NERICA Rice Cultivation and Its Potential for Gender Empowerment in the Gezira State, Sudan

by

Meysoon Amin

A Thesis
presented to
The University of Guelph

In partial fulfillment of requirements
for the degree of
Master of Science
in
Capacity Development and Extension

Guelph, Ontario, Canada

© Meysoon Amin, July, 2015
The purpose of this study was to explore the nature of crop diversity, specific to NERICA cultivation, in order to determine how it can contribute to gender empowerment in the Gezira State. It intended to identify the capacity of female and male stakeholders in utilizing the rights, resources and opportunities afforded to them through NERICA. The sample population was purposively drawn from JICA’s NERICA project. Data was collected through: key informant interviews, participatory exercises and focus group discussions. Findings suggested that women and men were experiencing empowerment through their involvement with NERICA. This was attributed to their increased capacity to access and participate in economic and skills opportunities, which added to their decision-making power. Decreases in their capacity to access land and financial resources were also observed. The study highlighted the need for collaborative capacity building, which would enable women and men to access resources related to their basic rights.
ACKNOWLEDGMENTS

The development and completion of this thesis would not have been possible without the support and effort of several individuals and organizations. As such, I would like to express my sincere thanks to everyone who contributed and participated in the research study in Sudan and Canada.

In Sudan, I would like to thank JICA and Ministry of Agriculture, as their correspondence, attentiveness and support facilitated the progression of the study. Moreover, I would like to extend my sincerest thanks to all of the research participants, for their honestly, kindness and hospitality.

In Canada, I would like to express my full gratitude and deepest thanks to my advisor, Professor Glen Filson, whose expertise, guidance and tireless efforts facilitated the development and implementation of the study. Moreover, Professor Filson’s encouragement and tremendous support played an instrumental role in my academic experience at the University of Guelph. As such, I am greatly indebted to him for his dedication and sacrifice in helping me to pursue my Master’s degree. I would also like to express my heartfelt gratitude to my committee member, Professor Helen Hambly, as her assistance, guidance and moral support, enabled me to pursue this research in Sudan.

Additionally, I would like to thank my family, friends and colleagues within SEDRD for their sanity and unwavering love and support. The study would have not been possible without them.
Table of Contents

ABSTRACT II

ACKNOWLEDGMENTS III

LIST OF TABLES VI

LIST OF FIGURES VII

CHAPTER ONE: INTRODUCTION 1

INTRODUCTION 1
RESEARCH GOAL & OBJECTIVES 3
RESEARCH COUNTRY 4
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA) 7
HISTORY OF JICA IN SUDAN 8
CAPACITY BUILDING PROJECT: THE EXECUTIVE PROGRAM FOR AGRICULTURAL REVIVAL 9
RESEARCH SIGNIFICANCE 9
ORGANIZATION OF THE THESIS 10

CHAPTER TWO: LITERATURE REVIEW 12

INTRODUCTION 12
TRANSITION FROM OIL PRODUCTION BACK TO AGRICULTURE 13
GEZIRA SCHEME: PAST AND PRESENT 17
EMERGENCE OF THE SCHEME 19
ORGANIZATION OF THE GEZIRA SCHEME 20
GEZIRA LAND ORDINANCE 22
LAND TENURE SYSTEM 22
REFORM EFFORTS 25
CROP DIVERSITY 27
GENDER EMPOWERMENT 31
CONCEPTUAL FRAMEWORK 33
SUMMARY 34

CHAPTER 3: RESEARCH METHODS 35

INTRODUCTION 35
EPISTEMOLOGY 35
RESEARCH DESIGN 37
RESEARCH SETTING 38
RESEARCH ASSISTANCE 40
DATA ACQUISITION METHODS 41
RESEARCH SAMPLE 41
QUALITATIVE METHODS 41
DATA ANALYSIS 46
RESEARCH LIMITATIONS 47
CULTURAL AND GENDER DIFFERENCES 47
CASE STUDY 48
PARTICIPATORY MAPPING 48
# Key Informant Interviews and Focus Group Discussions

**Summary**

50

## Chapter Four: Findings

**Introduction**

50

**Impact of Agricultural Policies and Land Tenure on NERICA**

50

**Implications of NERICA on Gender Roles and Relations**

60

**Level of Personal Empowerment Experienced through NERICA**

72

**Female Perspectives on Empowerment**

72

**Male Perspectives on Empowerment**

75

**Summary**

78

## Chapter Five: Discussion

**Introduction**

81

**Influence of Agricultural Policies and Land Tenure Practices**

82

**Implications of NERICA on Gender Roles and Relations**

86

**Influence of NERICA Cultivation on Individual Empowerment**

92

**Summary**

95

## Chapter Six: Conclusion and Recommendations

**Introduction**

97

**Final Summary**

97

**Conclusion**

100

**Recommendations and Future Research**

102

## References

105

## Appendices

**Appendix 1 - Glossary**

115

**Appendix 2 - Questions from Key Informant Interviews**

116

**Appendix 3 - Key Informant Statements**

117

**Appendix 4 - Questions from Participatory Exercises**

119

**Appendix 5 - Seasonal Calendar and Post Activity Worksheet**

121

**Appendix 6 - Images from Transect Walk and Diagram & Worksheet**

122

**Appendix 7 - Total Production Costs of NERICA and Other Major Crops (2013)**

126

**Appendix 8 - Potential Value Chain for NERICA in Sudan**

127
LIST OF TABLES

Table 3.1: Summary of Key Informants
LIST OF FIGURES

Figure 1.1: Map of States in Sudan

Figure 2.1: Map of Oil Infrastructure in Sudan and South Sudan

Figure 2.2: Oil Production in Sudan and South Sudan between 2005-2014

Figure 2.3: Map of Farming System in Sudan

Figure 2.4: Conceptual Framework

Figure 4.1: Summary of Key Informant Responses

Figure 4.2: Seasonal Calendar

Figure 4.2a: Seasonal variability of income, expenditure and credit among men

Figure 4.2b: Seasonal variability of income, expenditure and credit among women

Figure 4.3: Transect diagram

Figure 4.4: Perspectives of Female Extensions Officers (Focus Group)

Figure 4.5: Perspectives of Male Farmers and Extension Officers (Focus Group)
Chapter One: Introduction

Introduction

For the last 20 years, Sudan has been experiencing a severe economic crisis due to the decrease in global oil demand, as well as the interruption of domestic production due to escalating political tensions within the country and region. The country’s overreliance on the commodity has led to the regression of its once prominent agricultural sector, which like many other sub-Saharan nations was the backbone of the economy. Prior to the discovery of crude oil, the majority of the population relied on agriculture for sustenance (i.e. income stability and food security). In comparison, present day agricultural involvement has jeopardized the livelihood of millions of Sudanese, with women being the most vulnerable (FAO, 1994). This is primarily due to the fact that 87% of their labour force participation is concentrated within the sector (Sirageldan, 1990). As such, the recent regression in agricultural productivity has substantially impacted them and their families (FAO, 1994). In response, the Sudanese government drafted and implemented the Executive Program for Agricultural Revival (EPAR) in 2008. The program aims to improve crop productivity and ultimately the livelihood for small-scale farmers, in hopes of combating rural poverty and helping to revitalize the sector (Republic of Sudan, 2008).

Recent strategies, like the EPAR are structured around the cultivation of non-traditional high-yielding crops, which the Sudanese government believes are better suited for the environment and have a higher likelihood of achieving income stability and food security for farmers (Republic of Sudan, 2008). As such, the government has been encouraging commercial and small-scale farmers to diversify their crops in order to
minimize the potential risks and maximize their profits. In addition, the government viewed the EPAR as a way to allocate resources towards the restoration of the Gezira Scheme, which is considered to be one of the largest irrigation projects in the World (CFI, 2013). Furthermore, the majority of Sudan’s cash crops (i.e. cotton and groundnuts) are grown throughout the Scheme, so there is a significant dependence on the region for agricultural production and export. As such, most revitalization efforts have been concentrated within the Gezira, due to its history and existing infrastructure. However, despite its many benefits, the traditional cropping system of the region that is largely based on cash crop generation, has failed to provide for the nearly 120,000 tenant farmers and labourers who rely on the Scheme as their primary source of income (Gezira: Sudan’s Fertile Triangle, 2001). This has led to displacement of many families, who have been forced to abandon their crops and migrate to more urban areas in search of work. In addition, the overdependence on cash crop production has contributed to the issue of gender stratification for those still remaining. Thus, the need for crop diversification is evident (Guvele, 2001), with calls for crops that are more economically feasible and promote self-reliance among both men and women.

