOGY

#### 3.1 Introduction

This chapter carries a brief description of the study site and the research design adopted for this study. It further explains the targeted population, sample size and sampling procedures, data collection instruments and procedures, data analysis and presentation and the ethical issues that the research considered.

#### 3.2 Study Site

The study was done in Bura Irrigation and settlement Scheme in the view that the scheme was established by the government of Kenya to settle the land less citizens and provide employment opportunities. Despite that this scheme is governed through the government with the NIB being the main player. In this line therefore, extensive government monetary of the scheme is necessary for the success of the set targets and the general social wellbeing of the tenant farmers settled in the scheme. Failure of the governance structures to develop the project to its maximum potentials would bring in social crimes related to the environment and the wellbeing of the famers. Unlike other public irrigation schemes, BISS has after its establishment drawn people from different geographical backgrounds in Kenya and therefore this justifies the choice of the study site for it is anticipated to offer a better understanding on how governance of the public irrigation schemes has translated into the viable tool for ensuring food security concerns of the farmers settled not just in BISS but also in other public irrigation schemes in Kenya .

Bura irrigation and settlement scheme is located in Hirimani ward of Tana-river County in the southeastern parts of Kenya, approximately 400Kms from Mombasa town. The Scheme was established by the Government of Kenya in partnership with the World Bank in 1978. It hosts 2,245 farmers within 10 residential villages distributed around 2,245 households each

with a land allocation of about 0.65ha (1.6 acres) held in 2 plots of 0.625ha each for cash crop and food crop production and an additional 0.05ha for a vegetable garden (Ruigu, 1988). The scheme had increasing food and cash-crop production (maize and cotton, respectively) as one of its set objectives during establishment (Ibid).

### **3.3 Research Design**

The study adopted a descriptive survey research design which is used for describing the observed characteristics of an individual, a subject or a phenomenon in its natural setting (Kothari, 2004). The design allows analysis of multivariable (Kumar, 2005). In this study, the design was useful in describing agricultural governance in the scheme and also for describing food security among tenant farmers. Multivariate analysis was applied in the description of agricultural governance which assumes three key variables whereas food security was described using two pillars of food security. The design was preferred for this study because it allowed for the collection and analysis of both qualitative and quantitative data (Bryman, 2001).

### **3.4 Target Population**

According to NIB (2015) there are 136,301 tenant farmers practicing agriculture in the seven established public irrigation and settlement schemes in Kenya. This provided the targeted population of this study.

### **3.5 Accessible Population**

The accessible population of the study included the 2,245 tenant farmers from the ten constituent villages in BISS (NIB, 2015) and four key informants representing the institutions operating in BISS. These are: NIB, Ministry of Agriculture, the Kenya Seed Company and Agricultural Finance Co-operation (AFC).

### **3.6 Sampling Procedure**

Purposive sampling and systematic random sampling were used to select the respondents. First, purposive sampling was used to select the four key informants. This method was necessary for it allowed for selection of respondents with vast knowledge regarding the area of enquiry (Latham, 2007). Second, Systematic Random Sampling (SRS) technique was used to select proportionately distributed farmers from each of the 10 villages. This was enhanced using a sampling frame in form of a list of farmers in each of the ten villages found in the scheme. The list was obtained from the National Irrigation Board (NIB). A sampling interval ( $n^{\text{th}}$ ) for each village was derived by dividing the total number of farmers in each village by the respective sample proportion and then the sample was obtained by picking every  $n^{\text{th}}$  individual after a random start. The method ensured that each unit of study had an equal probability of inclusion in the sample and therefore reduced the biasness in the study (Abbott & Bordens, 2011). This is a useful method when a sampling frame is available in the form of a list (Kothari, 2004) and in this case the list of farmers in each village.

### **3.7 Sample Size**

A sample of four key informants and 225 tenant farmers constituting 10 percent of 2,245 farmers in Bura irrigation scheme was used for the study. Mugenda & Mugenda (2003), observe that 10-50 percent of a population is acceptable in a descriptive research and that 10 percent of the population is large enough. With a large sample the researcher is confident that if another sample of the same size was to be drawn, findings of the two samples would be similar to a high degree (Abbott and Bordens, 2011).

The sample was proportionately distributed to each of the ten (10) villages found in BISS as shown in the Table 2.

**Table 2**  
*Proportionate Sampling of Villages*

Village	Total Number of Farmers in each Village	Proportionate Percentage%	Sample Size (n)
1	205	0.0913	21
2	200	0.089	20
3	250	0.11	25
4	240	0.107	24
5	220	0.098	22
6	250	0.11	25
7	210	0.094	21
8	230	0.102	23
9	200	0.089	20
10	240	0.107	24
<b>Total</b>	<b>2245</b>	<b>100%</b>	<b>225</b>

### 3.8 Instrumentation

The study used interview schedules and Focus Group Discussion guides to collect data.

#### 3.8.1 Interview Schedule

Two sets of interview schedules were prepared and administered to the farmers and the Key Informants respectively. Interview schedule allows for systematic questioning of the respondents and prioritization of the most significant questions at the beginning of the interview. These questions could otherwise be left out in case the respondents withdraws participation at the mid of the interview. Further the interview schedule has the ability to probe the respondent (Kothari, 2004; Bhattacharjee, 2012).

#### 3.8.2 Focused Group Discussion Guide

Focused Group Discussion (FGD) guide was prepared and used among three categories of farmers' groups representing men, women and the youth. The stratification of the

respondents was done purposely to avoid limited response that could be experienced if the three groups were kept under the same discussion forum. This tool was useful in enriching and verifying the information gathered during individual interviews (Abawi, 2013). In the groups, members tend to be more open and dynamic as they interact, a factor that enriches the quality and quantity of information collected (Bhattacharjee, 2012).

### **3.9 Validity**

Before the data collection exercise, the validity of the instruments was determined by experts from the Department of Environmental Studies-Community Development of Pwani University. The experts who have vast skills and experience in social research and expertise knowledge in research methodology undertook extensive reading of the work and the instruments to determine coherence to the research objectives, questions and the study variables. This was done purposely to assess the face, content and construct validity of the instrument. Face validity provides a measure of the degree at which the instruments gathers data that is relevant to the study and that the responses are free from biasness, the content validity involves the test of whether the instruments provide adequate coverage of the study and adequately answers the research questions (Kothary, 2004). Conformity of the gathered results to the predicted correlation with other theoretical preposition is referred to as measure of the Construct validity (Ibid). This reduced biasness of the data collected (Abbott& Bordens, 2011).

### **3.10 Reliability**

For successful data collection, internal consistency of the Interview Schedule and the Focused Group Discussion was confirmed before use in data collection. To determine reliability, a pilot test using Test re-test method was applied (Luvai & Maende, 2014). This was done through conducting two interviews to a small group of selected members not exceeding five who were not part of the study but had the same characteristics as the study

sample. Participants for this exercise were selected from the list of farmers by picking those who were not captured in the sampling frame. The test was repeated after two weeks had elapsed to check if the responses were homogenous despite the time differences. The differences between the two tests were calculated to confirm consistency of the response. This was important for standardization of the instrument and for reliable data that provides consistent results (Abott & Bordens, 2011; Kothari, 2004).

### **3.11 Data Collection Procedure**

A letter of approval and an introductory letter for the research were obtained from the ethical review panel of Pwani University and from PU Graduate School respectively. The approval letter was presented to the scheme manager to obtain permission to conduct the research in the area. Dates for mobilization and sensitization of the farmers were set and preparation made on the actual data collection exercise. Two enumerators were selected based on their education level and experience in research. They were trained on the flow of the questions and on how to translate the meaning of the questions to those respondents who were not familiar with English language. The training was done for five days before the data collection exercise which took approximately one month.

The researcher administered the interview to the 4 key informants' whereas the selected 225 tenant farmers were interviewed with the assistance of the trained enumerators on the agreed exercise dates. The interview was conducted to the individual respondent who were visited into their households and to their farms in some cases. During the interview, information on the study variables was gathered using a four-point Likert scale ranging from good to very poor.

The researcher conducted Focus Group to three groups consisting of ten members each selected from among 225 farmers that were interviewed.

### 3.12 Data Analysis and Presentation

Before processing the data, comprehensibility of the compiled data was confirmed to ensure consistency. Qualitative information generated was coded according to emerging themes by assigning codes along the study objectives. Accordingly, qualitative data on objective one and two was analyzed using hermeneutic analysis technique, a process of understanding the meaning of the whole through understanding its parts (Bhattacharjee, 2012; Kinsella, 2006). The collected quantitative data was further analyzed using means, standard deviations and frequency distributions with the help of the Statistical Package for Social Sciences (SPSS). Ordinal logistic regression (Hosmer and Lemeshow, 2000) was used to establish the influence of agricultural governance on food security. This was done with the help of Minitab. For the regression, qualitative data from the Likert scale was converted to quantitative data by assigning numerical ranks ranging from 1 for very poor, 2 (poor), 3 (moderate) and 4 (good). Ordinal logistic regression adopted the following equation model;

$$g(xFS) = \beta_0 + \beta_1 CCP_{1+} + \beta_2 FCP_{2+} + \beta_3 VCP_{3+} + \beta_4 LRP_{4+} + \beta_5 OC_{5+} + \beta_6 OF_{6+} + \beta_7 FLM_{7+} + \beta_8 FI_{8+} + \beta_9 NIB_{9+} + \beta_{10} AFC_{10+} + \beta_{11} KSC_{11+} + \beta_{12} MOA_{12}$$

Where;

$g(xFC)$  = The logistic probability that (FS) food security (measured using the number of meals consumed in a household per day) is the outcome of the regressed variables in the model

$\beta_0$  = the constant (the value of Y when X is set at zero)

$\beta_1 \beta_2 \beta_3 \beta_4 \dots \beta_{12}$  = Beta Co-efficient for the independent variables

CCP= the implementation of the policy for cash crops land size

FCP= the implementation of the policy for food crops land size

VCP= the implementation of the policy for vegetable land size.

LRP= the implementation of the land reallocation policy in BISS

OC= achievement of the objective on improving cash crop production in the scheme

OF= achievement of the objective on improving food crop production in the scheme.

FLM=farmers' access to farm labor machines

FI=farmers' access to farm inputs

NIB=farmers' involvement in water supply by the National Irrigation Board

AFC=farmers' involvement in the credit facility by Agricultural Finance Cooperation

KSC= farmers' involvement in the seed supply by the Kenya Seed Company

MOA= farmers' involvement in the input supply by the Ministry of Agriculture in BISS

Description of the challenges to implementation of agricultural governance that is responsive to food security among farmers was provided based on the response given. Findings were presented using charts, percentages and frequency tables. Presentation of qualitative information included response description and verbatim quotes from the respondents to enrich quantitative findings of the study.

### **3.13 Ethical Considerations**

The research was conducted after the provision of ethical review certificate by the Ethical Review Committee (ERC) of Pwani University. An informed consent form (APPENDIX 1& 2) describing the participants freedom to participate or not to participate and to withdraw from the same at any given time was signed by all the respondents prior to the interview exercise and despite that all the participants in this research were of legal age. Further the researcher sought for a permission to undertake the research in the scheme from the scheme manager.

## CHAPTER FOUR

### RESULTS AND DISCUSSIONS

#### 4.1 Introduction

This chapter presents the findings, interpretations and discussion of the study. The presentation is guided by the research objectives and questions. The findings are presented in tables and figures that clearly show variations in responses to the study variables.

#### 4.2 Demographic Characteristics of the Respondents

Respondents were asked questions pertaining to their characteristics such as age, level of education, gender and economic activities. The demographic characteristics are important for this study since they provide significant explanations for observed relationships between governance and food security in Bura irrigation and settlement scheme. The results on demographic characteristics are as shown in Table 3.

##### 4.2.1 Age of the Respondents

Results in Table 3 show that over one third (49% and 47%) of the respondents were in the category of old age (above 50 years) and middle aged (36 to 50 years) respectively. This implies that most of the farmers in BIIS were of an advanced age with vast experience and knowledge of the scheme's operations since its establishment unlike the young people who lack the background information on the same. Apparently, those aged (above 50 years, 49%) may have less energy unlike the young people who could utilize their energy to maximize food production in BIIS. Accordingly, young women within the age bracket of 20-35 are expected to be strong and agile to carry out farm labor which involves a lot of drudgery (Steve, Godwin & Kate, 2014). Contrary, Elias *et al.* (2013), is of the view that age can be considered as an indicator of farming experience.

#### **4.2.2 Gender of the Respondents**

Table 3 shows that over three fifth (61%) of the respondents in this study were male .This could probably because the study interviewed household heads who are generally male. In addition, patriarchal relations make most of the men to be land owners, while women's main role is household food production. In fact, the traditional division of labour between men and women in farming is well defined. This gender division has an influence on agricultural productivity and the household food security. The role of men is majorly land clearing and preparation, while women carry out tasks such as planting, weeding, harvesting, winnowing and grinding(Women in Europe for a common future (WECF), 2014). Women are crucial in the agriculture sector, mostly in subsistence agriculture, as they are often the ones who cultivate food (vegetables) crops. Indeed, women are in charge of food selection and preparation. If they generate an income, this is most likely to be spent on food and the needs of their households (Ibid). Contrary to this, men spend very little of their earnings on food needs of the households (World Bank, 2007b).

#### **4.2.3 Education Level of the Respondents**

Results in Table 3 show that over half (53%) of the respondents have not gone to school, while over one third (37%) have only primary level of education. Almost all (100%) of the interviewed farmers have not attained tertiary level of education. This means that most of the respondents have none or minimal level of education. The high (53%) level of illiteracy could negatively affect food security status in the scheme. In a study done by Githui (2015), people with low levels of education are more likely to be food insecure as they have limited economic activities to engage in. Additionally, Ong'ayo and Akoten (2007) hold that having tertiary level of education is likely to make a famer more food secure as they are open to varied economic practices.