In response to the tensions and widespread poverty, the Sudanese government permitted the introduction of non-traditional high-yielding crops, like New Rice for Africa (NERICA). NERICA is a new variety of upland rice that is currently being cultivated through a joint partnership with Japan International Cooperation Agency (JICA) and the Sudanese government. Both stakeholders consider NERICA to be a strategic crop due to its multipurpose nature, as a cash and subsistence crop. As a result, they believe that it has the potential to address farmers’ immediate concerns by providing
them with a more consistent source of income and food, as well as helping them to maintain an adequate standard of living. In addition, JICA and the Sudanese government are investing in the long-term potential of NERICA to become an alternative export crop, and offset the need for food aid (CFI, 2013). Moreover, NERICA is being implemented in hopes of narrowing the gender gap and providing women with more economic opportunities. As rice is predominantly grown by female farmers, who are known to have higher levels of productivity and gains with the crop than their male counterparts (Quisumbing & Pandolfelli, 2010). As such, the Sudanese government considers NERICA to be an extremely advantageous crop.

However, the nature of upland rice and crop diversity is still unclear and the available literature fails to mention the strategic gender needs of both women and men throughout these development initiatives. As such, through this research problem I hope to address the implications of NERICA rice production and gender dimensions associated with reform in the Gezira State.

**Research Goal & Objectives**

The purpose of the study was to explore the strategies of crop diversity, specific to NERICA rice cultivation and determine how it can contribute to gender empowerment for rice stakeholders in the Gezira State.

In considering the research goal, three objectives were developed:

1. To determine the influence that agricultural policies and the prevailing land tenure system have on NERICA cultivation.
2. To identify the implications that NERICA can have on gender roles and relations among rice stakeholders.
3. To investigate the level of personal empowerment experienced by women and men through upland rice cultivation.

In order to explore and describe the influence that the current socioeconomic environment can have on NERICA rice cultivation for both genders, the researcher conducted interviews with JICA experts at the Ministry of Agriculture in Khartoum and the Gezira State and utilized secondary data sources. In addition, the researcher measured participants’ perspectives on NERICA and its contribution to empowerment by conducting two separate focus group discussions with extension officers and rice farmers, as well as, two participatory mapping exercises with a mixed group of extension officers and farmers.

**Research Country**

The research was conducted throughout the Republic of Sudan, a country that was once considered to be the largest nation in Africa. However, very minimal information has been published post 2011, after its southern counterpart gained independence. As such, it is important to highlight the current demographic, social and political aspects of the country, in order to deepen our understanding of the research study.

Sudan is located on the northeastern side of Africa and is bordered by the Red Sea and seven countries: Egypt to the north, Eritrea and Ethiopia to the east, South Sudan and Central African Republic to the south, as well as Chad and Libya to the West. Currently, ranked as the third largest country in Africa, Sudan occupies an area of 1.86 million sq. km, which is divided into 18 states (Maps of the World, 2015). Refer to Figure 1.1 Map-States of Sudan.
In addition, Sudan has been experiencing a steady growth in population despite its socioeconomic issues. This is supported by the World Bank (2015), who place the current population at 35.5 million, with a 1.02 male to female ratio. Furthermore, the country has been experiencing an increase in internal migration as more people have started relocating to urban areas in search of job opportunities and better livelihoods (CIA, 2014). However, despite the steady increase of urbanization, the majority of the population, 66.8%, still resides in rural areas, where agriculture and cattle rearing are the main sources of livelihood (CIA, 2014). As such, most people are either employed as pastoralists or farmers. In addition, similar to many other African nations, agriculture is the foundation upon which Sudanese civilization was built.
For centuries now, the prominence of agriculture in Sudan, in addition to the abundance of natural resources has attracted many people from all parts of Africa. As a result, there are over 300 ethnic groups dispersed throughout Sudan, who speak 60 different languages and dialects, besides the official Arabic language (Embassy of the Republic of Sudan, 2013). These ethnic groups can be categorized into 5 major categories (ERS, 2013):

- 39% of Arab descent in Central Sudan, Kordofan and Darfur
- 30% of African origin throughout the southern part of the country
- 15% of Nubian origin in the North and Southern Kordofan
- 12% of Beja origin, in Eastern Sudan
- 4% of other origin

In addition to ethnic diversity, the cultural and religious practices of people tend to vary from region to region. However, the official religion and political structure is founded on the principles of Islamic Sharia Law (CIA, 2014), which has been a source of conflict throughout the country, due to its misinterpretation and manipulation by the current government (Hamilton & Hudson, 2013).

The political system in Sudan operates under a multi-party leadership, with legislative power being allocated towards the government (i.e. the National Congress Party) and parliamentary system (i.e. National Legislature), with judicial power under the authority of the constitutional courts (CIA, 2014). However, all branches are formally governed under the 2005 Interim National Constitution (INC), which is recognized as the supreme law of Sudan (CIA, 2014). Additionally, the INC was said to encompass aspects from the 1998 constitution and 2005 Comprehensive Peace Agreement (CPA), which
officially ended the civil war with the South (CIA, 2014). As such, the country is formally identified as a democratic republic, under the leadership of President Omar al-Bashir, who acts as the head of state and government, in addition to occupying the position of commander-in-chief of Sudan People’s Armed Forces (Encyclopedia Britannica, 2014).

The lack of trust and support for President Bashir and his party, the National Congress Party (NCP) has continued to grow, due to their pro-Islamic fundamentalist values and blatant violations of domestic and international laws. In addition, the high level of corruption and resource monopolization by the NCP has also contributed to the separation of South Sudan, and civil wars throughout Darfur, Kordofan and the Blue Nile Provinces (Hamilton & Hudson, 2013). In addition, the lack of investment and support for the country’s main economic sector (i.e. agriculture) has led to substantial unemployment levels and widespread hunger. As such, most revitalization efforts have been concentrated on agricultural development, primarily in the Gezira State due to its history and high potential for success. Moreover, the Sudanese government hopes that large-scale agricultural development in the Gezira can help promote self-sufficiency and stability throughout the country, in addition to gaining back the support of the Sudanese people.

Japan International Cooperation Agency (JICA)

This study was conducted with the assistance of Japan International Cooperation Agency (JICA). JICA is an independent governmental agency that coordinates official development assistance for the Japanese government (JICA, 2014). The organization’s mandate is to promote inclusive and dynamic development by supporting infrastructure
and human resource projects throughout the third world (JICA, 2014). They offer support for initiatives that encourage people of all genders, races and classes to recognize the development issues they face and collectively work at addressing them, in order to improve their livelihoods (JICA, 2014). As such, JICA works alongside governments and collectives to establish systems that promote economic growth and poverty reduction.

History of JICA in Sudan

The organization has a long history of development with Sudan due to Japan’s strong economic ties with the country (Rose, 2013). JICA’s main headquarters is located in Japan, however their Sudanese branch is located in the capital city of Khartoum, with smaller localities throughout seven of the major states (JICA, 2014). As such, they have had a dominant presence in the country for many years now. Moreover, since 2011 JICA has contributed over 59 million dollars of grant aid to Sudan, making it their sixth largest aid recipient (JICA, 2014). This large contribution has facilitated the implementation of numerous development projects, in addition to strengthening their working relationship with the Sudanese government, as well as several local NGOs and communities (Embassy of Japan, 2013).

The organization’s grant contributions have been allocated towards three major areas of development, which include (JICA, 2014):

- Assistance for internally displaced individuals and reintegration into communities
- Assistance for basic human needs
- Infrastructure development of food production systems

Furthermore, JICA currently has nine on-going development projects throughout Sudan, with agricultural development being one of their primary focuses (JICA, 2014).
Capacity Building Project: the Executive Program for Agricultural Revival

As previously mentioned, Sudan’s escalating economic crisis and on-going civil war has resulted in widespread poverty and food insecurity throughout the country. However, the high potential for agricultural development led JICA and the Sudanese government to reinvest in the sector, as the expansion of food production systems is thought to contribute to poverty reduction and food security (Embassy of Japan, 2013). As a result, the Executive Program for Agricultural Revival (EPAR) was launched in 2008. The project promotes NERICA upland rice cultivation as a means for income stability and food security throughout the Gezira and has since expanded to 5 other states (CRF, 2014). The two objectives of the project are to: (1) develop human resource and organization capacity through the Ministry and (2) promote upland rice production through training and rice cultivation (JICA, 2014).

Research Significance

The importance of conducting research on the implementation of NERICA is that it can deepen our understanding of crop diversity, specifically the implications of rice-based technology and its potential for small-scale reform throughout the Gezira. Furthermore, not much literature is available on the topic due to its originality in Sudan, so this research could act as catalyst for future development and exploration. Also, the information that is collected could help project coordinators, agricultural scientists and extension workers and community leaders and producers in identifying the challenges and potential benefits of the crop. As a result, the research may help inform future policies and plans, which may strengthen the administration of the project.
Additionally, conducting gender analysis can provide a more holistic understanding of the realities faced by both women and men, and their perceptions around NERICA rice cultivation (Lodin, Paulson & Jirstrom, 2014). It can also highlight the specific gender needs and priorities of participants, as well as the degree of empowerment that may be experienced through rice cultivation. Furthermore, the research could contribute to literature as most of the information on the Gezira Scheme is written by male authors. As such, the literature often fails to acknowledge the different perspectives and challenges of women, who account for nearly 50% of the labour force (FAO, 1994). As such, the information from this research could aid project staff and policy makers in identifying areas of reform and transformative change consistent with recent analytical approaches to gender and social inclusion. Lastly, this research may help ensure the sustainability of the project in the Gezira and may contribute to its expansion and implementation throughout Sudan.