#### **4.2.4 Household Size**

From the results presented in Table 3, over 50 percent of the households are of the medium size (5 to 8 individuals), while over one quarter (30%) are small householders (1 to 4 individuals). The finding is in agreement with the Tana River District Development Plan which indicates that the household's size in the county is approximately 4.9 members (GoK 2008, b). The number of individuals in a household has an impact on food security based on the households' food access and availability. Indeed, Titus & Adetokunbo (2007) postulate that food insecurity incidence increases with increase in household size.

#### **4.2.5 Economic Activities**

Results in Table 3 show that over four fifths (81%) of the interviewed respondents are involved in crop cultivation only as their economic activity. The findings support the report by the Tana-River County Integrated development plan which indicate that over four fifth of the population in Tana River County is employed in agricultural production (GoK, 2013). These results have implication for the farmers' food security situation as economic activities determines the households' income purchasing power. Apparently, availability of various economic activities for a community in an area is critical for ensuring food security (Prakash & Palanivel, 2011).

**Table 3**  
*Demographic characteristics of the respondents*

<b>Variable</b>	<b>Category</b>	<b>Frequency</b>	<b>Percent (%)</b>
<b>Age</b>	Young : 20-35	10	4
	Middle age:36-50	105	47
	Old :Above 50	110	49
<b>Gender</b>	Male	137	61
	Female	88	39
<b>Level of education</b>	None	119	53
	Primary	84	37
	Secondary	21	10
	Tertiary	1	0
<b>Household size</b>	Small family :1 to 4	69	30
	Medium family :5 to 8	121	54
	Large family :More than 8	35	16
<b>Economic activities</b>	Livestock keeping	5	2
	Charcoal burning	13	6
	Small scale business	21	10
	Formal sector employment	2	1
	Crop cultivation	184	81

### **4.3 Status of Agricultural Governance Factors in BISS**

Objective one of the study sought to establish the status of agricultural governance factors in Bura Irrigation and Settlement Scheme. Respondents were asked questions relating to their awareness of the; objectives for the establishment of the scheme, policies implemented in the scheme, stakeholders operating in the scheme and the technology applied in the scheme's farming practices. The respondents were also asked to indicate the actual objectives of the scheme, the respective policies governing the scheme, the respective stakeholders operating in the scheme and the kind of technology used in the farming practices. The respondents were also asked the extent to which; the schemes objectives were achieved, Policies are implemented and stakeholders are involved in the scheme. Further the respondents were asked questions related to technology adoption in the scheme. The findings are presented in the following sub sections.

#### **4.3.1 Respondents' Awareness of the Agricultural Governance Factors in BISS**

The respondents were asked questions on their awareness of; the objectives of the scheme, policies governing the scheme, stakeholders operating in the scheme and technology used in the scheme. The results are captured in Table 4.

Results in Table 4 show that most of the famers (88%, 97%, 92% and 98%), know the objectives, policies, stakeholders and technology operating in BISS. This means that there is information sharing and community sensitization by the project proponents on the objectives and policies of the scheme. This has an implication on the; farmers' activities and practices, the extent of policy implementation and agricultural production consequently resulting into the achievement of the entire objectives of the scheme.Indeed, integrating community awareness on the objectives and policies of a proposed project, operating stakeholders and the applicable technology has a relatively long lasting positive impact on agricultural production (Eamin, 2012; Piadozo *et al.* 2014). The initiative scales up technical knowhow,

goal achievement and a “win- win” situation where everyone benefits (WEF, 2010; Sababo & Adeniji, 2007; Simtowe, Asfaw & Abate, 2016).

**Table 4**  
***Respondents’ awareness of the agricultural governance factors in BISS***

Agricultural governance factors	Awareness			
	Yes Frequency	(% )	No Frequency	%
Objectives	198	88	27	12
Policies	218	97	7	3
Stakeholders	207	92	8	18
Technology	221	98	4	2

#### **4.3.2 Components of Agricultural Governance Factors in BISS**

Respondents were asked questions pertaining to the actual components of the agricultural governance factors that they were aware of which include: objectives of establishment of the scheme, policies governing BISS, the respective stakeholders operating in the scheme and on the technology used in the scheme. Their responses are summarized in Table 5.

From table 5, almost all the respondents (98% and 99%) mentioned improving food crop and improving cash crop as the objectives for the establishment of BISS (Table 5). More than 90 percent of the respondents mentioned the policies for balancing crops in the scheme with 90 percent indicating awareness of all stakeholders except East African Seed Company which is known to only 29 percent of the respondents.

**Table 5**  
*Components of Agricultural governance factors in BISS*

Agricultural governance factors	Components	Response	
		Frequency	Percentage
Objectives	Improve cash crop	223	88
	Improve food crop	221	87
Policies	0.65 ha cash crop	220	98
	0.65 ha food crop	222	99
	0.05 ha vegetable cultivation	218	97
Stakeholders	NIB	218	97
	K-Seed company	208	92
	AFC	207	92
	KEPHIS	220	98
	Ministry of agriculture	205	91
	East Africa seed company	65	29
Technology	Farm labour machines	222	99
	Herbicides	220	98
	Insecticides	209	92
	Fertilizers	224	99

Findings on Policies governing BISS are further supported by a respondent's narration that *“there is a land allocation policy in which the land is reallocated to the tenants in every cropping season and this has discouraged the tenants to carry out further activities in the allocated land for it is not permanently owned”*. The changes in land allocation affect the farmers' ability to invest in the land and this has implications on agricultural productivity.

This shows that basically, BISS main focus was on both food crop and cash crop production while the policy practices are majorly on crop balancing. The main stakeholders operating in the scheme being NIB, KSC, AFC, KEPHIS and the ministry of agriculture while technology use is majorly on use of farm labour machines and farm inputs. This finding is in agreement with the study done by Ruigu and the NIB report which recognizes that BISS has land allocation policy in which tenant farmers are assigned 0.625ha held in two plots for cash crop and food crop production in every season and an additional 0.05ha for a vegetable garden respectively (Ruigu, 1988; National Irrigation Board, 2015). This has an influence on agricultural production for enhanced food security as it determines the farming practices carried out by the farmers in the scheme. Indeed, Pirkler *et al.* (2015), postulate that food insecurity situation of the local famers in less developed countries is mainly attributed to the imbalance of cash crop and food crop policies. Significant to note is that, necessary growth in food production can best be achieved with continued application of modern technology in the form of fertilizers, machinery and crop protection measures (Duflo, Kremer & Robison, 2008; Suri, 2011).

During an FGD, it was revealed that there is a marketing policy in which the selling of the harvested maize seed is restricted to the seed providing company particularly the KSC. Participants also mentioned that the farmers are not allowed to do intercropping according to the KEPHIS regulations for quality assurance of the harvested seed for international marketing. This has implications on the income generated by farmers as crop diversification which could otherwise reduce shocks related to food crisis is discouraged while the maize seed price is solely determined by the KSC with no market competition. Accordingly, crop diversification enhances physical access to variety of food and besides that it boosts the households' incomes and maintains food security (Dasgupta and Roy, 2011). In a study conducted by World Bank, monopolization in the marketing of agricultural produce through a monopolized market sector has brought in market failures in the agriculture sector and

thus the practicing farmers at both large scale and small scale are left with losses and even big debts out of the inability to service the loans from their creditors (World Bank, 2007a)

### 4.3.3 Achievement of the Objectives of the Scheme

To establish the extent at which the scheme's Objectives on improving cash crop and improving food crop are attained, respondents were asked to indicate the yields for cash crops and food crops cultivated in the scheme. Their responses are as presented in Table 6.

**Table 6**  
*Households' Maize yields for cash and food crops per 0.65 ha (1.6 acres)*

Crop type	Number of bags harvested per 1.6 acres							
	Response							
	0-5		6-10		11-15		More than16	
	F	%	F	%	F	%	F	%
Maize seed- cash crop	11	5	135	60	56	25	23	10
Maize for food crop	158	70	45	20	16	7	8	3

Results in Table 6 shows that very few households were able to harvest more than 16 bags per 1.6 acres with more than half (60% and 70%) harvesting 6-10 and 0-5 bags for cash and food crops respectively. This means that though the project was initiated to improve cultivation of cash crops and food crops in the study area, these targets have not yet been attained and the yields performance of both food crops and cash crops in the scheme is low. The 1.6 acres cultivated by the farmers in BISS is expected to yield lowest projection of at least 60 bags of maize compared to the optimum projected yields of 40 bags per acre in Kenya (Olwande, 2012; Alila & Atieno, 2006). The findings on the scheme's failure to attain the set objective are supported by those by Mwega (2008). According to Mwega, increasing agricultural output was one of the set targets for the establishment of BISS, however this

target has not fully been achieved as the crop yields proved to be well below the expectations with cotton as one of the cash crops yielding 70 percent and maize as food crop yielding below 50 percent of the lowest projection.

#### **4.3.4 Extent of Policy Implementation on the Cultivated Crops**

Policy implementation rate is an indicator of the status of agricultural governance and it is a measure of the extent to which the established policies are applied for enhanced productivity. The respondents were asked on the extent to which policies have been implemented in the scheme. Findings are as presented in Table 7

Findings in Table 7 shows that only 35, 37 and 36 percent of the respondents indicated the implementation of the policies as fully implemented on the cultivation of 0.65 ha cash crop, 0.65 ha food crop and 0.05 ha vegetables crops respectively. The finding of the study on partial policy implementation are further indicated in a narrative by the Kenya Seed Company key informant interviewee that;

**Table 7**  
*Extent of policy Implementation in BISS*

Policies	Extent of Policy implementation					
	Fully implemented		Partially implemented		Not implemented	
	F	%	F	%	F	%
Policy on the cultivation of 0.65 ha cash crop	79	35	145	64	1	0
Policy on the cultivation of 0.65 ha food crop	83	37	131	58	11	5
Policy on the cultivation of 0.05 ha vegetables	80	36	69	31	76	34

*“The extent of policy implementation was better in the beginning but it went down recently. This is particularly the policy on 0.05Ha vegetable cultivation in the scheme which is almost zero in its implementation and the recent scheme activities are much more in favor of the cash crop policy because the product has an existing market through the Kenya seed company programme”.*

The findings and the narration implies that less than 50 percent of the respondents agree that policies in the scheme are fully implemented and this has implications on the scheme's ability to achieve the set objectives of improving food crop and cash crop production. The observed extent of partial policy implementation is in line with the study by Ngigi (1998), who postulate that despite the various actors engaged in development of irrigation in Kenya, implementation of the institutional framework to effectively coordinate and rationalize the use of the limited resources is a daunting task. Information from the narration is in agreement with the findings by Pirkler *et al.* (2015), who indicate that marketing policies in the less developed countries prioritize cash crop production for export at the expenses of food crop for domestic consumption.

#### **4.3.5 Extent of Stakeholder Involvement in BISS**

Respondents were asked on the extent of their involvement in the functioning of the respective stakeholders. The results are as summarized in Table 8

Results in Table 8 shows that only 8 percent of the respondents are actively involved in NIB while more than 50 percent of the respondents reported active involvement in the functioning of other stakeholders. According to AFC interviewee, the institution involves farmers to agricultural finance using a dual strategy of investing in farmer education (financial literacy) and innovative financing arrangements (backstopped by a community-based cloud computing model that revolutionized agricultural financing in Kenya through direct cost savings, production improvements, and innovation). FGD participants further indicated that the farmers are not involved in the decision making process but only involved in the later stage of implementing the season plans by the NIB.

**Table 8**  
***Farmer's involvement in the functioning of the respective stakeholders in BISS***

Stakeholders	Functions	Farmer involvement					
		Active		Passive		Not involved	
		F	%	F	%	F	%
NIB	Water supply	18	8	205	90	2	2
Kenya Seed Company	Seed supply and output Marketing	161	72	44	20	20	8
AFC	Input financing	205	91	12	5	7	4
KEPHIS	Quality assurance	90	41	2	1	130	58
Ministry of agriculture	Provision of seed to the farmers	6	3	21	10	204	90

Being the custodian of water supply and the implementer of the project, all other institutions depend on the functioning of NIB yet 91 percent of the respondents rated passive involvement to the NIB functioning. This actually indicates institutional failure on the part of NIB. The passive involvement of farmers in the scheme has an influence on agricultural

productivity for enhanced food security as it could bring in few signs of initiative among farmers.

In a study conducted among farmers in Mwea irrigation scheme, Kabutha and Mutero (2002), observe that farmers failed to cooperate with NIB due to passive involvement into the scheme management. This was until the project was taken over by a cooperative society which involved farmers actively when farmers worked tirelessly to improve agricultural production in Mwea Irrigation Scheme. Further weak community involvement in Luanda Majenje scheme in Tanzania brought in lack of the sense of ownership of the project, a factor that hampered agricultural production (Mwakila & Noe, 2005).

#### **4.3.6 Extent of Technology Adoption among Farmers in BISS**

To analyze the extent to which farmers adopt the available technology in BISS, respondents were asked questions relating to access of technology facilities in the scheme. The farmers were asked on the extent of their access of farm labour machineries, farm inputs and on the provision of irrigation infrastructure. Further the farmers were asked questions related to the access of extension service with experts, access to credit facilities and the availability of rental markets for labour machinery. The findings are presented next.

Results in Table 9 shows that more than 50 percent of the farmers were of the opinion that access to farm labour machines was neutral indicating that it was not poor but the accessibility varied from time to time. The access to farm inputs and provision of irrigation infrastructure was poor. This implies that although farm labour machines are accessible to the farmers, access to the farm inputs has a challenge. The results may have an influence on agricultural production in the scheme as access to tractors determines the size of the cultivated land and the yields per acreage. Limited access to farm inputs and irrigation infrastructure could be attributed to the limited economic activities among the farmers (Table

3) which limits income levels of the farmers that could otherwise enable farmers to purchase the required farm inputs and fund the water pumping system.

**Table 9**  
*Households access of technology facilities*

A study conducted by Duflo, Kremer & Robison (2008), holds that; whereas lack of farm

Technology facility	Technology Access to the farmers		
	Percentage response		
	Good	Neutral	Poor
Tractor for ploughing and ridging	20	75	5
Farm inputs	0	20	80
Irrigation infrastructure (water pumping)	0	0	100

inputs in irrigated crops reduces the chances of better crop productivity and yields per hectare, farmers who have access to tractors or draft animals are more flexible in changing their land tillage practices for improved production than the farmers who rent or borrow equipment. Further, funding of public irrigation sector through Operation and Maintenance funds works best among farmers with high economic standards contrary to dealing with farmers whose economic standards are low in which the system experience draw backs (Nyoro, 2007). The findings on the shortage in the provision of irrigation infrastructure is in agreement with a FAO report which indicates that inability to constantly supply water in almost all the public irrigation schemes has ruined the irrigation sector performance (FAO, 2016).

To determine extent at which farmers adopt technology, respondents were asked on their perceptions regarding their access of extension service from experts, purchase of farm inputs, access to credit facilities and the availability of rental markets for labour machinery. Likert scale of measurement of perception was used. The findings are presented next.

From Table 10, none of the farmers often have access to extension service, negligible percentage (2%) of respondents often purchase farm inputs with less than a quarter (15%) indicating that rent market for labour machine is often available while 50 percent of the respondents often have access to credit facility.

This shows that farmers lack maximum access to expertise knowledge on the technology applied and that though the farmers cannot afford to purchase farm inputs and farm labour machines directly, access to credit facilities and the existing rent market enables them to access technology.

**Table 10**

*Extent of Technology adoption among the farmers in BISS*

Statements	Response							
	Often		Sometime s		Rarely		Never	
	F	%	F	%	F	%	F	%
I have extension contact with experts through seminars and training	0	0	34	15	180	80	11	5
I personally purchase fertilizer, pesticides and herbicides	5	2	11	5	8	3	203	90
I have access to credit facilities	113	50	101	45	7	3	5	2
There is an existing market for renting labour machinery	36	15	180	80	11	5	0	0

This is likely to increase the farmers' ability to apply available modern technology for increased yields, food access and availability among the farmers. Contrary, farmer characteristic on age and education; almost half of the respondents, 49 percent were in the category of old age (above 50 years) while 53 percent of the respondents have not gone to school see table 3 findings, may limit the farmers adoption of technology. Findings on the

farmer access to credit facility from AFC is in agreement with the study conducted by Tum who observe that tenant farmers in public irrigation schemes are among the targeted clients for AFC. Their lending scheme is based on the established farmer groups in the forms of Community Based Organizations and this has encourages technology diffusion trend among the farmers (Tum, 2015; Simtowe, Asfaw & Abate, 2016). In a study conducted by Sababo & Adeniji (2007), it is mentioned that availability of machine renting facility will boost farmers' ability to make use of existing farm labour machinery to boost production unlike in areas with lack of access to such facilities however, younger farmers are more likely to adopt technology because they had more schooling than the older generation who are unlikely to deal with technical recommendations that require certain level of numerical literacy (Tomoya, Takashi & Sserunkuuma, 2013).

#### **4.4 Influence of Agricultural Governance Factors on Food Security**

Objective two of the study sought to establish the influence of agricultural governance factors on food security among farmers within the BISS. The respondents were asked questions relating to how their food security status is influenced by; the extent of objectives achievement, policy implementation, stakeholders involvement and the technology adoption trends. Regression analysis was also conducted to establish the influence of agricultural governance factors on food security. The results are presented in the following subsections.

##### **4.4.1 Influence of the Scheme's objectives on Food Security**

As revealed in Table 5, the schemes objectives were to grow cash crops and food crop. To analyze how the achievement of these objectives influenced famers' food security, respondents were asked questions on the variety of food crops obtained from the farm each season. Their responses are summarized in Table 11.

Findings in Table 11 show that over 99 percent of the respondents produced maize as both food crop and cash crop from the farm in the 1<sup>st</sup> (99%) and 2<sup>nd</sup> (100%) seasons respectively.

This implies that contrary to the objectives on improving both food crop and cash crop production, majority of the famers produce maize with negligible numbers (1% and 0 %) cultivating green grams in the scheme. Information gathered during FGD revealed that although the scheme policy recommends growing of vegetables, none of the farmer cultivates vegetable in the 0.05 ha due to risks associated with crop failure out of water shortage.

**Table 11**

*Variety of food crops obtained directly from the farm in each cropping season*

Crop variety	Response			
	1st season		2nd Season	
	Frequency	Percentage	Frequency	Percentage
Maize as food crop	223	99	0	0
Green grams	2	1	0	0
Maize as cash	0	0	225	100

This shows that there is lack of crop diversification in the scheme's production. Consequently, lack of crop diversification among farmers in BISS may results to inadequate food production, access and unavailability among the farmers. Accordingly, lack of crop diversification limits the returns and gains that could otherwise be pooled from different farm activities for the realization of food availability and despite that it increases environmental risks associated with lack of crop rotation (Vereecke, 2015).

#### **4.4.2 Influence of Policy Implementation on Household Food Production**

In order to establish how the implementation of 0.65 ha food crop, 0.65 ha cash crop, and 0.05 ha vegetable land cultivation per seasons policies have influenced farmers' food security in the scheme, respondents were asked questions on the quantity of yields harvested from the farm and the quantity of food stored for household food consumption. Further the respondents were asked to indicate their net income status from cash crop that is grown one season annually. The respondents were also asked questions on the daily

expenditure on food stuffs. The results are presented in Table 12, Figure 2, and 3 respectively.

Table 12 shows that four fifths (80%) of the respondents harvested 600-700 Kgs and 1000-1500 Kgs of the maize as food crop and cash crop maize seed respectively. 150 to 200 Kgs from maize cultivate as food crop and 50-100 Kgs from the maize seed cultivated as cash crop is stored for the household food consumption with only 19 percent of the respondent's harvesting green grams from the 0.05 ha land for vegetable. The finding is in agreement with the information captured in a narration by one of the respondent who indicated that *“most of the harvested maize for food crop and cash is sold to pay for the farming expenses and therefore the quantity stored tends to be lower than what is sold and also the net income from the cash crop is low while food crop and vegetable crop raises no income to the famers due to high farming costs”*.

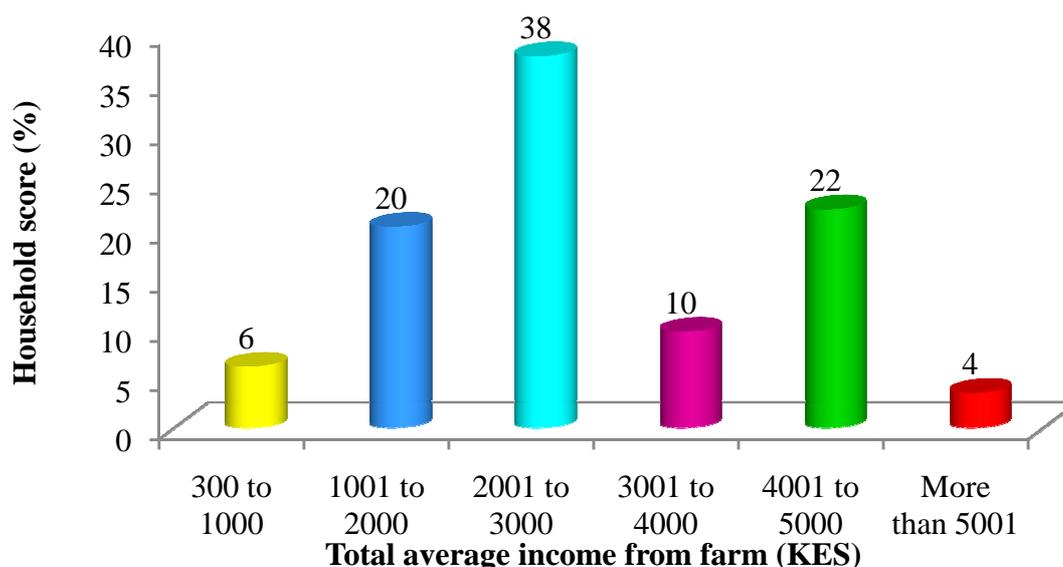
The stored maize quantity (100 to 200 Kgs and 50-100 ) implies that farmers have inadequate food supply and access especially with the observed household size of 5-8 members in most of the households as presented in the demographic section with regard to the recommended annual maize consumption estimated at 88 Kgs per individual annually (Mohajan, 2014; FAO, 2009c) . In a study done by Melinda and Olwande (2011), it is noted that maize scarcity exposes farmers to food shortages contrary to adequate availability which is vital for global food security and poverty reduction. Consequently, the finding on the harvested maize (600-700 Kgs food crop and 1450 Kgs maize seed for cash crop) is in agreement with the reviewed County integrated development plan which indicates that maize yields in the County are below the projected estimates with the farmers producing 900 kilograms per acre less the potential of 2,250 kilograms per acre (GoK, 2013).

**Table 12**  
*Quantity of food harvested and stored for consumption*

Policy	Crop	Quantity harvested in Kgs	Quantity stored In Kgs	Response	
				Frequency	Percentage
0.65 ha of food crop	Maize	600- 700	150-200	180	80
		500-600	50-100	38	15
		Less than 500	0-50	12	5
0.05 ha of vegetable crop	Green grams	10-100	0	43	19
		0	0	182	81
0.65 ha of cash crop	Maize seed	1000-1500	50-100	200	89
		500-100	0	14	6
		0-500	0	12	5

Findings on the limited green gram cultivation in the scheme imply that there is lack of crop diversification in the scheme and this could translate into inadequate food availability among the farmers. According to a study conducted by Rahman and Chima (2016), it is mentioned that lack of crop diversification actually reduces production efficiency and the economic scope for improved food security and general livelihood of farmers.

It is established from the respondents' narrations that the farmers' income solely relies on maize seed which is produced as cash crop. Respondents were asked to indicate their net income from the cash crop that is grown one season annually and on the food expenditure. Their responses are as presented in figure 2 and 3

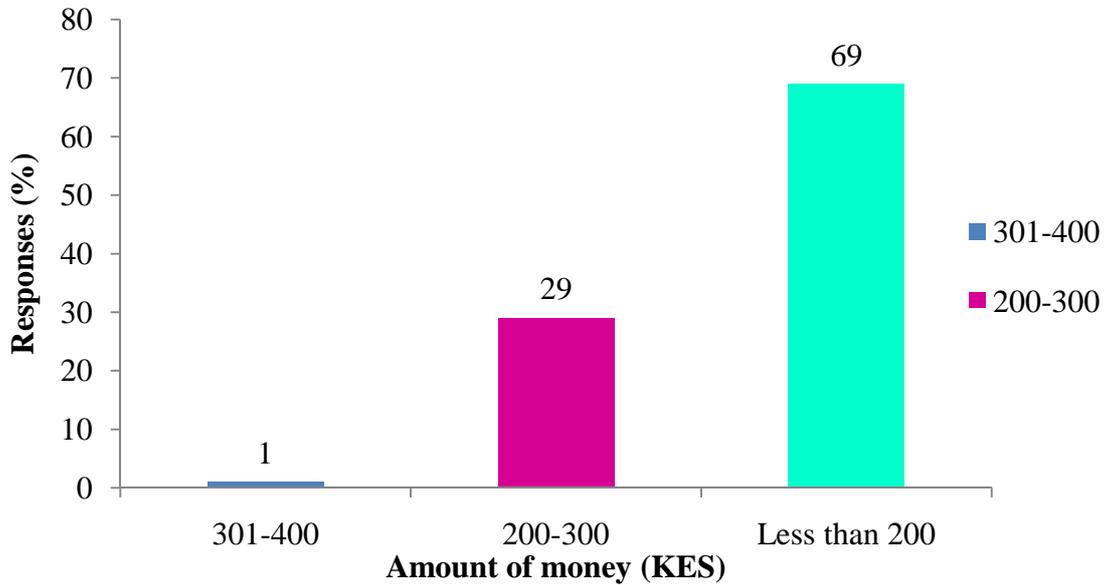


**Figure 2: Household income from cash crop produced once annually**

From Figure 2 it is clear that over one third (38%) of the respondents indicated that they get between KES 2001 to 3000 monthly from farming activities. This finding is in agreement with the projected farming expenses and farmers' net income by the AFC and NIB which indicates the average take home income for the farmers is KES 37,515 per one cropping season for cash crop annually (Appendix 8). This annual figure provides an estimate of KES 3,000 monthly. Information gathered from FGD participants also indicated that the farmers' monthly income is not promising due to the regularly experienced poor yields in the scheme.

The findings have implications on the households' food security. Revealed from the demographic section, majority of household size in the scheme have average of 5-8 members, therefore this monthly earning (KES 2001 to 3000) implies that the income purchasing power among the farmers is low and therefore inadequate food access compared to the consumer price index of KES 186.24 (GoK, 2017).

Further on how the cash crop production policy influenced food security among the farmers, the respondents were asked questions relating to their daily expenditure on food in their household. The results are presented in Figure 3.



**Figure 3: Daily expenditure on food consumption in the household**

From Figure 3, it is evident that over two thirds (69%) of the respondents spend less than KES 200 per day, while over one quarter (29%) spent KES 200 to 300. This level of expenditure on food stuffs could be as a result of the observed low levels of household income to majority of the farmers (Figure 2). It could also be attributed to the high number of male gender (61 % of the respondents in Table 3) which determines the household expenditure level on food. Indeed, men spend very little of their earnings on the households food needs (World Bank, 2007b). A study carried out by Achterbosch, *et al.* (2014), indicate that farmers or workers who have low earnings spend very little of their income on foods of better quality. On gender perspective, men spend very little of their earnings on food needs of the households as compared to their female counter parts (World Bank, 2007b).