**Organization of the Thesis**

This thesis is organized into six chapters. Chapter One: Introduction provides an overview of the socioeconomic environment in Sudan, as well as the need for NERICA and its potential for gender empowerment throughout the Gezira. Furthermore, Chapter One outlines the research goal and objectives of the study as well as its potential significance to the field.

Chapter Two: Literature Review, covers the major components (i.e. history, policies, gender gap) that led to the emergence of crop diversity in Sudan. It also summarizes the previous literature on NERICA in Sub-Saharan Africa and highlights potential areas of development that could lead to gender empowerment and reformative...
change. Various gaps in the literature are also addressed. Chapter Two concludes with the conceptual framework of the researcher, which has informed the study.

Chapter Three: Methodology introduces the epistemology of the researcher and discusses its relevance to the methodological approach of the study. The research design and procedures are also outlined. This includes a thorough description of the various research sites, as well as an overview of the sampling frame and population that participants were drawn from. In addition, the different methods and procedures of data collection and analysis are also described. The chapter concludes by outlining the limitations of the research study.

Chapter Four: Findings, offers a visual and textual presentation of the data that was collected and analyzed by the previously discussed methods. The information is organized based on the relevant objectives mentioned in Chapter Two.

Chapter Five: Discussion offers an interpretation of the research findings presented in Chapter Four. It also discusses the connection between the findings, research question and the literature. In addition, possible reformatory and transformative solutions that may contribute to gender empowerment are discussed.

Chapter Six: Conclusion and Recommendations is the final chapter of thesis. It offers a summary of the research study and concludes the thesis by discussing potential areas for future research.
Chapter Two: Literature Review

Introduction

Agriculture is deeply embedded in the cultural fabric of most civilizations. It has single-handedly revitalized communities through poverty reduction, which in turn has helped facilitate socio-economic growth in many different areas. Those in the developed world have capitalized on this relationship by continually investing in agricultural development. As a result, there have been significant improvements in productivity. Unfortunately, this trend has not effectively carried over to the developing world, where food availability, income stability and self-sufficiency are still among their primary concerns. This is especially true of most African countries, where 65% of the population relies on agriculture as their primary source of livelihood (Stads & El-Siddig, 2010). As such, African governments have vowed to increase public investment in agriculture, specifically in crop diversification systems, which tend to be more stable and resilient (Johnston, Vaupel, Kegel & Cadet, 1995).

Sudan, once known as the breadbasket of Africa, due to its vast resources and acres of cultivable land, is ideally suited for modernization practices (Kaikati, 1980). In addition, agricultural interventions have recently become a priority for the Sudanese government, which has begun introducing novelty crops, such as New Rice for Africa (NERICA) upland rice, in hopes of promoting economic diversity. That being said, the majority of these investments and diversification efforts have been implemented throughout the Gezira State, which encompasses the country’s most prominent irrigation scheme and cultivable lands. As such, the aim of this literature review is to provide a thorough examination of the contribution that crop diversity, specifically NERICA rice production,
can have on gender empowerment in the state. The first section outlines the past and present agricultural environment in Sudan and reform measures currently being undertaken in the Gezira State. The second section discusses the potential of crop diversity and new technologies as a way to address various socio-economic issues. The third section examines the literature on crop diversity as a means for gender empowerment. Lastly, a summary of the conceptual framework is provided in order to outline the exploratory descriptive design of the research study.

**Transition from Oil Production back to Agriculture**

The majority of the world’s crude oil reserves are concentrated in developing countries, which often lack the technological skills to find, produce and refine oil (OPEC, 2014). As such, most oil producing nations often establish partnerships with multinational companies in order to effectively supply consumers from more industrialized nations, and to ensure steady incomes for producers. This close working relationship led to the establishment of the Organization of the Petroleum Exporting Countries (OPEC) in the early 60s (OPEC, 2014). The OPEC helps developing nations coordinate and unify petroleum policies in order to gain more control over oil prices and activities (OPEC, 2014). Currently, the organization consists of twelve members: Algeria, Angola, Ecuador, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates and Venezuela. According to Douglass (2006), prior to their official invitation in 2009, the Sudanese government had been unofficially affiliated with the OPEC for several years due to their heavy involvement and production in the oil sector (Sudan Tribune, 2009). However, their refusal to adhere to regulations that ensure efficient and environmentally sustainable oil production prevented them from being accepted into the OPEC (Sudan Tribune, 2014).
According to the US Department of Energy (2014), during the pre-separation era Sudan was producing 500,000 barrels of oil per day. However, following the succession of South Sudan in 2011, the North lost more than two-thirds of its oil revenue, as over 80% of the major oil fields (that is, those in the Muglad and Melut Basin) are located and under the control of the South Sudanese government (EIA, 2013). This is displayed below in Figure 2.1- Map of Oil Infrastructure in Sudan and South Sudan.

![Map of Oil Infrastructure in Sudan and South Sudan](image)

Figure 2.1 Map of Oil Infrastructure in Sudan and South Sudan
Source: James (2012)

However, despite having access and control over the oil fields, South Sudan is still geographically landlocked, and as such relies on its northern counterpart for export. This has been the primary area of concern over the last few years, as most major disputes between the north and the south are over the production, processing and transport of oil. As both countries continued to suffer substantial economic losses, efforts were finally
made in 2012 to resolve these issues. These efforts, which included multiple negotiations and discussions around land claims and boundaries, eventually resulted in the formation of a 3-year processing and transportation contract. The contract, which was valued at 3 billion dollars, explicitly stated the costs for oil transport between the southern fields and northern refineries, in addition to the processing fees for use of the refineries (EIA, 2013). However, in order to account for lost oil revenue and hasten the country’s recovery rate, the Sudanese government raised the processing and transport fees, which the contract prohibited. This blatant violation, a year into the agreement resulted in the South halting oil production and just furthered mistrust between the hostile nations (EIA, 2013). This interruption and steady decline of oil is depicted below in Figure 2.2.

![Oil production in Sudan and South Sudan between 2005-2014](image)

**Figure 2.2 Oil Production in Sudan and South Sudan between 2005-2014**  

As the production of the commodity continues to decrease, the back forth conflict between the two countries has significantly escalated, with minimal hope for a formal resolution. This is likely due to the fact that oil is seen as a vehicle for economic growth and power, especially in developing nations who tend to overly rely on it as their primary
source of income and sustainability. As a result, any significant changes in supply can have a disastrous effect on the economy, often leading to internal conflict and political uncertainty in these fragile nations (Rapier, 2012). This illustrates the current environment in Sudan, where oil is considered to be the most valuable commodity in terms of domestic development and global power. Siddig (2012) reiterates this point by stating that; the discovery and export of crude oil in the late 90s had radically transformed and revived the country’s deteriorating economy through substantial GDP contributions.

To put this into perspective, oil revenues accounted for 2% of the GDP in 1999, and have steadily increased to nearly 50% in 2010 (Siddig, 2012). Furthermore, in 2010, 90% of the country’s exports could be attributed to oil (Siddig, 2012). As such, the commodity has been the predominant export for sometime, contributing to foreign exchange and government revenues. Yet, the success of these exports has not translated into other sectors of the economy, primarily the Sudan’s agricultural sector. In fact, the over reliance on the single commodity and inefficient investment of its revenues have negatively impacted almost all other exports, especially the agricultural commodities (Rapier, 2012).

However, with the current state of oil in jeopardy, the Sudanese government has been trying to revitalize the rest of the economy, in hopes of mitigating economic losses. Most of these revitalization efforts have been focused on strengthening and reinvesting in the country’s vital agricultural sector.

As previously mentioned, Sudan is historically known to have an enormous amount of agricultural potential due to its advantageous location, proximity to the Nile River, as
well as its vast natural resources (Sudan Embassy, 2008). Additionally, prior to oil exploitation the Sudanese economy was centered on agricultural production as the country’s main source of income and internal consumption (International and Area Studies, 2011). However, its contribution to the GDP has decreased over the last few years due to the lack of re-investment of oil revenues and minimal governmental support (Rose, 2013). That being said, despite the declining contribution from agricultural productivity and export, 80% of the country’s workforce is still employed in the sector and most revitalization efforts have been directed towards agricultural interventions (The Heritage Foundation, 2014).

As part of these agricultural interventions, the Sudanese government began exploring novel strategies for crop diversity in order to re-establish the country as a major agricultural producer. Also, international interest in crop diversity has grown over the last few years and as a result the Sudanese government began receiving pledges of support from neighbouring African and Arab nations (Rose, 2013), in addition to investments from Japan and China, who are the primary importers of Sudanese oil (Rose, 2013). Therefore, by prioritizing and revitalizing the agricultural sector the Sudanese government hopes to diversify the economy, by opening it up to foreign investment, which could potentially combat unemployment and poverty in the country (Siddig, 2012).