Compared to the observed average households size (5-8 members per household, Table 3), this expenditure level implies limited food access. This is based on the income purchasing

power compared to the minimum healthy food basket price of spending at least KES 45 per person per day in the households in rural (WFP, 2013). The finding is in agreement with the study conducted by Musyoka, Kavoi and Omiti, (2014), which indicates that household food expenditure among farmers in rural parts of Kenya is about KES 214 per household of 5 members.

The findings from figure 2 and 3 are likely to be attributed to the findings on partial cash crop policy implementation rate as gathered in section 4.3.4 (Table7).Indeed a study done by Agwu & Orji (2013), reveal that specific agricultural policies play a significant role in determining income variability among farmers. Consequently, with the rising income, households consume food items of better quality and more expensive than those consumed by low income households (Government of Kenya, 2008a).

#### **4.4.3 Influence of Stakeholder Involvement on Food Security**

National Irrigation Board is the implementer of the BISS project and therefore all other institutions operating in the scheme for the betterment of the tenant farmers relied on its functionality. Respondents were therefore asked questions on how their involvement with NIB has influenced production in the scheme and the translated outcome into their food security concerns. Likert scale method of measurement of perception was used. The results are presented in Table 13.

**Table 13**  
***Farmer involvement and the magnitude of food security concerns***

Farmer involvement in NIB (Percentage response)			Statements	Magnitude of food security concerns				
				Often (%)	Some times (%)	Rarely (%)	Never (%)	Not sure (%)
Active	Passive	Not involved	I worry that my household may not have enough food	67	31	2	0	0
8	90	2	We eat a limited variety of food	75	20	1	0	4
8	90	2	We eat less than two meals in a day	8	88	4	0	0
8	90	2	We have no food to eat of any kind in our household	7	77	14	2	0
8	90	2	We go a whole day without eating	4	72	21	2	1

The results in Table 13 show that almost all (90%) of the respondents are of the opinion that they are held passive in the NIB operations. This has had an influence on the food security concerns among the farmers with over two thirds (67%) of the respondents indicating that they often “worry that their household may not have enough food”, Three quarters (75%) of the respondents often “eat a limited variety of food in their households”, while over four fifth (88%) of the respondents stated that they sometimes “eat less than two meals in a day”. On the other hand, over three quarters (77%) of the respondents asserted that sometimes they had

no food of any kind to eat in the household. Further, over three fifths (72%) of the respondents indicated that sometimes they would go a whole day without eating.

Information gathered through personal communication, November 9, 2016, from one of the Key informant interviewee indicated that the relief food demand analysis conducted by the Tana River County Department of Special Programs indicated that the scheme region scored above 70 percent in demand for relief food supply. The food security concerns among the farmers imply that farmers' regularly experience shortage of food availability and limited food access in the scheme. Indeed 56 percent of the population in Tana River County suffers from food insecurity (GoK, 2013). These contradict the Kenyan Constitution (2010) which assured that all Kenyans have a right to be free from hunger and to have adequate food of acceptable quality (Article 43(c) (GOK, 2010b).

The finding could be attributed to the passive involvement of farmers by NIB. Evidently, farming in BISS is totally regulated by NIB and this has had a negative impact on the food security situation among farmers since most of the harvested produce is taken by Kenya Seed Company for international marketing (Ministry of Agriculture, 2013). Further it is significant to note that the potentials for success in ensuring that irrigation sector is viable for improved agricultural productivity and enhanced food security will depend particularly on the engagement with farmers and the representative bodies (Frazen, Hammer & Balfors, 2015).

#### **4.4.4 Influence of Technology Adoption on Food Security**

To establish how the use of tractors, fertilizers and the crop protection measures in the form of herbicides, insecticides and pesticides influence agricultural productivity for enhanced food security, farmers were asked to indicate the size of land that they do cultivate when using and when not using the farm labour machines, the yields produced when using and

when not using fertilizers, herbicides, pesticides and insecticides. The response is as presented in tables 14 and 15

**Table 14**  
*Cultivated Land size in relation to land mechanization*

Land size	Mechanized cultivation (using tractor)		Manual cultivation	
	Response		Response	
	Frequency	%	Frequency	%
<b>0.65 ha cash crop</b>	220	98	10	4
<b>0.65 ha food crop</b>	223	99	5	2
<b>0.05 ha</b>	40	18	5	2
<b>Zero ha (I do not cultivate any of the land portions)</b>	0	0	223	99

From Table 14, almost all (98 and 99%) of the respondents are able to cultivate the 0.65 ha land for cash crop and food crop when tilling the land using farm labour machines. However very few farmers (4 and 2 percent of the respondents) are able to till the same land size manually while almost all (99%) do not cultivate any of the allocated portion of land if there is no labour machine access. Further information gathered in FGD indicate that normally famers do not cultivate in the cash crop and food crop portions when there is tractor shortage instead most of them opt to cultivate in the 0.05 ha of land for they can be able to till this portion manually while some farmers fail to cultivate in any of the portions what so ever.

This shows that agricultural production in BISS relies to a great extent on land mechanization without which the cultivated land size reduces and does the production. This implies that use of tractors increases the cultivated land and as the land size increases so do the crop production and yields, which raise the economic standards and the food quantity stored for consumption and therefore boost farmers' food security. Indeed, the environment

of agriculture is conditioned by resource mechanization which enhances the capacity to bring more land under cultivation for increased productivity and enhanced food security (Munack, 2002). On the contrary, an irrigation investment that is short of tractor package is likely to be inefficient, non-sustainable, unprofitable and unresponsive to the farmers' food demands (Olwande, 2012)

Further on the influence of technology adoption on food security, the respondents were asked to indicate the yields produced when using and when not using farm inputs (fertilizers, herbicides, pesticides and insecticides). The results are presented in table 15.

**Table 15**  
*Maize yields in Kgs in relation to the use of farm inputs*

Yields in kilograms	Using farm inputs		Not using farm inputs	
	Response		Response	
	Frequency	Percentage	Frequency	Percentage
0-100	0	0	180	80
101-200	0	0	34	15
201-300	0	0	11	5
301-400	5	3	0	0
401-500	200	88	0	0
More than 500	20	9	0	0

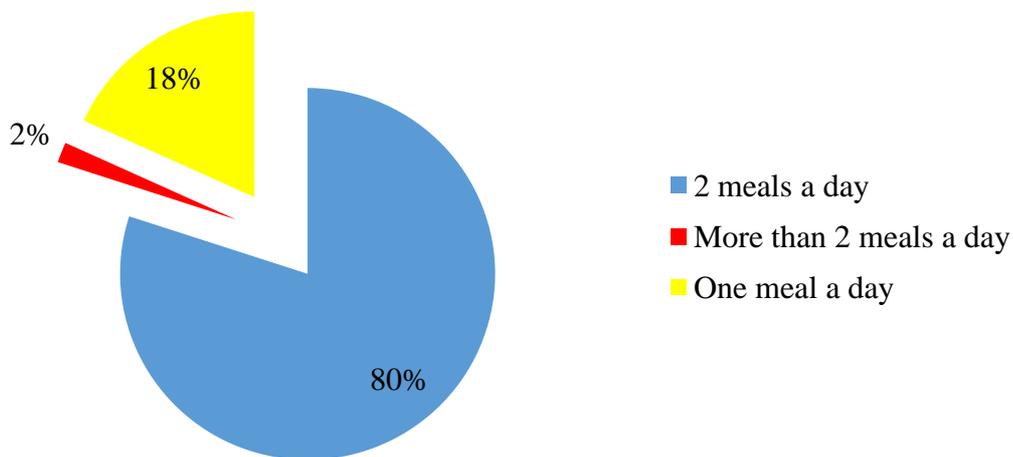
From Table 15, use of farm inputs enables most of the famers (88%) to harvest around 401-500. Contrary to this, 80 percent of the respondents indicated that they harvest 0-100 Kgs of maize when not applying farm inputs. This is further mentioned by one of the Key informant who explained that;

*“Farmers who do not have the capacity to fund farm inputs during the cropping plans are left out of the season plans for it is considered wastage to plant a crop that will not give a farmer maximum yields. To avoid loss associated with this challenge, priority for season plans are given to those*

*famers who are covered in the AFC lending scheme in that particular season for they have assurance for input access”.*

Findings from Table 15 and from the narrative show that agricultural production in BISS relies on the use of farm inputs informs of fertilizers, herbicides, pesticides and insecticides without which the production rate is limited. This implies that use of farm inputs enhances increased production and as production increases so is the betterment of food access among farmers. Indeed, use of herbicides seem to be more effective in weed control with promising maize yields contrary to mechanical weed control which is associated with yield loss (Akinnefes, Ajayi, Sileshi, Chirwa and Chianu, 2010).

In order to establish how the use of technology in agricultural production has translated into the farmers’ food security, respondents were asked to indicate the number of meals consumed in their households daily. The results are presented next



**Figure 4: Average number of meals consumed in the household per day**

Results in Figure 4 show that only 2 percent of the respondent took more than 2 meals a day. This implies that most (98%) households in the study area are food insecure as they cannot manage to access three meals in a day. The finding on the number of meals is below the acceptable meal frequency for both adults and children set to at least three meals in a

day (WFP, 2013). The findings could be attributed to limited technology adoption among the farmers which determines agricultural production and food access among the farmers. Evidently, use of farm labour machines and farm inputs will directly increase the crop productivity per hectare leading to improved food security (Munack, 2002; Duflow, Kremer & Robison, 2008).

#### **4.4.5 Determination of Agricultural Governance Factors Influencing Food Security**

Multi-Logistic Regression Analysis (MLRAM) was done to establish the influence of agricultural governance factors on household food security.

The collected quantitative data was ordinal in nature and therefore logistic regression analysis for ordinal data was used. The coefficients of the covariates for the independent variables were estimated and the results are as presented in the following subsections.

Results presented in Table 16 show that only three of the studied agricultural governance factors (policy on land reallocation, achievement of the objective on improving food crop production in the scheme and on the farmer involvement in the functioning of the Kenya seed company) have a significant relationship with food security of the tenant farmers in BISS as indicated by the p values of 0.03, 0.02 and 0.002 respectively. Other variables in the model reveal p- values that are greater 0.05 threshold. This implies that there is no relationship between food security and the studied agricultural governance factor except in the three of the variables (policy on land reallocation, achievement of the objective on improving food crop production in the scheme and on the farmer involvement in the functioning of the Kenya seed company). However land reallocation policy has a negative relationship with food security (log coefficient -1.22) while the objective on improving food crop production in the scheme and on the farmer involvement in the functioning of the Kenya seed company indicates positive relationship (log coefficient 0.54 and 0.77 respectively). This implies that an increase in the implementation of the land reallocation policy decreases farmers' food security status in the scheme while an increase in the

achievement of the objective on cultivating food crop and an increase in the farmer involvement in the functioning of the Kenya seed company respectively increases the farmers' food security status.

The z values of the studied independent variable are less than 1.96 interval ratio except land reallocation policy, achievement of the objective on improving food crop production and for the involvement of farmers in the supply of seed by Kenya Seed Company; -2.08, 2.25 and 3.07 respectively, this implies that the three variables have strong relationship to food security.

The findings imply that land allocation policy, the schemes objective on improving cultivation of food crop and the extent of farmer involvement in the operations of the Kenya Seed Company are the governance factors to be revisited for the realization of food security among the tenant farmers in BISS. This is in agreement with the researches from recognized publications. According to the 2004 report from Economic Commission for Africa, land tenure determines farming activities and the general investment in land, a factor that affects food security (Economic Commission for Africa, 2004). Further the provision of land to the farmers on renewable leases leads to a sense of insecurity and destroys any incentives for the tenants to develop the land or settle permanently (Mwega, 2008). This exposes farmers to unexpected shocks of food shortage (Ibid).

Food crop production provides solutions and answers to the questions of food availability which has the capacity to reduce food insecurity shocks associated with the rapidly increasing global food crisis and price volatility (FAO, 2006). Kenya Seed Company plays a key role in the agricultural value chain in BISS. Therefore, farmer involvement in the functioning has the capacity to influence income variability and the purchasing power among the farmers. Accordingly, integration of smallholder farmers into the various agricultural value chain activities is a potential pathway to rising the food security and

welfare of farmers as it drives increased productivity, market access and reduced transaction cost (Barrett et al., 2012; Bellemare, 2012; Jaleta, 2009).

**Table 16**  
*Covariates coefficients for the logistic regression model*

<b>Predictor</b>	<b>Coefficient</b>	<b>Standard Coefficient</b>	<b>Error</b>	<b>Odds Z value</b>	<b>95% CI P-value Ratio</b>
Constant 1	-2.82	2.25		-1.25	0.21
Constant 2	3.93	2.36		1.66	0.09
CCP	-0.11	0.23		-0.49	0.62
FCP	0.37	0.20		1.79	0.07
VCP	0.59	0.59		0.99	0.32
LRP	-1.22	0.58		-2.08	0.03*
OC	-0.45	0.24		-1.87	0.06
OF	0.54	0.24		2.25	0.02*
FLM	0.57	0.39		1.46	0.14
FI	0.57	0.39		1.46	0.14
NIB	0.60	0.32		1.84	0.06
AFC	-0.14	0.28		-0.52	0.60
KSC	0.77	0.25		3.07	0.002*
MOA	-0.07	0.24		-0.32	0.75

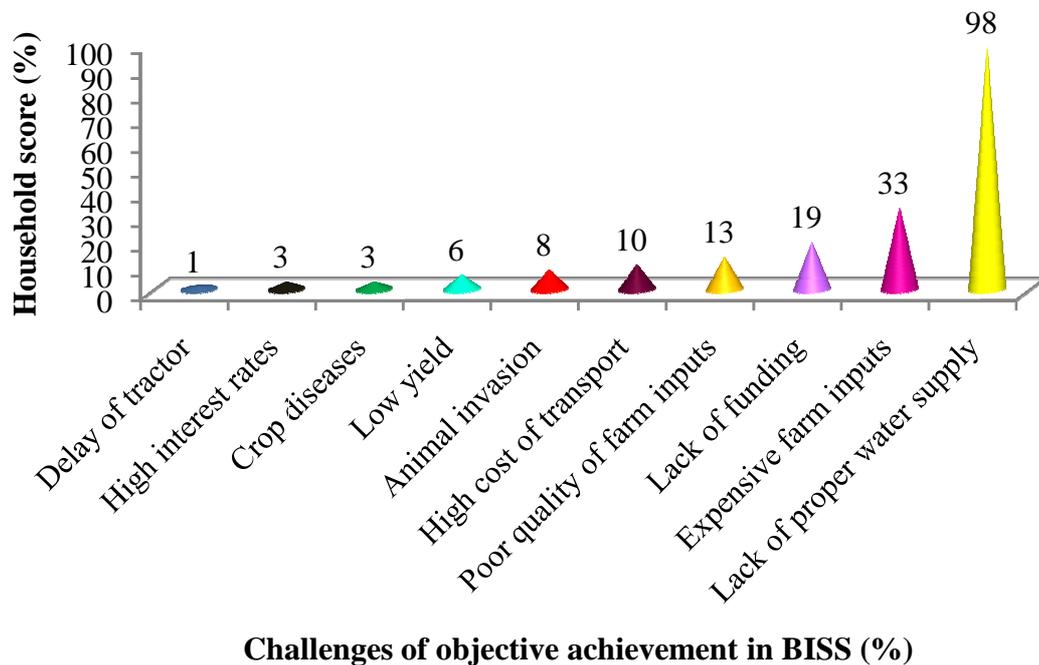
*Dependent variable= Household daily expenditure on food*

#### 4.5 Challenges to Effective Implementation of Agricultural Governance

Objective three of the study sought to establish challenges to the implementation of agricultural governance that is responsive to food security among farmers in the BISS. The respondents were asked questions pertaining to the various challenges facing attainment of the scheme's objectives, the ability to implement policies, the challenge facing the functionality of the stakeholders involved in the scheme operation and the challenges to technology adoption. Their responses are presented in the following sub section.

##### 4.5.1 Challenges Facing Achievement of the Schemes' objectives

Improving food crop and cash crop production in BISS are the objective for the establishment of the scheme. The respondents were therefore asked on the challenges of cultivating food crops and cash crop in BISS. Their responses are presented in Figure 5.



**Figure 5: Challenges of achievement of the set objectives in BISS**

Results in Figure 5 shows that most (98%) of the respondents mentioned lack of proper water supply as the main challenge in crop cultivation. The challenge is further clarified in a statement made by one of the key informant who stated that “*the water pump breakdowns*

*coupled with delayed spare parts is a limiting factor to the departmental functionality which has rendered the irrigation infrastructure inadequate in attaining the set targets for the agriculture sector”.*

From this narration, challenges for the achievement of the scheme objective have its bases from the institutional failure in water supply. This shows that water is the main barrier to the achievement of the objectives of the scheme of improving food and cash crops in the scheme. These could be influencing the famers’ food security situation in BISS. These findings are supported in the findings of a report by World Bank (1990) which acknowledges that BISS project continues to suffer from an unreliable supply of irrigation water and delayed cultivation. Accordingly, Mwega (2008) asserts that major delays were experienced at BISS from the onset of the implementation of the scheme in practically all administrative areas as well as major revisions on scheme design. This affected the project from realizing its goals and objectives. Molden (2007), posit that the challenge of meeting the growing demand of food will hinge on the ability to constantly supply water, particularly in areas with high incidence of poverty and in areas with high variation in rainfall.

#### **4.5.2 Challenges Facing Policy Implementation in BISS**

Cultivation of cash crops in a 0.65 ha of land and food crop on the 0.65 ha is the set policy for balancing cash crop and food crop production in the scheme. Respondents were asked questions pertaining to the challenges facing implementation of these policies in the BISS. Their responses are presented in Table 17

Results in Table 17 show that most (98%) of the respondents mentioned water crisis as the main challenge influencing the balancing of food crops and cash crops according to the set policy. The finding is further mentioned in an FGD session in which the participants acknowledged that despite the establishment of the policy for balancing food and cash crops

in the BISS project, water crisis in the scheme tends to be more rampant during the food crop production seasons unlike in the cash crop cropping seasons.

**Table 17**  
*Challenges on implementation of cash crop and food crop policy*

<b>Presented challenges</b>	<b>Frequency</b>	<b>Percent (%)</b>
Delayed funding	2	1
Crop diseases	3	1
Poor yield	4	2
Delayed seed supply	5	2
High cost of transport	6	3
Expensive inputs	15	7
Animal invasion	18	8
Poor quality of farm inputs	69	31
High interest loans	93	41
Water crisis	221	98

Water use policy is also mentioned in the FGD forum as one of the regulations in which farmers are required to irrigate following the lineup of the assigned portions. This regulation is likely to affect farm production as the irrigation delay caused by one farmer is likely to affect the rest of the farmers in the lineup.

This indicates lack of coordination between the established policies and the existing institutions responsible in supplying water for irrigation. The finding on water challenge further implies that though BISS is one of the national irrigation projects, water abstraction from the river remains a drawback to agricultural productivity for enhanced food security among the farmers. This is probably because of laxity in the operation of National Irrigation Board (NIB) which is an agency with the mandate to pump water to the farms. The frequent break-down of the water pumping machines together with the slow

nature of their maintenance as revealed by study participants has hampered this irrigation project to implement the policies accordingly and to achieve its optimal potential.

This finding is in agreement with the report by the Ministry of Agriculture, Livestock and Fisheries (2015) in which water shortage is cited as the main constraint for the farmers to realize the benefits of the supplied seed variety through the ministry programs. Indeed, water reallocation in micro-irrigation sector poses challenges related to the effective utilization of water resource among the water users who are exposed to great risks associated with crop failure and poor yields (Molle, Wester, & Hirsch, 2010).

On policy implementation challenges, the study subjects were further asked questions with regard to the challenges facing the implementation of policy on cultivating vegetable crops in a 0.05 ha of land in the BISS. Their responses are presented in Table 18.

Among other challenges presented, lack of proper water supply was cited as the main (81% response) constraint (Table 18) hindering BISS from implementing the policy on vegetable cultivation.

The findings could be attributed to institutional failure of NIB which has the responsibility to supply water for irrigation. The failure in policy implementation could be inhibiting the scheme to achieve the goal to improve food security among the settled farmers.

**Table 18**  
*Challenges of implementing the vegetable cultivation policy*

<b>Presented challenges</b>	<b>Frequency</b>	<b>Percent (%)</b>
High interest loans	4	2
Lack of funding	6	3
Lack of farm input	11	5
Expensive farm input	11	5
Limited land	12	5
Crop diseases	17	8
High transport cost	23	10
Low yield	24	11
Animal invasion	38	17
Water crisis	182	81

The finding is further expounded by one of the NIB Key Informant who stated that:

*“The inappropriate utilization of waste water among farmers is a great challenge to the schemes development. Farmers are advised to establish temporary farms inform of out growers along unutilized land around the scheme so that they are able to utilize the spilling water from the main farms for vegetable cultivation. The idea however receives lesser uptake among the farmers”.*

The finding from this narration is in agreement with the findings in table 17 and 18. This shows that policy implementation in BISS is hampered by the water related challenges. Accordingly, the FAO report mentions lack of water supply as one among the constraints that have led to the decline in irrigation performance and policy implementation in public irrigation schemes (FAO, 2007; 2016) .The findings on lack of proper water supply has an influence on food security among farmers. Indeed, food security is a major output of irrigation development activities; however this cannot be achieved without sustainable water resources management (Ruigu, 1988).

### 4.5.3 Challenges Facing Involvement of Stakeholders in BISS

Stakeholder involvement is important in this study as it is the structure responsible for implementing the policies in place and ensuring goal achievement in the project. Respondents were therefore asked to indicate barriers to their participation in the running of the scheme activities such as water management and funding of farming. Their responses are presented in Table 19.

**Table 19**  
*Challenges facing farmer participation in scheme operations*

Challenges to farmer participation	Response	
	Frequency	Percentage
Skills to manage	113	50
Low financial returns	156	70
Illiteracy	203	90
Communication environment	221	98
Funding of the Farming expenses	135	60

Results in Table 19 shows that 90 percent of the respondents mentioned illiteracy as a barrier to the farmer participation in running the scheme activities. Further, 98% of the respondents mentioned communication environment as a limiting factor to farmer participation out of the fact that development partners and experts do not provide consultancy or training to build farmers skills. Further from the table, economic factor in the form of low economic returns from the farm (70% of response) and the inability to fund the farming expense (60% of the response) are mentioned as discouraging farmer participation in decisions related to output marketing and pricing but instead the farmers rely on decisions by the suppliers of inputs, the financier and the buyer.

This shows that farmers' low level of education and low economic standards as presented in the demographic section (Table 3) coupled with lack of extension contact with experts is a disadvantage to their involvement in the schemes plans and operations. This has implications on agricultural production specifically on the yields percentage in the scheme.

Indeed, basic education can influence farmer participation in the agri-environmental schemes as it builds the skills and machinery to manage resources for better productivity of the sector (Damianos & Giannokopoul, 2002; Ben-Aye, 2002; Sokoya, Adefunke & Fagbola, 2014). With regard to economic factors as a challenge, it is significant to note that the income levels play a significant role in determining the probability to participate in agricultural cooperative. It enables farmers to fund farming expenses, a factor that further sustains participation and builds more interest in agricultural activities (Salam, Noguchi & Koike, 2005; Karly, Bilgic & Celik, 2006).

The researcher further gathered information on the challenges experienced in the functioning of the key entities and institutions operating in BISS. Findings gathered through FGDs and the key informants' narrations are presented next.

Focus Group Discussion (FGD) participants revealed that disagreement among the stakeholders operating in the scheme has hindered the stakeholders to operate harmoniously towards achieving the set targets of the scheme. For instance the policy on cultivating cotton as cash crop in the scheme has failed out of the stakeholders' disagreement despite the recent effort made to launch and sign an agreement on the planting of cotton (Appendix 6). This has implications to the farmers' food security in that failure to cultivate cash crops will reduce their financial gains and limit their purchasing power. Significant to note is that agreement between the stakeholders support informed future response as everyone's interest are presented in a collaborative process, a factor that brings in a variety of activities engaged by farmers towards improving income levels and sustainable food production (Mutambar, Darkoh & Mutambara, 2014)

Low budgetary allocation was mentioned by the key informants from NIB and Kenya seed as a drawback to the functioning of these departments in the agriculture sub-sector as expressed by NIB informant that “ *The established water pump station for Bura Irrigation*

*and Settlement Scheme suffered from financial consequences in the planning stage; gravity irrigation system was to be constructed but this abstraction was postponed out of low funds allocated and a diesel water pump constructed instead..... The situation is made even worse with the experienced limited supply of spare parts and fuel’.*

This implies that the performance of stakeholders in BISS is largely rendered ineffective by limited financial allocation which translates into water shortage issue and therefore the inability to enhance food security among the settled farmers. Hanjra and Qureshi (2010), hold that water scarcity is among the emerging forces challenging the achievement of the human goals of eradicating extreme poverty and hunger.

The challenges facing the functioning of the involved stakeholders in BISS are further espoused by a KEPHIS Key Informant, who narrated that *“there is slow adoption of research into new seed technology associated with lack of expertise in the department. The farmers receive poor quality seeds thus low productivity and susceptibility to diseases”*. The findings from this narration reveal that lack of expertise renders the stakeholders ineffective in providing services to the famers. This has negative implications on agricultural production for enhanced food security among the tenant farmers. Finding from the narrative is in agreement with the study conducted by Langyintuo, Mwangi, Diallo, Mac, Dixon and Banziger (2010). According to their findings, lack of qualified man power among other factors is a draw back to the normal field operations of the seed industries in East Africa.

Information gathered from one of the KIIs reveal that; *“the functioning of the involved stakeholder in the scheme is held ineffective due to limited incentives for investment in irrigation materials, equipment and machinery partly due to scheme location and due to poor wages paid by the sector. A factor that renders the maintenance of the water pumping station difficult in that highly skilled mechanics needed to maintain the water station cannot*

*be obtained*". This shows that the challenge of water shortage in the scheme is mainly attributed to the mechanical problem and this has implications on realizing the potentials of the scheme. The KIIs report is in agreement with the World Bank report (1990), that the maintenance and operation of the pumping station and agricultural machinery in BISS became particularly problematic. Additionally, Mwega (2008), acknowledge that the BISS has failed to achieve the set targets from the fact that the project staff were poorly trained, poorly motivated and in deficient numbers and that qualified and experienced staffs were difficult to obtain, due to the project's location and the salaries offered.

#### **4.5.4 Challenges Facing Technology Adoption in BISS**

The respondents were asked to indicate the challenges facing farmers' ability to adopt technology in the scheme. The response is as presented below

From Table 20, almost all (90 and 98%) of the respondent mentioned limited farm labour machines and restricted credit facility as the main constrain to technology adoption among farmers. This shows that farmers in BISS have limitations to adopt technology and this has an implication on the yields produced in the scheme and the farmers' food access and availability.

**Table 20**  
*Challenges facing technology adoption in BISS*

<b>Challenges facing technology adoption</b>	<b>Response</b>	
	<b>Frequency</b>	<b>Percentage</b>
Limited farm labour machines in the scheme	203	90
Restricted credit facility access	221	98
Expensive farm inputs	113	50
Limited supply of subsidized inputs	156	70
Resistant crop diseases	135	60

The finding is in agreement with the study done by Munack (2002), which found that limited access to tractors among farmers in irrigation sector is a barrier to the farmers' adoption of new land tilling practices. This retards agricultural productivity as the cultivatable land tends to be limited, yields reduce and therefore exposes farmers to food insecurity shocks.