**Gezira Scheme: Past and Present**

It is difficult to discuss agricultural revival in Sudan, and not mention the Gezira Scheme. Historically referred to as the jewel of Sudan, the scheme was the center of the country’s agricultural production (Barnett, 1977). Spanning 2.1 million hectares, an area roughly 1/3 of the size of Belgium, the scheme is currently one of the largest and most
ineffective irrigation projects in the world (American University, 2014). That being said, the Gezira Scheme is responsible for maintaining the livelihood of the 1.9 million people, who live in and around the region (Guvele, 2001). However, recent decreases in operating efficiency have significantly impacted their quality of life. This is also a major concern for the 120,000 tenant farmers in this region, who are primarily dependent on the scheme for income and sustainability (Babikir, 2007). As Guvele (2001) notes, increasing production costs and growing tensions over property rights, have led to drastic decreases in living conditions over the years, causing a large number of tenant farmers to abandon their crops. However, despite its lack of productivity over the past few years and entrenched colonial legacy, the Scheme is still regarded as a source of national pride, symbolizing a shift towards modernity and civilization (Barnett, 1977). As a result, most governmental efforts have been focused on developing innovative strategies to revitalize the region, in order to provide productive opportunities for the rural poor and ultimately contribute to economic recovery (JICA, 2014).

Since 1979, the International Fund for Agricultural Development (IFAD) has been working in Sudan trying to ensure the balanced allocation of resources to the country’s agricultural sector, as well as rehabilitate its irrigated farming sector (IFAD, 2014). The organization states that in order for effective reform to occur, the quality and quantity of production must improve, as well as the transparency in governance and accessibility to financial services and marketing channels for the rural poor (IFAD, 2014). The Gezira Scheme was initially built on this premise.
**Emergence of the Scheme**

At the time of its emergence in 1925, the Gezira Scheme was advertised as a vehicle for socioeconomic growth, specifically in the Great Plains between the two Niles (Barnett, 1977). As Bernal (1997) notes, the gradual development of the Scheme would forever alter the course of Sudanese history. However, despite being a symbol of national pride and development, the history of the Scheme is also heavily tied to British colonialism. This is supported by Bernal (1997) who states that, Britain’s plans for Sudan were based on colonial assumptions about world order, and Britain’s right to it.

However, prior to Britain’s involvement and the emergence of the Scheme, the Sudanese economy operated on a rain-fed system of farming. This system proved to be ineffective, as most crops and livestock were less economically successful. In contrast, the Gezira Scheme, a few miles south of Khartoum and 25 miles north of Sennar (Refer to Figure 2.2 Map of Farming Systems in Sudan) was more advantageous. The environmental and physical conditions of the region were well suited for irrigated farming, which was known to be more economically successful. This was reiterated by Plusquellec (1990) who describes the environment as being highly advantageous due the favourable climatic conditions, continuous supply of water because of the proximity to the two Niles, as well as the region’s naturally sloping clay soils, which facilitated the transport of water through gravity irrigation. In addition, the quality and richness of the soils minimized the amount of water lost to seepage, which in turn reduced the amount of input required (Plusquellec, 1990).

The British textile companies capitalized on the advantageous environment, as they believed Sudan was predestined by nature for the purpose of irrigation (Barnett,
1977, p.450), specifically, irrigation directed towards a single cash crop (i.e. cotton). As Plusquellec (1990) notes, the scheme went on to operate at a very high capacity for the next 40 to 50 years and led to the expansion of many cotton related business (i.e. textile factories, transport trains etc.). However, many argue that the monoculture nature of the scheme ultimately led to its deterioration as the global demand for cotton significantly decreased (Plusquellec, 1990).

Figure 2.3 Map of Farming Systems in Sudan
Source: Dawelbeit et. al. (2010)

Organization of the Gezira Scheme

Another predominant feature that contributed to the deterioration of the Gezira Scheme was the lack of infrastructure and centralized services. Prior to nationalization in the late 1950s, the Scheme was one of the largest centrally managed irrigation projects in the world (Plusquellec, 1990). The vastness of the fields, led to it being divided into 18 groups and further subdivided into 113 blocks, each operating under a strategic management system (Plusquellec, 1990). However, over the last few decades,
liberalization and flexibility of the Scheme’s management and administrative services has led to its steady deterioration.

The British-owned Sudanese Plantation Syndicate (SPS), later renamed the Sudanese Gezira Board (SGB), developed the Gezira Scheme in 1925. The uniqueness of the Scheme stemmed from its three-way partnership with the SGB, the Sudanese government and local tenant farmers (i.e. farmers who rent the land). Each partner had a designated role in the operation and management of the Scheme: the farmers were responsible for cotton cultivation; the SGB handled the administrative and management services, while the Sudanese government provided the land and irrigation services (Barnett, 1977).

The SGB were also responsible for assigning tenancies to farmers in the region. Tenant farmers involved in the scheme received 20 feddans, roughly 8.4 hectares each and operated on a standard 5 crop rotation, which included cotton, groundnuts, sorghum, wheat and a fallow (Plusquellec, 1990). In reference to profit allocation, the Sudanese government and tenant farmers each received 40 percent of production profits, with the remaining 20 percent being allocated to the SGB (Barnett, 1977). This original system of organization and internal management allowed the Gezira Scheme to successfully operate for over 40 years, and as a result, it became widely regarded for its quality and consistency. This was reiterated by Bernal (1997) who states that the structure of the Scheme (i.e. miles of irrigation canals, uniform grid-like fields, schedules of operations and hierarchy of management) although rigid, kept it optimally functioning and maintained an effective profit-sharing system that maximized returns for tenant farmers. Furthermore, Eldaw (2004) also states that in order for effective revitalization to occur,
and for the Scheme to become economically competitive, a central management system must be put in place, excluding water management. In addition, the initial structure of the Scheme also helped guarantee that all tasks were carried out according to specific regulations and that all parties were adequately compensated. This helped ensure that a consistent level of productivity was maintained (Bernal, 1997).

Gezira Land Ordinance

The Gezira Land Ordinance was a form of legislation that facilitated the implementation of the Scheme in 1925. It was initially passed in 1921, as a way to reallocate land as irrigated tenancies for cotton production (Barnett, 1977). The issue with the 1921 Land Ordinance is that it completely disregarded existing land rights and forced original owners to rent out their land to the Sudanese government at a marginal rate (Barnett, 1977). Gaitskell (1959) argues that the Land Ordinance was passed as a way for the government to confiscate land, “without outraging the traditional right to proprietorship”. However, the ordinance even applied to communally owned land, which was according to legislation, now classified as government land (Gertel et. al, 2014). Although the Gezira Land Act of 1927 eventually repealed the 1921 Ordinance, it’s important to note, as it paved the way for future governmental land acquisition in Sudan (Gertel et. al, 2014).

Land Tenure System

Conflict and competition over land has been a serious issue in Sudan for decades, especially due to the cultural and socio-political association of the asset with status and power (Pantuliano, 2007). In addition, the Sudanese government is known to have a repressive approach when it comes to upholding land rights and policies at national, state
and local level (USAID, 2013). As such, their inability to address land disputes has also contributed to the escalation of civil war throughout the resource rich regions in the Sudan’s Western and Southern States. As a result of this tension and growing animosity due to conflict, poverty has also escalated throughout the country, with people being forced to abandon their homes (USAID, 2013).

Therefore, this conflict has had a substantial impact on the rural poor, as they are heavily reliant on land for all of their basic needs and in most cases land is their only productive asset (USAID, 2013). So displacement due to land disputes has put them at a significantly higher risk of poverty, as they often have no assets to start over (Pantuliano, 2007). This is supported by the World Bank (2003) who state that the most economically and socially deprived people are the rural landless, as they are more vulnerable to extreme poverty. As such, the Department for International Development (2004) believes that access to land is a necessary precondition to achieving global poverty reduction as well as agricultural sustainability and economic growth.

Issues associated with land acquisition and property rights are often mitigated through land tenure policies. However, Sudan does not have a unified legal framework of land tenure, which is crucial as ownership dictates who is able to control and manage the land (USAID, 2013). Nevertheless, as Pantuliano (2007) notes, legislation in the North is primarily founded on colonial land laws. The Coalition for African Rice Development (2004) in Sudan states that all land, other than freehold can be classified into 3 types: registered leases on government land (type 1), registered land with usufruct rights (type 2) and unregistered land with traditional usufruct rights (type 3).
That being said, land laws are rarely upheld due to the high level of corruption in the country and the absence of a legal framework (Guvele, 2001). This has significantly contributed to conflict over land in the Gezira State. As a result, land allocation in the region has been primarily based on the political judgment of the government, which has led to large-scale losses of traditionally owned land (Guvele, 2001). As mentioned above, tenant farmers in the region are allocated 20 feddans of land, for preparation and production of government chosen crops. As a result, they are limited by the space and crop restrictions imposed on them. These restrictions continue to threaten the livelihood of tenant farmers in the region (Pantuliano, 2007). In addition, the 1970 Unregistered Land Act ensured that all unregistered land would fall under government ownership. This Act has resulted in an increasing number of rural poor, who are unable to get access to land.