Restricted credit facility is further mentioned by an AFC informant who reported that their financing policy is restricted to farmers who have cleared the previous loan. However, majority of the farmers are out of the AFC lending scheme due to outstanding loans encountered in seasons that yields' income could not clear the loan. Further the informant mentioned that other credit facilities that were operational in the scheme including Equity Bank have withdrawn their service due to such debts encountered by the farmers. This shows that the yields in BISS are not promising and therefore expose farmers to debts they cannot clear and as a result limits their access to credit facility. This has implications on their ability to apply fertilizers and other farm inputs for improved agricultural production. Indeed, credit facility is statistically significant and positively correlated with improved technology such as fertilizers and high yielding seed variety (Diagne and Zeller, 2001). Further it is a stimulant for technology adoption as it mitigates the challenge encountered by farmers who face seasonal cash fluctuations (Ibid).

## CHAPTER FIVE

### SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

#### 5.1 Introduction

This chapter presents the key findings of the study and conclusions guided by the research objectives. Policy recommendations and recommendations for further studies in this field of academia are also presented.

#### 5.2 Summary of the Study and the Key Findings Based on the Study Objectives

Drawing from the findings of study objectives, the following were the findings;

- 1) Most farmers in BISS are aware of different agricultural governance structures applied in the running of the scheme.
- 2) Over 50% of the respondents indicated that the policies in place are partially implemented. Whereas NIB passively involved farmers in its functions, farmer involvement in the functioning of other stakeholders was indicated as active. With regard to technology, respondents indicated that access of the farm inputs and the provisions of irrigation infrastructure were poor in the scheme.
- 3) Almost all the farmers obtain maize from the farm in both the two cropping seasons with a negligible numbers cultivating green grams in the scheme. Maize harvest is around 600-700 Kgs of maize as food crop and 1500 as cash crop. However the stored food quantity is minimal with majority storing 100 to 200 Kgs for maize as food crop and 50-100 Kgs from maize seed, for household food consumption. Net income of majority of the farmers is estimated at KES 2001 to 3000 monthly.
- 4) Over 50% of the respondents spend less than 200 KES for the purchase of food per day. The magnitude of food insecurity concern with reference to farmer involvement in the running of the scheme is high among most of the farmers in BISS.

- 5) Almost all farmers rely on the use of farm inputs in crop cultivation. However households' food access and availability is low with most of the respondents consuming two (2) meals a day. The regression results reveal that the agriculture governance factors that were significant in relation to food security were policy on land reallocation, achievement of the objective on improving food crop production in the scheme and on the farmer involvement in the functioning of the Kenya seed company.
- 6) Lack of proper water supply for irrigation, illiteracy, limited access to farm inputs and restricted credit facility are the main draw backs to the achievement of the schemes objectives and the implementation of the established policies.

### **5.3 Conclusions**

- I. BISS has well-established governance structures regulating farming practices. However, after 39 years in operation, the scheme has not fully achieved the set objectives and the policies in place are partially implemented.
- II. The functioning of the agricultural governance structures in the scheme has translated into low yields for both the cash crop and food crop in the scheme and therefore limited food availability and food access among the farmers.
- III. Food crop production in the scheme, Land tenure system and the extent of farmer involvement in the seed supply by Kenya Seed Company are the significant areas of concern to be emphasized.
- IV. Among other challenges presented, water scarcity was the main challenge to the implementation of agricultural governance that is responsive to food security among the farmers.

## **5.4 Recommendations**

From the findings of the study the following recommendations for policy reforms and practices are made.

### **5.4.1 Policy recommendations**

- I. The Government through the Ministry of Agriculture and other partners should develop programs and strategies aiming at promoting the production of both food crops and cash crops to encourage crop diversification.
- II. The study recommends that the National Irrigation Board should establish strategies to ensure maximum utilization of the land allocated to the farmers for the cultivation of several crops in the scheme.
- III. The Government through the underlying ministries should establish laws that will ensure active involvement of farmers in the functioning of NIB and KSC for enhanced production and food security.
- IV. The Government of Kenya through the NIB should accelerate proper investment in the water department to finance the acquisition of modern equipment to ensure constant and efficient supply of water to all individuals' farms.

### **5.4.2 Recommendations for further research**

- I. Agriculture being a devolved unit in the new Kenya constitution, the study recommends a research on how the county governments have contributed to the betterment of agricultural production and general wellbeing of tenant farmers especially on food security matters in the public irrigation scheme.
- II. More research needs to be done on how food security of the tenant farmers in public irrigation schemes can best be improved to meet not just the Millennium Development Goals but also the Sustainable Development Goals.

**REFERENCES**

- Abawi, K. (2013). *Data collection instruments (Questionnaires and interview): Training in sexual and reproductive health research*. Geneva, Switzerland: Geneva Foundation for Medical Education and Research.
- Abbott, B.& Bordens, S. (2011). *Research design and methods: A process approach* (8<sup>th</sup> Ed.). New York, USA: McGraw- Hill.
- Achterbosch, T., Berkum, S. & Meijerink, G. (2014). *Cash crops and food security: Contributions to income, livelihood risks and agricultural innovation*. Wageningen, Netherlands: LEI Wageningen UR.
- African Development Bank*. (Ed.) (2012). *Highlights of food security situation in Africa*. (2nd.ed.). Singapore, Washington D.C: Pearson Education.
- African Union (2014). *African union handbook: A guide for those with and within the African Union*. Addis Ababa, Ethiopia: African Union and New Zealand crown.
- Agwu, N. & Orji, C. (2013). Empirical analysis of income inequality and welfare among farmers in South Eastern Nigeria. *Journal of Agricultural Sciences*, 8(1).
- Akinnefes, F., Ajayi,C., Sileshi,C., Chirw,W. & Chianu, J. (2010). Fertilizer tree for sustainable food security in the maize based production system of East and Southern Africa. *Agronomy for Sustainable Development*, 30, 615-629
- Alila, P. & Atieno, R. (2006). *Agricultural Policy in Kenya: Issues and processes*. Nairobi, Kenya: Institute of development studies

- Awulachew, B., Merrey, J., Kamara, B., Van Koppen, B., Penning de Vries, F. & Boelee, E. (2005). *Experiences and opportunities for promoting small scale micro irrigation and rain water harvesting for food security in Ethiopia: Working paper 98*. Addis Ababa, Ethiopia: IWMI (International Water Management Institute)
- Barrett, C., Bachke, M., Bellemare, M., Michelson, H., Narayanan, S. & Walker, T. (2012). Smallholder participation contract farming: comparative evidence from five countries. *World Development*, 40(4), 715–730.
- Bellemare, M. (2012). As you sow, so shall you reap: the welfare impacts of contract farming. *World Development*, 40(7), 1418–1434.
- Ben-Aye, M. (2002). *People participation in rural development programme in Tunisia. A case study/ PhD Dissertation*. Colombia, United States: University Missouri
- Bertalanffy, V. (1968). *General systems theory: Foundations, development, applications*. New York, U.S.A: George Braziller.
- Bertalanffy, V. (1973). *General system theory* (Revised Edition). Edmonton, Canada: University of Alberta.
- Bertalanffy, V. (1975) . *Perspectives on general system theory*. New York, U.S.A: George Braziller.
- Bhattacharjee, A. (2012). *Social science research: Principles, methods, and practices*. Florida, USA: Creative Commons Attribution.
- Biermann, F. (2009). Earth system governance as a crosscutting theme of global change research: Global environmental change. *Human and Policy Dimensions*, 17, 326-327.

- Birendra, K., Schultz, B. & Prasad, K. (2011). Water Management to meet present and future food demand. *Irrigation Drainage*, 60, 348-359.
- Birner, R. (2007). *Improving governance to eradicate hunger and poverty: 2020 Focus brief on the world's poor and hungry people*. Washington, DC: IFPRI.
- Birner, R. & Von Braun, J. (2016). Designing global governance for agriculture development: Food & nutrition security. *Review of Development Economic*, 21(2) 265-284.
- Boon, K. (2009). *Food insecurity in Africa: Challenges and Prospects*. Brussels, Belgium: Regional Sustainable Development Review.
- Brunner, J., Santiago, P., Guadila, C., Gerlachi, J. & Velho, L. (2006). *OECD review of tertiary*. Paris, France: OECD publication.
- Bryman, A. (2001). *Social research methods*. Oxford, UK: Oxford University Press.
- Damianos, D. & Giannokopoul, N. (2002). Farmer participation in agri-environment scheme in Greece. *British Food Journal*, 104, 261-274
- Das, R. (2015). *Handbook of research on globalization, investment and growth: Implications of confidence and governance*. Katwaa College, India: IGI Global.
- Dasgupta, S. & Roy, I. (2011). *Good agricultural governance: A resource guide focused on smallholder crop production*. Bangkok, Asia: RAP publication 2011/18.
- Dereje, M. & Desale, K. (2016). Assessment of the impact of small-scale irrigation on household livelihood improvement at Gubalafto District, North Wollo, Ethiopia. Samara, Ethiopia: MDPI.

- Diagne, A. & Zeller, M. (2001). *Access to credit and its impact on welfare in Malawi*. International Food Policy Research Institute. Washington. DC.
- Dorward, A., Keddy, J., Morrison, J. & Urey, I. (2004). A policy agenda for pro-poor agricultural growth. *World development*, 32, 73-89.
- Duflo, E., Kremer, M. & Robison, J. (2008). How high are rate of return to fertilizer? Evidence from yield experiments in Kenya. *American economic review*, 98(2), 482-888.
- Eamin, A. (2012). Agricultural information literacy of farmers in northern region of Bangladesh. *Journal of Information and Knowledge Management*, 2(6), 4-7.
- Economic Commission for Africa (2004). *Land tenure system and their impact on food security and sustainable development in Africa*. Addis Ababa, Ethiopia: ECA print shop
- Elias, A., Nohmi, M., Yasunobu, K. & Ishida, A. (2013). Effect of agricultural extension program on smallholders' farm productivity: Evidence from three peasant associations in the highlands of Ethiopia. *Journal of Agricultural Science*, 5(8), 163–181.
- European Commission -Standing Committee on Agricultural Research (2009). *New challenges for agricultural research: Climate change, food security, rural development, agricultural knowledge systems*. Brussels, Belgium: European Union.
- Food and Agricultural Organization (2003). *World agriculture towards 2015/2030: An FAO perspective*. London, UK: Earth Scan publications Ltd.

- Food and Agricultural Organization (2006). *Food security and agricultural development in Sub-Saharan Africa: Building a case for more public support policy Brief NO.1.London, UK*. Earth scan.
- Food and Agricultural Organization (2007). *Summary of findings of mission in selected countries in East & South Africa: Irrigation Technology Transfer in Support of Food Security*. Italy. Rome: Oxford university press.
- Food and Agricultural Organization (2008). *What are the links between agricultural production and food security?* London, UK: Earth Scan publications Ltd.
- Food and Agricultural Organization (2009a). *How to Feed the World in 2050. Insights from an Expert Meeting at FAO, 2050(1)*, 1–35. <http://doi.org/10.1111/j.1728-4457.2009.00312.x>.
- Food and Agricultural Organization (2009b). *How to feed the world by 2050: The technology challenge*. UK, London: Earth scan Publications Ltd.
- Food and Agricultural Organization (2009c). *FAO stat production, Consumption and trade*. <http://faostat.fao.org/site/291/default.aspx>.
- Food and Agricultural Organization (2010). *The State of food insecurity in the world 2010: Addressing food insecurity in protracted crises*. Rome, Italy: Oxford university press.
- Food and Agricultural Organization (2011). *The state of the world's land and water resources for food and agriculture: Managing system at risk*. Rome and Earth scan, Landon: Food and Agricultural Organization of the United Nations.

- Food and Agricultural Organization (2012). *The State of Food Insecurity in the World 2012: Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition*. Rome, FAO: Oxford university press.
- Food and Agricultural Organization (2013). *The State of food insecurity in the world: The multiple dimensions of food security*. Rome, Italy: Oxford University press
- Food and Agricultural Organization (2014a). *State of Food Insecurity in the world*. Rome, Italy: Oxford University press.
- Food and Agricultural Organization (2014b). *Water governance for agriculture and food security*. Rome, Italy: Oxford University press.
- Food and Agricultural Organization (2015). *The state of food insecurity in the world 2015*. Rome, Italy: Oxford University press.
- Food and Agricultural Organization (2016). *Irrigation water use*. Retrieved February 21, 2017, from <http://www.fao.org/irr/aquastat>.
- Fontain, C., Haarman, A. & Sahmid, S. (2006). *Stakeholder theory of the MNC*. Oxford, UK: Oxford University press.
- Fraunze, H.& Bruntup, M. (2014). Agricultural policy process: A challenge for Africa's Development. *Quarterly Journal of International Agricultural*50 (1), 1-7.
- Frazen, F., Hammer, M. & Balfors, B. (2015). Institutional development for stakeholders' participation in local water management: An analysis of two Swedish catchments. *Land use policy*, 43, 217-227.
- Freeman, R. (2004). *A stakeholder theory of modern corporations: Ethical theory and business (7th Ed.)*. Upper Saddle River, NJ: Prentice Hall.

- Girma, K. (2011). *The contribution of small scale irrigation to households' income and food security: The case of Gambela Tere irrigation scheme, east wellega zone of Oromia*. Addis Ababa, Ethiopia: Addis Ababa University College of Development Studies.
- Githui, N. (2015). Assessment of factors influencing food security in Wenje division, Tana River County - Kenya. *Master's Thesis*: Pwani University.
- Government of Kenya (2003). *The economic recovery strategy for wealth and employment creation (2003-2007)*. Nairobi, Kenya: Government Printer.
- Government of Kenya (2008,a). *Food Insecurity assessment in Kenya Bases on Kenya Integrated Household Budget Survey, 2005/06*.Kenya National Bureau of Statistics. Nairobi, Kenya.
- Government of Kenya (2008,b). *Tana River district development plan 2008-2012: Ministry of state for planning, national development and vision 2030*. Nairobi, Kenya: Government Press.
- Government of Kenya (2010a). *Agricultural sector development strategy 2010-2020*. Nairobi, Kenya: Government printer.
- Government of Kenya (2010b). *The constitution of Kenya*. Nairobi, Kenya: National Council for Law Reporting.
- Government of Kenya (2012). *The Kenya Food Security Steering Group (KFSSG).The 2011/2012 Short Rains Assessment Report*. Nairobi, Kenya: Government printer.
- Government of Kenya (2012b). *Laws of Kenya: National Irrigation Act. National Council for Law Reporting*. Nairobi. Kenya).