According to Bicciato & Faggi (2005), the government maintains ownership and management of the land, natural resources as well as the region’s production policy. It has been argued that the government retains this level of control in order to subject farmers to their economic and agricultural policies (Sudan Tribune, 2013). As a result, farmers in the region often have minimal input when it comes to production and management decisions. These issues have fueled the struggle over landownership between the two groups. Furthermore, conflict over land has led to significant unrest in the region, as farmers have been joining anti-government protests in large numbers due to increasing fears over land loss (Wallis, 2011).

As such, in order to revitalize the Gezira Scheme and ultimately the agricultural sector in Sudan, land reform must also occur. As DFID (2004) reports, this would entail
the redistribution of land to the rural poor, the remodeling of rights and the improvement of management and administrative services. As a result, many scholars have reiterated the importance of reform efforts in Sudan, which could contribute to agricultural productivity and potentially lead to political stability (DFID, 2004).

**Reform Efforts**

At the height of its productivity, the Gezira scheme contributed approximately 3 percent of the national GDP and 65 percent of Sudan’s cotton exports (The World Bank, 2010). Today, the Scheme utilizes 35 percent of Sudan’s Nile water allocation but operates at less than 50 percent efficiency (CARD, 2012). Furthermore, the traditional cropping system, which encourages cash crop generation, has been economically unsuccessful for many years now, and it has put the thousands of tenant farmers at risk. The emphasis on cash crop generation has also contributed to gender segregation throughout the region, as it has excluded a significant number of women from being able to participate in farming. This has left many households, especially those being headed by women, unable to sustain themselves (JICA, 2012). This was supported by Elsheikh and Siwar (2004), who indicated that poverty incidences among female-headed households, 89%, tended to be higher than those headed by males, 68%. Additionally, as more men are migrating for work, the percentage of female-headed households, 31%, and poverty incidences has continued to rise (Elsheikh & Siwar, 2004). As a result, farmers have been demanding for changes in the cropping system, primarily the freedom to grow alternative crops that they perceive as being more economically advantageous. This is reiterated by Guvele (2001) who states that the potential for crop diversification is
substantial, especially considering the need and current conditions of farmers throughout the Scheme.

In response to the demands and worsening socio-economic conditions, the Sudanese government began implementing reform efforts (i.e. acts, policies and projects) that were concentrated on improving the technical and economic efficiency of the Scheme through diversification strategies (Eldaw, 2004). This led to the development of the Gezira Act, which was implemented in 2005, as a way to reform the Scheme through a process of management restructuring and crop diversification (Mohamed et al., 2011). The act was supposed to give farmers the freedom to produce alternative crops, as well as more control over crop management (Mohamed et al., 2011).

However, the implementation of the 2005 Gezira Act has not led to substantial changes, as improvement in productivity has been marginal at best. This is likely due to increasing production costs, minimal investments as well as technical restrictions placed on alternative and traditional crop production (Sudan Tribune, 2011). This further emphasizes the need for better management, improved crop technologies and more sustainable crops, which require less irrigation and labour.

In response to the ineffective Gezira Act and the unstable economic environment, the Sudanese government formulated the Executive Program for Agricultural Revival (EPAR) in 2008. The program targets the development of export crops (i.e. rice), in order to combat poverty and provide food security (CARD, 2012). The EPAR facilitated the establishment of the National Rice Project in the Federal Ministry of Agriculture as well as the subsequent partnership with JICA. As such, the project has been working in concert with JICA’s NERICA rice cultivation effort, in the Gezira State. The overall goal
of the project is to establish a competitive rice production system through investment promotion and capacity building (CARD, 2012).

**Crop Diversity**

As mentioned above, diversification efforts in the Gezira region have been limited, despite the introduction of the 2005 Gezira Act and 2009 EPAR. Tenant farmers are still restricted to certain parameters that limit their ability to introduce novel crops. As such, the majority still operates on the standard crop rotation that includes cotton, sorghum, groundnuts, wheat and a fallow (Sudan Tribune, 2011). As a result, farmers in the Gezira State predominantly grow cotton, as its still one of the country’s main exports.

Cotton production is favoured in the region and is often referred to as a government crop. Furthermore, Guvele (2001) states that governmental control of prices, as well as crop allocation tends to facilitate the production of cotton over other crops. In addition, tenants are required to sell their yield to the government, which continues to discourage farmers from introducing novelty crops into their rotations. Moreover, Ibrahim et al. (2002) highlight that, the ineffectiveness of the region’s irrigation system, heavy siltation, weed growth and poor water management has continually hindered farmers’ abilities to diversify their crops. In order to overcome these barriers, Ibrahim et al. (2002) emphasize the need for more efficient water practices as well as better farm management, in order to produce higher yields and establish optimal crop combinations.

That being said, the Sudanese government has been actively trying to facilitate the introduction of novel cropping systems in order to help farmers diversify their crop portfolios. In addition, the Sudanese government hopes that these efforts will aid in
revitalizing the agricultural sector and better equip farmers so that they are able to deal with the changing economic environment.

However, one of the main challenges they face is getting farmers to participate in these initiatives, because of the numerous challenges that include: high production costs, fluctuating payment schedules, unidentified marketing channels and minimal technical support. As such, the Sudanese government needs to start offering incentives, such as access to land as well as credit and extension services in order to encourage and support farmers in effectively cultivating these non-traditional crops. Furthermore, the government should develop agricultural policies that would encourage the private sector to invest in areas of commodity marketing and services. This is supported by Samar et al. (2013), who states that investment into crop diversity can help facilitate sustainable development for both commercial and small-scale agricultural communities.

**New Technology- NERICA rice cultivation**

As mentioned above, the strategic approach of diversifying Sudan’s enterprises has led to the introduction of new varieties, such as NERICA upland rice. For centuries, rice production and consumption has been heavily associated with Asia, where the crop is the main source of food for millions (Aliou, 2010). However over the last few decades, consumption in Sudan and Africa in general, has consistently increased and now falls within the range of 16 million metric tons, making it the fastest growing staple food in the continent (ARC, 2010). Africa has now become a major importer of rice, accounting for 32 percent of global rice imports (ARC, 2014). In Sudan, rice is known to be a secondary cereal crop behind the popular but less-productive sorghum (CARD, 2012). However, the demand for rice is steadily rising, as the country annually imports 15
million dollars worth of rice (CFI, 2013). As a result, the Sudanese government began introducing rice as one of its strategic crops due its history in Sub-Saharan Africa, high demand in the Sudanese economy and its significant potential for self-sufficiency.

Investment in agricultural research and innovation, in addition to value chain identification facilitated the development of NERICA upland rice by the Africa Rice Center (ARC) in 1996 (CARD, 2012). To date, the ARC has developed 18 varieties of NERICA suited for upland cultivation (NERICA 1 through 18) and 60 varieties suited for lowland cultivation (NERICA-L1 through 60). According to the ARC (2014), the varieties of upland and lowland rice were developed by crossing two species: the African rice variety (*O. glaberrima* Steud.) and the Asian variety (*O.Sativa L*). This form of crossbreeding ensures that the offspring contain the best qualities of each parent. Furthermore, the ARC (2014) argue that these qualities make NERICA varieties more competitive than their parent crops and other traditional rice crops. This is due to the fact that they:

- Contain 25% more protein content than the traditional Asian rice variety
- Generally, produce higher yields in a shorter amount of time
- Have superior weed competitiveness and are relatively pest resistant, requiring less herbicide and pesticides
- Grow taller than most rice varieties which makes them easier to harvest
- Require less irrigation, which allows them to tolerate and adapt to drought conditions

These qualities make NERICA varieties better suited for the upland environment of sub-Saharan Africa. In addition, the Coalition of Rice Development (2012) emphasizes that
there are numerous economic opportunities associated with producing NERICA rice in Sudan. These include:

- The high domestic and external demand for rice
- The competitiveness and productivity of the crop compared to other cereal crops
- The suitable production potential of the country (i.e. the availability of land, water resources and different climatic conditions)

However, there are also several challenges that need to be addressed in order to ensure long-term sustainability of the crop. The Coalition of Rice Development (2012) states that the major constraints faced by farmers include:

- Availability of seeds and land
- Inefficient land preparation, specifically in reference to land leveling
- Inaccessible credit facilities and delayed payment
- Lack of effective irrigation facilities and milling equipment
- Lack of knowledge on rice cultivation

Nevertheless, NERICA seeds are a source of hope for millions of poor rural farmers. This growing interest in NERICA rice, has contributed to its rapid expansion and cultivation across Africa (CARD, 2014). To date, 31 countries, including Sudan have begun operating pilot farms for NERICA4 cultivation (Africa Rice Center, 2014). In 2010, NERICA4 was introduced into the Gezira State through a joint partnership with Japan International Cooperation Agency (JICA) and the Sudanese government. Since then, encouraging productivity and high profit returns have led to the expansion of the project into five other states (Gedaref, Sennar, White Nile, River Nile and Northern State) and movement into large-scale production (JICA, 2014). Therefore, if the aforementioned
bottleneck issues are addressed, and an effective marketing system is developed,
NERICA4 has the potential to become an alternative export crop as well as address the
issue of food insecurity that is plaguing the country (CFI, 2013).

**Gender Empowerment**

In Sudan, women are heavily involved in agriculture and food production (Samar et. al, 2013). They also tend to carry out most of the time and labour intensive work. Within farming systems the literature points to key labour demands upon women and children such as weeding and more potentially significant is crop protection from birds according to Lodin (2013). This division of labour is very prominent in Gezira Scheme, where women account for more than 50 percent of the workforce (Sirageldan, 1990). However, higher paying jobs under modern agricultural systems, (i.e. those that involve technological skills), are generally male-dominated (Sirageldan, 1990). This is the type of agricultural system that is currently employed in the Gezira Scheme. It excludes women from the production process as land preparation and cultivation are carried out through the use of machines (Sirageldan, 1990). This is a significant issue, as most new initiatives involving cash crops, are structured around male farmers. So most extension services are offered to men, who are thoroughly trained on how to employ these novel techniques for successful cultivation (Afshar, 1985). In contrast, no effort is usually made on training female farmers or female leaders of farmers organizations (Government of Sudan, 2010).

Therefore, despite their vital role in agricultural development, women in Gezira often face many challenges in terms of productivity and income generation, as they rarely engage in off-farming practices because of the limited employment opportunities (Samar et al., 2013). Women in the scheme are therefore relegated to assisting in the production
of subsistence or less economically advantageous crops employing traditional methods of production. This also limits their economic participation to a seasonal nature and further reduces their income potential (Sirageldin, 1990).

In addition, the perspectives, experiences and rights of women are often marginalized and in some cases, completely overlooked when it comes to project development and implementation. As Bernal (1997) states, these gender inequalities were heavily reflected in the organization of the Gezira Scheme. The Gezira Scheme was structured around the peasant household model that included a male landowner, whose wife and children worked the land with him. The tenancy system also tended to favour the male landowner, as women were often denied land, even if they had previously owned land in the region (Barnett, 1977). It has been stated, that women regardless of their marital status or age, tend to experience extreme difficulty acquiring land in Sudan, especially since the country has no formal land tenure system (DFID, 2004). As the DFID (2004) states, upholding gender equality in terms of access to land and control over products, should be a priority for the Sudanese government, as women carry out most of the labour intensive agricultural work, and can therefore have the largest impact on productivity. Furthermore, the Scheme gave value as well as rewarded the opinions and experiences of the privileged elite (i.e. the religious sheikhs, slave owners and educated men), yet completely disregarded those that they deemed of less value (i.e. women and slaves).

However, in reference to crop diversity, a 2013 study conducted by Samar et al., showed that an increase in the number of male-headed households would cause a reduction in the level of crop diversity by 18 percent. Samar et al. (2013) argue that,
males are more likely to engage in off-farming practices to supplement their income and improve their livelihoods, while, females tend to remain in the village and thus, pay more attention to crop cultivation. As such, female participation in farming activities is shown to have a greater affect on crop diversity, than male participation. Therefore, in order to generate long-term sustainability through crop diversity, the Sudanese government needs to take the necessary steps to ensure that female farmers are provided with the same opportunities as male farmers.

In general, the Africa Rice Center positions NERICA as a profitable seed enterprise for women, as it’s been able to link West African female farmers to various research, microfinance and marketing opportunities (AfricaRice, 2015). However, the impact on women in Sudan is still unknown. That being said, women tend to play a major role in the production, processing and trading of traditional rice in Sudan, so the foundation for NERICA rice production does exist. Therefore, in order to increase NERICA productivity and maintain its sustainability within the country, policy decisions that empower female-headed households and create off-farming opportunities for them are essential (Samar et. al, 2013).

**Conceptual Framework**

Figure 2.4 below displays the conceptual framework employed for the qualitative study. The framework for this study recognizes empowerment as a multidimensional process that enhances the capacity of men and women to utilize the rights, resources and opportunities afforded to them through upland rice farming. Additionally, the framework also considers various enabling and constraining factors that may influence crop diversity and gender empowerment within each dimension. Moreover, the multidirectional arrows
account for the possible interactions between the dimensions, in addition to highlighting the continuous nature of empowerment. This offers a more holistic approach to understanding the implications of NERICA and its contribution to gender empowerment in the Gezira State.

Figure 2.4 Conceptual Framework

Summary

In summary, the above literature review provides a detailed examination into diversification efforts currently being undertaken as a means for agricultural reform and economic success in Sudan. In addition, the literature review also provides a background into the nature and progress of these innovative strategies, specifically crop diversity and its potential for gender empowerment among rice stakeholders. Many different variables are examined in order to address the gaps in the literature and deal with the complexity of the research topic. These included: context and policies, crop diversity, new technologies (NERICA) and various gender dimensions. Lastly, the literature review addresses the need for crop diversity in Sudan, specifically crops that are more economically feasible and promote self-reliance, such as NERICA upland rice.
Chapter 3: Research Methods

Introduction

This chapter provides a detailed description of the methodology used to explore how crop diversity, specifically NERICA rice cultivation, can contribute to gender empowerment in the Gezira State. As such, this chapter will outline and explain the research design and methods that were employed for data collection and analysis, in order to provide a more holistic understanding of the research study.

Epistemology

The chosen epistemological approach for this study is feminist post-positivist. In general, post-positivists oppose the idea of certainty (Groff, 2004). They recognize that reality is changing and is dependent on context (Groff, 2004). As such, post-positivist approaches tend to emphasize the importance of diversity and complexity. This epistemology is appropriate for the research study as a multi-method approach is adopted to reduce bias and further our understanding on the nature of crop diversity and the associated gender dimensions.

The research study is also influenced by the feminist standpoint, which is based on individuals recognizing and challenging the cultural values and power relations that affect the lives of women and other marginalized groups in systems of oppression (Wood, 2009). That being said, more emphasis is placed on the experiences and realities of women, as the standpoint argues that our traditional ways of knowing tend to devalue women’s knowledge, and thus renders their experiences and contributions as irrelevant (Sarantakos, 2013). This allows for the maintenance of social hierarchies and the
continued oppression of women. As such, the standpoint attempts to address and expose these structures in hopes of empowering and liberating women, as well as other marginalized groups (Sarantakos, 2013).

In order to contribute to gender empowerment, the standpoint seeks to understand the social norms and practices of marginalized groups and explore how these conditions might contribute to their production of knowledge, as well as the implications it might have on these systems of oppression (Grasswick, 2013). This is very similar to Marxist theory, which claims that our concept of knowledge (i.e. what we know and how we behave) is based on the work we do and the activities we engage in (Wood, 2009).

Furthermore, Marxism attempts to understand and oppose all systems of domination, which is reiterated by the feminist standpoint (Harstock, 1983). As such, the roots of the feminist standpoint stem from key principles in Marxism.

Lastly, the feminist standpoint is appropriate for this study as the researcher aims to assess the implications of crop diversity and the contribution it can have on gender empowerment in the Gezira State. Moreover, engendering the research can further our understanding on the effectiveness of reform efforts throughout the Gezira, as past intervention strategies were exclusively tailored towards men. Also, most of the available literature devalues the contributions of women, as it classifies their work as being non-agricultural despite their heavy presence in the field (Samar et. al, 2013). As such, important aspects of crop diversity, specifically in reference to NERICA rice cultivation, remain undocumented and misunderstood.
Therefore, the researcher’s post-positivist feminist epistemology would facilitate the exploration of crop diversity, and help promote gender empowerment through the use of participatory tools.

**Research Design**

A case study approach was employed in order to explore the implications of rice-based technology and the associated gender dimensions in the Gezira State. This is an appropriate strategy as the literature on crop diversity tends to be outdated and limited in scope. Additionally, the study is situated within a gender context, which is an area that is often overlooked in agricultural research. As such, the adoption of a case study would allow the researcher to investigate unexplored dimensions of the problem, in addition to addressing the gaps in the literature (Yin, 2003). Also, the application of a single instrumental case study could provide valuable insights into crop diversity as a tool for gender empowerment, as well as contribute to the uniqueness of the overall research study (Stake, 1995).

Moreover, Ying (2003) states that the case study approach is most effective when: the phenomenon takes place in a real-life context and the boundaries between the phenomenon and context are unclear. This is relevant to the research study, as the contributions of NERICA on gender empowerment are still unknown and cannot be fully understood without considering the socioeconomic environment of the Gezira.

Additionally, the case study approach is able to utilize a variety of methodologies, which allows for greater flexibility in addressing emergent issues (Yin, 2003). This can contribute to empowerment, as it’s able to incorporate different perspectives and allows richer, more in-depth data to emerge (Yin, 2003). Therefore, the application of a case
study is essential, as it enriches the learning experience and provides a more holistic understanding into the nature of crop diversity and its potential for gender empowerment in the Gezira.

Research Setting

The study took place throughout two major states in Sudan: Khartoum and the Gezira State (Refer to Figure 1.1- Map of Sudan). In Khartoum, key-informant interviews were conducted at the Federal Ministry of Agriculture (in the city of Khartoum) and at Sudan University’s Faculty of Agriculture (in the city of Bahri). In the Gezira State, key-informant interviews, focus group discussions and participatory exercises took place at the General Ministry of Agriculture (Wad Madani) and demonstration sites around the Scheme.