- Government of Kenya (2013). *County Integrated Development Plan Tana River County*. Nairobi, Kenya: Government printers.
- Government of Kenya (2014). *National Drought Management Authority (NDMA).Drought early warning bulleting for December, 2014*. Nairobi, Kenya: Government Printer.
- Government of Kenya (2017). Consumer price indices & inflation rate. Nairobi, Kenya: KNBS.
- Graves, A., Matthews, R. & Waldie, K. (2004). Low- external-input technologies for livelihood improvement in subsistence agriculture. *Advance in Agronomy*, 82, 473-555
- Green, K. (2013). The theory of active involvement processes underlying interventions that engage adolescents in message planning and or production. *Heath communication*,28(7), 644-656.
- Hanjra, M. & Qureshi, M. (2010). *Global water crisis and future food security in an era of climate change*. *Food policy*, 35(5), 365-377.
- Hosmer, D. & Lemosh, S. (2000). *Applied logistic regression*. Singapore. Toronto. Wiley-inter-science publication.
- Huang, Q., Rozelle, S., Lohmar, B., Huang, J. & Wang, J. (2006). Irrigation, agricultural performance and poverty reduction in china. *Food Policy*,31, 30–5.
- International Foundation for Agricultural Development (2001). *Rural poverty report 2001*. Oxford, UK: Oxford university press.
- International Foundation for Agricultural Development (2011). *Strategic framework 2011-2015: Enabling poor rural people to overcome poverty*. Rome, Italy: Oxford university press.

- Jaleta, M., Gebremedhin, B. & Hoekstra, D. (2009). *Smallholder commercialization: Processes, determinants and impact*. Discussion Paper No. 18. Improving Productivity and Market Success (IPMS) of Ethiopian Farmers Project. Nairobi, Kenya: LRI (International Livestock Research Institute).
- Kabutha, C. & Mutero, C. (2002). *From government to farmer- managed small holder rice schemes: The unresolved case of Mwea irrigation scheme*. Unpublished work.
- Karly, B., Bilgic, A. & Celik, Y. (2006). Factors affecting farmer decision to enter agricultural cooperative using random utility model in the Southern Anatolia region of Turkey. *Journal of Agriculture and Rural Development in the Tropics & Subtropics*, 107, 115-127.
- Kast, F. & Rosenzweig, J. (1972). General Systems Theory: Applications for organization and management. *Academy of management Journal*, 23, 447-464.
- Kibaara, B., Gitau, R., Kimenju, S., Nyoro, J., Bruntrup, M. & Zimmermann, R. (2009). *Agricultural Policy Making in Sub-Saharan Africa*. Paper presented at the CAADP progress in Kenya. Nairobi, Kenya: Tegemeo, pp.35-2008.
- Kinsella, E. (2006). Hermeneutics and critical Hermeneutics: Exploring possibilities within the art of interpretation. *Journal of qualitative social research*, 7,3.
- Kothari, R. (2004). *Research Methodology: Methods and Techniques*. (2<sup>nd</sup> ed.). Jaipur, India: New Age International Publishers.
- Kuafman, D., Kray, A. & Mastruzzi, M. (2007). *The Worldwide governance indicators Project: Answering the Critics*. Washington, DC: World Bank Policy.
- Kumar, R. (2005). *Research methodology: A step-by-step guide for beginners*. (3<sup>rd</sup> ed.). Singapore, Washington, D.C: SAGE.

- Langyintuo, A., Mwangi, W., Diallo, A., Mac, J., Dixon, J. & Banziger, M. (2010). Challenges of the maize seed industry in eastern & southern Africa: A Compelling Case for Private Public Intervention to promote growth. *Food Policy*, 35 (4),323-331.
- Latham, B. (2007). *Sampling: What is it? Quantitative Research Methods*. Belmont, California: Wadsworth.
- Luvai, O. & Maende, B. (2014). Perceived relationship between teacher acquisition of higher degree and student's academic performance in Kakamega Central district, Kenya. *International Journal of Education and Research*, 2, 4.
- Mohojan, H. (2014). Food and Nutrition Scenario of Kenya. *American Journal of Food and Nutrition*, 2(2), 28-38.
- Manzoor, A. (2011). *Improving the international governance of food security and trade: ICTSD program for agricultural trade and sustainable development; Issue Paper No. 38*. Geneva, Switzerland: International Centre for Trade and Sustainable Development.
- Mckeeon, N. (2011a). Global governance for world food security: A scorecard four years after the eruption of the "Food Crisis". *Journal of Peasant Studies*, 1, 0–25.
- Mckeeon, N. (2011b). *Rethinking Development in an Age of Scarcity and Uncertainty*. Rome, Italy: York University.
- Melinda,S. & Olwande, J. (2011). *Is older better? Maize hybrid change on household farms in Kenya. Working paper No.47/2011*. Nairobi, Kenya: Tegemeo institute of Agriculture policy and development.
- Ministry of Agriculture, Livestock and Fisheries (2015). *The draft national irrigation*

*policy*. Nairobi, Kenya: Government Printer.

Ministry of Agriculture (2013). Tana River County floods, Tana North District, Kenya initial rapid assessment (Kira) Report.

Miruka, M., Okello, J., Kirugua, V. & Murithi, F. (2012). *The role of Kenya Agricultural Research Institute in the attainment of household food security in Kenya: A policy and organizational review*. Nairobi, Kenya: Springer science+ Business media and International Society for Plant and Pathology 2012.

Molden, D. (2007). *Water for Food, Water for Life: A comprehensive Assessment of Water Management in Agriculture*. Lanka/Earth scan, London: IWMI, Sri.

Molle, F., Wester, P. & Hirsch, P. (2010). River basin closure: Processes, implications and responses. *Agricultural Water Management*, 97(4), 569-577.

Mugenda, L. & Mugenda, R. (2003). *Research methods: Qualitative and quantitative approaches*. Nairobi, Kenya: African center of technology studies (A.C.T.S).

Munack, A. (2002). Agriculture and the environment: New challenge for engineers. *The CIGR journal of Scientific Research and Development*, 4(1), 7.

Musyoka, P., Kavoi, M. & Omiti, J. (2014). *Food consumption patterns and distributional welfare impact of import tariff reduction on cereals in Kenya*. *African Journal of Agricultural and Resource Economics*, 9(3), 183-199.

Mutambara, S., Darkoh, M. & Mutambara, J. (2014). Towards sustainable stakeholder engagement in smallholder irrigation schemes in Zimbabwe. *African Journal of Agricultural Research*, 9(50), 3587-3599.

- Mwakila, S. & Noe, C. (2005). *The use of sustainable irrigation for poverty alleviation in Tanzania: The case of small holder irrigation scheme in Igurusi, Mbarali District Tanzania*. REPOA. Research report NO 04.1-69pp.
- Mwega, F. (2008). *Aid Effectiveness to Infrastructure: A Comparative Study of East Asia and Sub-Saharan Africa Kenya Case Study*. Tokyo, Japan Bank for International Cooperation, Research Paper No. 36-3.
- National Irrigation Board (2015). Bura Irrigation Scheme, brief summary. Retrieved December 19, 2015, from <http://www.nib.or.ke>.
- Ngigi, S. (1998). Review of irrigation development in Kenya. Nairobi, Kenya: Nairobi University.
- Ngigi, S. (2002). *Review of irrigation development in Kenya*. Colombo, Sri Lanka: International Water Management Institute.
- Nyoro, J. (2007). Financing agriculture: Historical perspective. Presentation at the AFRACA Agri banks Forum.
- Olielo, T. (2013). Food security problems in various income Groups of Kenya. *African Journal of Food, Agriculture, Nutrition and Development*, 13(4), 1-13.
- Olwande, J. (2012). *Small holder maize production efficiency in Kenya*. Nairobi, Kenya: Tegemeo Institute of Agriculture.
- Ong'ayo, A. & Akoten, J. (2007). *The determinants of empowerment and food security among smallholder farmers in Kenya*. IPAR Discussion paper No.097/2007.
- Page, H. (2013). *Global governance and food security as global public good*. New York University, New York: Center for International Cooperation.

- Pan Africa Chemistry Network (2012). *Increasing Africa's Agricultural productivity*.(Unpublished).
- Pearberg, R. (2002). Governance of food security in an age of globalization. IFPRI, Washington. DC.
- Piadozo, M., Lantican, F., Pabuayon, I., Quicoy, R., Suyat, M. & Maghirang, P. (2014). Rice farmers' concept and awareness of organic agriculture: Implications for sustainability of Philippine organic agriculture program. *Journal of international society of South East Asian Agricultural society*,20(2), 142-156.
- Pirkle, C., Poliquin, H., Sia, D., Kouakou, K. & Sagn, T. (2015). Re-envisioning global agricultural trade: Time for paradigm shift to ensuring food security and population health in low income countries. *Global Health Promotion*, 22(1), 1797- 9757.
- Poulton, C., Berhanu, K., Chisinga, B., Cooksy, B., Fredrick, G. & Loada, A. (2014). *The Comprehensive Africa Agriculture Development Program (CAADP): Political incentives value added and way forward*. Nairobi, Kenya: Institute of Development Studies.
- Prakash, R. & Palanivel, C. (2011). Challenges in achieving food security in india. *Iranian Public Health Journal*, 40(4), 31–36.
- Qureshi, M., Dixon, J., & Wood, M. (2015). *Public policies for improving food & nutrition security at different scales*. Canberra, Australia: Springer science + Business media Dordrecht and international society for plant pathology.
- Rachel, M. (2012). *Good governance as a concept and why it matters for development policy*. United Nations University, United Nations: World Institute for Development Agenda.

- Rahman, S. & Chima, C. (2016). Determinants of food crop diversity and profitability in south eastern Nigeria: A multivariate tobit approach. *Journal of Agriculture*, 6,(2), 14.
- Ray, D., Mueller, N., West, P. & Foley, J. (2013). Yield trends are insufficient to double global crop production by 2050. *PloS one*, 8(6), 66-428.
- Ruigu, M. (1988). *Irrigation development in Kenya: Past performance and future prospects*. Nairobi, Kenya: Institute of Development Studies.
- Sababo, E. & Adeniji, T. (2007). Studies of awareness and accessibility to agricultural technology information by dry season vegetable farmers in Mubi, Nigeria. *Agricultural journal*, 2, 622-626.
- Salam, M., Noguchi, T. & Koike, M. (2005). Factors influencing sustainable participation of farmers in participatory forestry: A case study in Central Sal forest in Bangladesh. *Journal of Environmental Management* 74, 43-51.
- Shauri, H. (2011). *Drought and famine mitigation strategies: Basic concepts and strategies*. Berlin, Germany: LAP LAMBERT Academic publishing.
- Shepherd, B. (2012). Thinking critically about food security. *Security Dialogue*, 43(3), 195–212.
- Simtowe, F., Asfaw, S. & Abate, T. (2016). Determinants of agricultural technology adoption under partial population awareness: The case of pigeon pea in Malawi. *Agriculture and food economics*, 4(1) 7.
- Singh, A., Rahman, A., Sharma, S., Upadhyaya, U. & Sikka, A. (2009). Small holders' irrigation: Problems and options. *Water Resource Management*, 23, 289–302

- Sokoya, A., Adefunke, O. & Fagbola, B. (2014). *Farmers information literacy and awareness towards agricultural produce and food security: FADAMA III programs in Osun state Nigeria*. Lyon: IFLA.
- Steve, A., Godwin, O.& Kate, I. (2014). The impact of education on agricultural productivity of small scale rural female maize farmers in Potiskum local government , Yobe state : A panacea for rural economic development in Nigeria. *International Journal of Research in Agriculture and Food Security*,2(4), 26–33.
- Suri,T.( 2011). Selection and comparative advantage of technology adoption. *Economics*, 79(1)159-209.
- Texas Water Development Board (2001). *Texas water development board report 347 – surveys of irrigation in Texas, 1958, 1964, 1969, 1974, 1979, 1984, 1989, 1994 and 2000*. Austin, Texas: TWDB.
- Texas Water Development Board (2011). *Texas water development board report 378 – irrigation metering and water use estimates: A comparative analysis, 1999-2007*. Austin, Texas: TWDB.
- The Food Security Projects of the Nova Scotia Nutrition Council and Atlantic Health Promotion Research Centre (2005). *A workbook on food security and the influencing Policy*. Nova Scotia, Canada: Dalhousie University.
- Titus, B.& Adetokunbo, G. (2007). *An analysis of food security situation among Nigerian urban households : Evidence from lagos state*. Ibadan, Nigeria: University of Ibadan.
- Tomoya, M., Takashi, Y. & Sserunkuuma, D. (2013). Technology adoption and dissemination in agriculture; Evidence from sequential in maize production in Ugand. *National Graduate Institute for policy staudy*.7, 1-22.

- Tum, J. (2015). *Determinants of group lending by agricultural financing institutions in Kenya: a case of agricultural finance corporation of Kenya*. Research project, University of Nairobi. unpublished.
- Vereecke, L. (2015). *A sociological approach to crop diversification* (Master's thesis, Norwegian University of Life Sciences).
- Von Braun, J., Algeria, B. & Kalkuhl M. (2014). World Food System Disrupted in the early 2000s: Causes, impacts and cure. *World Food Policy No1.1*, 1-22.
- Women in Europe for a Common Future (2014). *Gender and Food Security*. The Netherlands.
- World Bank (1990). Bura irrigation and settlement project, Project completion report Number 8493.
- World Bank. (2007a). *World Development Report 2008: Agriculture for Development*. Washington, DC: World Bank.
- World Bank (2007b). *Gender and economic growth in Kenya*. Washington, DC: World Bank.
- World Bank. (2009). *Implementing agriculture for development: World Bank Group Agriculture Action Plan-2010-2012*. Washington, DC: World Bank.
- World Economic Forum (2010). *Realizing a new vision for agriculture; A road map for stakeholders*. Geneva. Switzerland. Network of Global Agenda Council.
- World Economic Forum. (2014). Network of global councils 2012-2014: midterm reports. Geneva, Switzerland: Network of Global Agenda Council.