The city of Khartoum, named after its state, is the second largest in size and population, with just over 5.3 million inhabitants (Embassy of Sudan, 2013). The metropolitan city is also the capital of the country, and the primary location for most government buildings (i.e. Federal ministries), corporations and universities. Additionally, the majority of oil wealth investment has been concentrated within Khartoum, which has led to an influx of people both internationally and domestically (Embassy of Sudan, 2013). This increasing diversity has also resulted in more liberal practices and freedoms with regards to the enforcement of Islamic law and has facilitated the transition and settlement of international organizations, like JICA, within Khartoum. The organization currently operates and maintains two offices within the city; one in the Riyadh region, and a smaller branch within the Federal Ministry of Agriculture. The
researcher conducted most key-informant interviews at their designated branch in the Ministry.

Several key-informants were also conducted at Sudan’s University’s Faculty of Agriculture in Bahri, which is adjacent to Khartoum. Bahri is the third largest city in Sudan, with an estimated population of 880,000 (Encyclopedia Britannica, 2014). The city’s large population can be attributed to its heavy industrial and agricultural presence, with numerous processing plants and agricultural campuses throughout the region (Encyclopedia Britannica, 2014). However, unlike the neighbouring city of Khartoum, Islamic law tends to be more strictly upheld, with specific dress codes and Islamic practices being enforced.

Additionally, a significant part of the research study was also conducted in the Gezira State, with key-informant interviews and focus group discussions being carried out at the General Ministry of Agriculture in Wad Madani. The researcher also conducted discussions and participatory mapping exercises at the Hudayba demonstration site, in addition to visiting the 7 other sites throughout the Scheme (Abdelrahah, Wad Bahai, Wad Alhadad, Faris, Hosh, Goz Alihead and Shibairab).

Wad Madani is the capital city of the Gezira State and was the primary location for most of the study due to its history of cotton production and irrigation in the Scheme. As such, most governmental buildings (i.e. Ministries) and corporations are located within the city. However, regression of the Scheme, has led to a significant number of people relocating to other areas, as most of the population are either farmers or pastoralists (Encyclopedia Britannica, 2014). Also, they tend to operate under the traditional patriarchal system, which has restricted women from participating in the work.
force and has contributed to increasing poverty rates and internal displacements
(Sirageldin, 1990). Furthermore, Islamic laws for dress and conduct are strictly enforced
throughout the region, unlike Khartoum and even Bahri, which tends to be more liberal.

Research Assistance
As mentioned above, the research was conducted with the assistance of JICA staff
involved in the EPAR project in Khartoum and the Gezira State. Prior to arriving in
Sudan, the JICA project coordinator was in correspondence with the researcher, helping
to schedule field interviews and site visits throughout the Gezira. Once in Sudan, the
project coordinator also helped the researcher with access to knowledgeable JICA and
Ministry staff, which agreed to participate in key-informant interviews. This significantly
contributed to the research process, as getting access to key-informants during the Islamic
month of Ramadan was particularly difficult. In addition, the project coordinator also
contributed to the study by participating in an interview.

Moreover, JICA worked with the researcher to organize accommodation, and
transportation during field visits in the Gezira. They also assigned two highly educated
extension officers, one male and one female, to facilitate introductions between the
researcher, rice farmers, and other extension officers involved in the project. The
assistance of both extensionists was crucial to the study, due to the social customs of the
region, and the gender of researcher. Furthermore, both extensionists also participated in
the focus group discussions and participatory mapping exercises. As such, JICA’s
continuous support was crucial to the development and implementation of the research
study.
Data Acquisition Methods

This study aims to use a series of related qualitative methods within the context of the case study on NERICA rice cultivation. These include key informant interviews, participatory approaches (mapping exercises and observation) and focus-group discussions. A multi-method approach is employed in order to increase reliability and strengthen the validity of the data. Triangulation can also corroborates data gathered from other sources, which helps provide a clearer understanding of crop diversity and its potential for gender empowerment (Yin, 1994).

Research Sample

The sample population for this study was purposively drawn from staff and participants involved in JICA’s NERICA rice project in the Gezira, in addition to educational institutions (i.e. Sudan University) affiliated with the rice initiative. As such, the population of interest included JICA staff (i.e. project coordinators and extension officers) and participants (i.e. farmers) as well as, Ministry representatives and university professors.

Overall. 30 individuals participated in the research study. This included the 10 key-informants, which are outlined in Table 3.1 below, as well as 12 of the 13 extension officers and all 8 farmers cultivating NERICA in the Gezira.

Qualitative Methods

Key informant interviews

Key informant interviews were conducted with JICA project staff, representatives from the Federal Ministry of Agriculture, in addition to agricultural professors affiliated with JICA at Sudan University. A summary of the key-informant interviews is provided in Table 3.1 below.
Table 3.1 *Summary of Key Informant Interviews*

<table>
<thead>
<tr>
<th>Key Informant</th>
<th>Gender</th>
<th>Position</th>
<th>Duration (hours)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>JICA project staff</td>
<td>1.5</td>
<td>Federal Ministry of Agriculture</td>
</tr>
<tr>
<td>2</td>
<td>Male</td>
<td>JICA project staff</td>
<td>1</td>
<td>Federal Ministry of Agriculture</td>
</tr>
<tr>
<td>3</td>
<td>Male</td>
<td>JICA project staff</td>
<td>1</td>
<td>Federal Ministry of Agriculture</td>
</tr>
<tr>
<td>4</td>
<td>Male</td>
<td>Federal Ministry Representative</td>
<td>2</td>
<td>Federal Ministry of Agriculture</td>
</tr>
<tr>
<td>5</td>
<td>Female</td>
<td>Federal Ministry Representative</td>
<td>1</td>
<td>Federal Ministry of Agriculture</td>
</tr>
<tr>
<td>6</td>
<td>Female</td>
<td>JICA project staff</td>
<td>2.5</td>
<td>General Ministry of Agriculture</td>
</tr>
<tr>
<td>7</td>
<td>Male</td>
<td>JICA project staff</td>
<td>1</td>
<td>General Ministry of Agriculture</td>
</tr>
<tr>
<td>8</td>
<td>Female</td>
<td>University Professor</td>
<td>3</td>
<td>Sudan University</td>
</tr>
<tr>
<td>9</td>
<td>Male</td>
<td>University Professor</td>
<td>2</td>
<td>Sudan University</td>
</tr>
<tr>
<td>10</td>
<td>Male</td>
<td>University Professor</td>
<td>1.5</td>
<td>Sudan University/Skype</td>
</tr>
</tbody>
</table>

A total of ten key informant interviews were conducted during the period of July 15th to September 11th, with most interviews being carried out at three different sites: the Federal and General Ministries of Agriculture, and Sudan University’s agricultural campus. Interviews with JICA project staff and Ministry representatives were conducted in Khartoum prior to participatory exercises and focus group discussions. These interviews helped provide detailed information regarding the introduction and sustainability of NERICA in Sudan. Additionally, data from these interviews was used to supplement existing reports and outline the role that land tenure and other agriculture policies can have on rice cultivation. It also helped shape the process of data collected in the Gezira.
In contrast, interviews with university professors were conducted in Khartoum following the completion of the participatory exercises in the Gezira. Although, this was mainly due to scheduling conflicts, the information from these interviews supplemented the findings from the Gezira. They also helped identify various bottleneck issues with alternative cropping, as well as potential solutions for future development. As such, key informant interviews were a crucial part of the research study, as they helped provide candid in-depth information about NERICA rice cultivation.

**Participatory Approaches**

Participatory observation took place between July 7th and August 5th. During this time, the researcher along with two JICA extensionists were able to visit all 8-demonstration sites, in addition to cotton, milling and textile factories throughout the Gezira. This was crucial to the study, as it facilitated the introduction and recruitment process. Additionally, by actively participating in the study instead of passively observing, the researcher was able to familiarize herself with the study environment and build relationships with farmers cultivating NERICA. This allowed for richer data to emerge and created a comfortable environment for participants to share their perspectives on the potential of NERICA to contribute to gender empowerment. These observations were documented in the researcher’s field notes, which were also supplemented by secondary data sources.

Participatory mapping exercises (i.e. seasonal calendar and transect walk) were also conducted because of their inclusivity and potential to reflect the reality of those directly involved and impacted by the project. As such, it helped place the research into a realistic context, and was culturally more appropriate, as it gave value to participants’ traditional knowledge and facilitated a mutual learning process. This combination of
exercises included the construction of a seasonal calendar followed by a transect walk at the Hudayba demonstration site and the construction of a transect diagram.