World Food Programme (2013). Kenya food security and outcome monitoring.  
Consolidated report.

## APPENDICES

### APPENDIX 1: INFORMATION SHEET

**Study Title: Influence of agricultural governance on food security: a study of farmers in Bura irrigation and settlement scheme in Tana- River County, Kenya**

**Program:** Masters of Science in Environmental Studies (Community Development)

**Names of the Supervisors:** Professor Halimu Shauri & Dr. Annie Hilda

**Researcher:** Habiba Guyato Ramadhan

Dear participant,

You are invited to participate in a research study conducted by Habiba G. Ramadhan and supervised by Prof. Halimu Suleiman Shauri and Dr. Annie Hilda from Pwani University. You are selected to participate in this study as it seeks to collect data concerning agricultural governance and food security in the Bura Irrigation Scheme. This research is purely academic and therefore the response you give shall be used only for that purpose. Information given shall be treated with confidentiality and no one shall be allowed under any circumstances to use this information anywhere else without the authority of the researcher and Pwani University. Your participation is voluntary and would consist of answering questions under the guidance of the researcher and the research assistants. You are free to withdraw your participation in the study at any time and there is no penalty nor will you be questioned for the same. There are no anticipated risks to your participation and there are no direct benefits to you for taking part in this study.

**For inquiries contact**

Habiba Guyato Ramadhan      Mobile number 0718903196 or [hguyato@gmail.com](mailto:hguyato@gmail.com)

Signature of the participant

Name	signature	Date

Signature of the researcher

Name	signature	Date

**APPENDIX 2: INFORMED CONSENT**

I,.....(**respondent**) having read and understood the information about the research as provided in the Information Sheet, here by agree to take part in this research exercise voluntarily.

I understand I can withdraw at any time without giving reasons and that I will not be penalized for withdrawing nor will I be questioned.

The procedures regarding confidentiality have been clearly explained to me and the use of the data in research and publications has been explained to me.

Participant's signature

.....

.....

Signature

Date

Researcher's signature

.....

.....

.....

Name

Signature

Date

### APPENDIX 3: INTERVIEW SCHEDULE

#### Introduction

Dear respondent, you are kindly requested to respond to the questions provided in this interview schedule so as to provide the required information for the study undertaken. Note that this study is sponsored by the Kenya Coastal Development program (KCDP) and it is being conducted by Habiba Guyato Ramadhan, a postgraduate student in the Department of Environmental Science of Pwani University. This research is purely academic and it intends to analyze the influence of agricultural governance to the community's food security situation in Bura division. The study is useful for providing guidelines to the policy makers on the effective management of the agricultural sector for enhanced food security. Information and response you give through this interview is confidential and will be used only for academic purposes.

#### Section A: Respondents Bio data information (tick in the box appropriately)

##### 1) Age range

22-25  26-30  -40  40-50  Above 50

##### 2) Gender

Male  Female

##### 3) Education level

Primary  Secondary  College  None

4) How many people are there in your household?

.....

5) How many are ;

Working  Post-secondary  Secondary school

primary  Illiterate

**Section B: Goals of the scheme and the policies implemented to attain the set goal**

i) Are you aware of the set goals of the scheme?

Yes

No

If yes state the goals

.....  
 .....  
 .....  
 .....  
 .....

ii) Please rate the performance of each of the crops cultivated in the scheme. (use a tick to rate the performance)

		Performance trend for the crops cultivated				
Crop type	Crops cultivated	Excellent	V.Good	Good	Poor	V.Poor
Cash crop						
Food crop						
Vegetable						

iii) Are you aware of the policies governing the scheme?

Yes

No



**Section C: Stakeholders involved in operating agriculture activities in the scheme**

i) Who are the stakeholders involved in the running of the scheme activities?

.....

ii) Fill in the table the functions for each of the stated stakeholder and hence rate your involvement in attending to the respective functions

Name of the stakeholder	Number for each	Key Functions	Rate of farmer involvement				
			Excellent	V. good	Good	Poor	V. poor

**Section D: technology adoption among farmers**

i. Are you aware of the technology used in the scheme?

Yes

No

ii. If yes state the technology that used in the farming practices.

**Rate the extent of your *access to the mentioned technology facilities above (tick appropriately)***

<b>Technology facility</b>	<b>Technology Access to the farmers</b>		
	<b>Good</b>	<b>Neutral</b>	<b>Poor</b>

*Tick appropriately against the statement on the extent of your technology adoption.*

Statements	Response			
	Often	Sometimes	Rarely	Never
I have extension contact with experts through seminars and training				
I personally purchase fertilizer, pesticides and herbicides				
I have access to credit facilities				
There is an existing market for renting labour machinery				

iii. Indicate the land size you cultivate when;

- a. using mechanized tillage
- b. when tilting manually

iv. Indicate the yields harvested when;

- a. applying farm inputs a
- b. when you are not using farm inputs

#### **Section E: Challenges experienced in the scheme operation**

- i. What challenges do you experience in the following areas;
  - a. Food crop production

- .....
- .....
- b. cash crop production
  - .....
  - .....
- c. vegetable production
  - .....
  - .....
- d. Marketing of cash crops
  - .....
  - .....
  - .....
- e. Marketing of food crops
  - .....
  - .....
  - .....
- f. Marketing of the produced vegetables
  - .....
  - .....
- g. Policy implementation

Policy	Experienced challenges
0.65 ha cash crop	
0.65ha food crop	
0.05 ha vegetable	

- h. Any other challenge (**specify**)
  - .....
  - .....
  - .....
  - .....
  - .....
  - .....

**Section F: Food availability and food stability among the tenant farmers in the scheme**

- i) State the variety of food stuffs that you obtain directly from the farm in each of the two cropping seasons in the scheme and the amount harvested and the amount you store for household food consumption.

Food stuffs	Quantity harvested	Number of Kilograms stored for household food consumption per season			
		0-200	200-400	400-600	More than 600
1 <sup>st</sup> season					
2 <sup>nd</sup> season					

- ii) Apart from farming, what other activities are you engaged in as a family?  
 .....  
 .....
- iii) On average what is the total amount of your monthly income in Kenyan shillings?
- iv) Break the above total average income into the following:
- Income from farm
  - Income from other activities
- v) How many Kenyan shillings in a day do you spend on food stuffs in your household? (**Tick appropriately**)

200-300  300-400  400-500  More than 500



- vii) Please tick either never, rarely, sometimes and often to indicate the magnitude of the concerns raised in the table below

Element	Scale			
	Never	Rarely	Sometimes	Often
I worry that my household may not have enough food				
We eat a limited variety of food				
We eat less than two meals in a day				
We have no food to eat of any kind in our household				
We go a whole day without eating				

**THANK YOU**

**APPENDIX 4: FOCUSED GROUP DISCUSSION GUIDE**

- 1 In general what is the annual income of the farmers in the scheme?
- 2 Is the farmers' monthly income sufficient to provide enough quality food for the daily household consumption?
- 3 Cultivation of cash crop in the 0.625ha of land, food crop on another 0.625ha and vegetable on a 0.05 ha plot is a policy for balancing food crop and cash crop in the scheme. Comment on the implementation and functioning of this policy in the schemes' farming activities.
- 4 With a closer look on to the departments running the scheme, comment on the farmers' involvement into the departmental functioning.
- 5 What challenges do farmers encounter in running the scheme activities?

**Thank you all**

**APPENDIX 5: KEY INFORMANTS INTERVIEW SCHEDULE**

**Section A: goals of the scheme and Policies implemented to attain the set goals**

i) Explain the goals for the establishment of BISS  
.....  
.....  
.....  
.....  
.....

ii) Mention the crops that farmers cultivate in the scheme for;  
a. cash crop  
  
b. food crop

iii) What is the trend of performance for each of the crop mentioned?  
.....  
.....  
.....  
.....

iv) In its inception phase, the scheme had a land allocation policy for controlling food and cash crop production in a cropping season through which a plot of 0.625 ha was used for cotton, another 0.625ha for maize and a 0.05 ha plot for vegetable  
Explain the implementation rate of this policy in the scheme  
.....  
.....  
.....  
.....

**Section B:**

**a. Stakeholders involved in operating the agricultural activities in the scheme**

i) Which organization / institution or department do you work with?  
.....  
.....

ii) Indicate the duties of your organization in the operation of BISS  
.....  
.....  
.....  
.....

iii) State other organizations, institutions or departments involved in the running of the scheme

.....  
.....  
vi) What duties do farmers have in the functioning of your department?  
.....  
.....  
.....

vii) What challenges does your department experience in exercising the duties?  
.....  
.....

b. Explain challenges experienced in the following concerns in the scheme;

i. Cash crop production

ii. Food crop production

iii. Vegetable production

iv. Marketing of cash crops

v. Marketing of food crop

vi. Marketing of vegetable

vii. Policy implementation

viii. Any other (**specify**)

**Thank you all**

## APPENDIX 6: LAUNCH OF COTTON PLANTING EXERCISE

*Launch of irrigated cotton planting exercise in Bura fail to take off (Posted on October 9 2016 by Kenya News Agency). By Jacob Songok*

*Launch of the irrigated cotton planting programme at Bura Irrigation Scheme in Tana River County failed to take off Saturday.*

*The launch was thrown into jeopardy after it emerged that stakeholders had not agreed on some issues regarding the programme.*

*Local leaders and the farmers were reported to have not agreed on outstanding sticky issues contained in an agreement between them and key stakeholders in the Sh 60 million scheme.*

*The highly hyped launch was to be presided over by Industrialization Cabinet Secretary Mr. Aden Mohamed.*

*However, the CS had sent his technical advisor on cotton/textile Rajeeve Arora as he was said to be out of the country.*

*Area Governor Hussein Dado and area MP Ali Wariowere also absent.*

*Deputy Governor JireSiyat who spoke at the function welcomed the project saying it was meant to uplift the economic standards of the farmers.*

*He, however, expressed concern that previous engagement with National Irrigation Board and other stakeholders had failed the farmers who had been impoverished.*

*“What we are running away from are prior-experiences that we have had before with the stakeholders that served to enrich a few at the expense of the impoverished farmers,” he said.*

*He added, “we don’t want to be used anymore and unless we sit down as leaders and farmers and engage the stakeholder among them Rivatex, Meru Gineries, AFC and Amiran among others we shall not append our signatures on this agreement”.*

*John Macharia representative of the farmers told the press that all they want is an assurance that they will not carry the burden in unlikely event of crop failure due to poor seeds quality, delay in payment for cotton delivered among others.*

*He said out of the 3,000 farmers at Bura Irrigation Scheme only 1,000 were active because the rest are allegedly owed Sh240 million by Equity Bank and Agricultural Finance Corporation.*

*They cannot access credit because they have been blacklisted, he added.*

*Macharia said the farmers had never been paid their dues four years down the line for cotton delivered to among others Kitui Ginnersy.*

*Hirimani MCA DaudiGaldesa who chairs the agriculture county assembly committee said Bura will not be used as an experimental ground where the farmers are used and dumped by unscrupulous stakeholders.*

*“This time round we want to understand every bit of the agreement before we sign it. Above all, we want to know how our farmers will benefit. The farmer must be ultimate beneficiary in all this deal,” he declared.*

*It was agreed that the launch would be rescheduled to next week or before the end of this month because the seeds that were distributed to the farmers may not do well after then.*

*The launch was to include the planting of seeds at a 500 acre farm at village 5 in Bura irrigation scheme that had been prepared for planting of cotton Saturday.*

**APPENDIX 8: COST OF PRODUCING 1.5 ACRES OF SEED MAIZE IN BURA**



COST OF PRODUCING 1.5 ACRES OF SEED MAIZE IN BURA SCHEME-2016				
ACTIVITY	QUANTITY	UNIT PRICE	COST	REMARKS
Ploughing & Ridging	1	4,800	4,800	
O&M Costs	1	5,000	5,000	
<b>sub total</b>			<b>9,800</b>	
seed	12kgs @150	1,800		supplied by ssed co.
Planting	1	2,000		family labour
D.A.P	2 Bags@2000	4,000	4,000	
Urea	3Bags@2600	7,800	7,800	
Bulldock-insecticide	1lt	2,000	2,000	
Irrigations	8 times@300	300		family labour
Topdressing	1	1,200		family labour
Weeding 1st	primagram 2l	1,600	3,200	herbicide
weeding	servian (50g 3 acres)	2,800	2,800	
Weeding 2nd	1	2,400		family labour
Detasseling	1	4,000	4,000	
<b>sub total</b>			<b>23,800</b>	
<b>harvesting bags</b>	ksh 50/bag	2,000	<b>2,000</b>	
Harvesting	15 rows@300	4,500	4,500	
shelling	ksh 50/bag*20	1,000	1,000	
<b>External Transportation</b>	<b>4.95/= per Kg for 1500kgs</b>	<b>1,500</b>		deducted from proceeds
<b>Local Transport</b>	<b>50 per cob bag for 40 bags</b>	<b>2,000</b>	<b>2,000</b>	
<b>Gunny bags</b>	<b>35pcs@50/=</b>	<b>1,750</b>	<b>1,750</b>	
<b>Grand Total</b>			<b>44,850</b>	
<b>INCOME</b>	<b>1500 kgX62/=</b>	<b>93,000</b>		
<b>Net Income</b>	<b>93000-55685</b>	<b>37,315</b>		

loan (not included) Take home

Branch Manager  
Agricultural Finance Corporation  
**BURA**

Normal yield expectation = 2000kgs @62 = 124000