The seasonal calendar was conducted on August 4th, with a group of 10 participants that included: 7 male farmers, 1 male extensionist and 2 female extensionists. The calendar was created at the JICA field office in Hudayba, on poster paper, with the aid of markers and a 1m ruler. The researcher and participants agreed upon the gender-specific activities, symbols and months of the calendar, in addition to the scale that was used to represent variability of each activity. Following the completion of the calendar, participants engaged in an active discussion around the trends, opportunities and challenges in rice cultivation. The entire activity was conducted over an hour and a half, with the completed calendar being given to participants, after being photographed by the researcher. As such, initially employing a seasonal calendar allowed the researcher to explore the different gender roles in rice cultivation. This is reiterated by FAO (1999) who support the use of seasonal calendars in evaluating gender-specific workload, in relation to resource availability and usage.

Following the construction of a seasonal calendar, a transect walk was conducted in order to capture and share the information elicited from the calendar (Hawkins, 2009). The subsequent construction of a transect diagram, allowed participants to describe the location and distribution of resources in the region, as well as the main land uses between genders (Hawkins, 2009). The transect walk was conducted on August 5th, with the same group of participants at the Hudayba demonstration site. Prior to the exercise, participants were asked to choose any path that covered 3 or more different zones (i.e. schools, crops, mosques etc.). The zones that were selected covered a large area, which made the use of a
vehicle necessary. As such, the transect walk was conducted with the aid of two JICA vehicles, with participants stopping at every zone and discussing the opportunities, constraints, soil types and vegetation. The researcher took detailed notes and photographs of each zone that would help inform the diagram. The subsequent transect diagram was constructed at the JICA field office, with the aid of markets, poster paper and a 1m ruler. The completed transect diagram was photographed by the researcher, with the original copy being given to participants. The walk and diagram were completed over a period of 3 hours. As such, the combination of both exercises allowed the researcher to explore the social interactions of farmers, labourers and extensionists involved in rice farming, in addition to how they perceive and interpret their environment (Macionis and Plummer, 2005). Furthermore, the application of these exercises provided greater insights into the local impacts of crop diversity (Guevele, 2001).

Focus group discussions

The researcher chose to conduct two separate focus group discussions because of several issues in scheduling and accessibility, which made individual interviews difficult. Additionally, employing focus groups helped the researcher to create a more comfortable environment for participants, which allowed for less formal conversations and more meaningful dialogue to occur (UNDP, 1997). It also made it easier for participants to share their thoughts and ideas about sensitive topics associated with rice cultivation, and it facilitated the reciprocal transmission of information between both parties (UNDP, 1997). As such, the researcher was able to obtain several different and similar perspectives about the contribution and constraints of NERICA rice cultivation.

Both discussions were held at the General Ministry of Agriculture on July 21st and 22nd, and lasted approximately 1.5-2 hours in length. The first focus group consisted
of 12 JICA extension officers: 5 female, 7 male, while the second was made up of 8 male farmers currently involved in the project. Both focus groups were asked a mixture of open and close-ended questions regarding the capacity and potential benefits a rice-based farming system. As such, these discussions were crucial to the study as they helped the researcher to identify and understand the type of agricultural inputs available for rice production, and the level of personal empowerment experienced by female and male participants in upland rice farming.

**Data Analysis**

As mentioned above, an exploratory, descriptive case study was employed with a multi-method approach to data collection. Qualitative data obtained from key-informant interviews and focus group discussions were recorded, idiomatically translated and transcribed. The transcripts were then thoroughly examined through a process of open coding. As such, the transcripts were read, highlighted and marked several times, in order to create tentative labels (i.e. codes) representing chunks of data. The codes were then analyzed through a process of thematic analysis. This was the most appropriate model for this study, as it focuses on identifying and describing ideas within the data (i.e. themes) by comparing code frequencies and graphically displaying the relationship between codes (Johnny, 2012).

Following this model, the data was organized into more workable categories based on the relationships between the codes. This process of coding and categorization was repeated multiple times, in order to ensure consistency and to develop mutually exclusive categories. To further ensure reliability and consistency, the researcher employed the assistance of two other graduate students, who agreed with the codes and
categorization of the data. This was a necessary step as thematic analysis relies very heavily on the researcher’s interpretation of codes; as such reliability tends to be an issue.

Following the coding and categorization process, the researcher was able to identify three major themes within the data: development context, livelihood and stakeholder priorities. Comparisons were then made between each theme, by identifying factors that may enable or constrain rice cultivation and influence the level of personal empowerment experienced by men and women. Additionally, quotations that supplemented these findings were selected and organized under the corresponding objectives.

The same process of open coding and thematic analysis was applied to qualitative data obtained from participatory mapping exercises. However, data from these exercises were also scaled and presented graphically, in order to compare the variability between men and women. The researcher’s field notes also supplemented the findings, which were then organized under the corresponding objectives.

As such, the findings that emerged from analysis helped illustrate the implications of rice-based technology and the associated gender dimensions in the Gezira State.

**Research Limitations**

Despite the researcher’s best efforts, several challenges arose during the planning and implementation stages of the study. These challenges limited the scope of the research and the generalizability of the results. They include:

*Cultural and Gender Differences*

The researcher’s Sudanese-Canadian background was advantageous at times, as it helped in understanding and navigating the dynamics of the country. It also helped the
researcher to establish relationships with locals, which often resulted in access to knowledgeable key-informants. However, the gender of the researcher and to some degree, cultural differences proved to be a challenge throughout the initial stages of data collection. As the changing social and cultural norms in Khartoum and the Gezira made it difficult to schedule and conduct interviews, focus group discussions and participatory mapping exercises without the assistance of a male JICA representative. As such, the presence and background of researcher may have impacted the scope of the study, and the quality of data that was collected.

Case Study

Employing a case study helped provide in-depth information on crop diversity through NERICA cultivation. However, it was difficult to gain access to a representative sample of farmers, as only eight male farmers were involved with the project, due to resource limitations and social restrictions that prevented women and small-scale male farmers from participating. As such, there is an issue with external validity and generalizability beyond the sample population (Yin, 2003).

Participatory Mapping

Participatory mapping tools were able to provide an overview of the local situation, in addition to facilitating participation among both genders, and encouraging communication between participants. However, there were also many limitations to this approach, which included: time, expense, accessibility of certain areas, subjectivity of participants, and cultural sensitivity.
Key Informant Interviews and Focus Group Discussions

Although, there are several benefits to conducting key-informant interviews and focus group discussions, there were also many limitations, which included: time and expense, the skill of the researcher to facilitate discussions and redirect interview questions, difficulty with data analysis as well as the potential for response biases due to respondents’ perceptions of the researcher. As such, these limitations may have affected the validity and reliability of the data.

Summary

In summary, Chapter Three provided an overview of the research study’s exploratory descriptive design. The design included the application of a case study, with a multi-method approach to data collection that involved key-informant interviews, participatory mapping exercises and focus-group discussions. The data collected by these methods was then analyzed through a process of thematic analysis. Although, there were several limitations with regards to time, cost, and cultural differences, these methods and tools for analysis, allowed the researcher to generate findings relevant to the research objectives.
Chapter Four: Findings

Introduction

Chapter four provides a detailed description of the research findings that were obtained through qualitative methods of data collection and analysis. These findings include data from: ten key informant interviews, two participatory mapping exercises and two focus group discussions. Additionally, gaps in the data were supplemented by government reports and documents, as well as the researcher’s field notes from participatory exercises. The subsequent research findings were then organized based on their corresponding objectives, and presented in the form of tables, figures and illustrative quotations.

As such, the chapter is divided into three sections: the first section provides a summary of the research findings from key informant interviews. This section focuses on the impact of the prevailing land tenure system and current agricultural policies on NERICA rice cultivation, whereas the second section summarizes the findings from participatory mapping exercises in order to describe the impact of NERICA on gender roles and relations. The chapter then concludes with the third section, which summarizes the findings from focus group discussions. This section describes the level of personal empowerment experienced by male and female participants in upland rice farming.

Impact of Agricultural Policies and Land Tenure on NERICA

Findings from key informant interviews, in addition to government reports and documents helped in addressing the first research objective. Key informants were able to identify various factors associated with agricultural policies and land tenure, which they
believed either, facilitated or hindered rice cultivation in the Gezira. This was partially
due to their extensive knowledge and experience with crop diversity, in addition to their
gender, which influenced the type of questions they chose to answer and the overall
quality of their responses.

As mentioned in the previous chapter, key informant responses were analyzed through a process of open coding and thematic analysis. This led to the identification of four major categories: socioeconomic environment, demand, crop choice and land allocation. Opportunities and constraints within each category were also identified and then classified under the major theme of development. A summary of these findings is presented in Figure 4.1 below.

Figure 4.1- Summary of Key informant responses

<table>
<thead>
<tr>
<th>Theme: Development</th>
<th>Category: Socioeconomic environment</th>
<th>Opportunities</th>
<th>Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>History and prominence of cotton production*</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>History of rice cultivation in the White Nile State</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of natural resources and experienced workforce (women and men)</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender policies not upheld</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lack of gender representation, agricultural knowledge and experience in the political sphere</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Failure of previous reform efforts</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Privatization and monopolization of the Scheme</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distrust of the government</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Category: Land allocation</td>
<td>Opportunities</td>
<td>Constraints</td>
<td></td>
</tr>
<tr>
<td>Existing land rights not upheld</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender disparities in land allocation</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government collecting rent on privately owned land with expired leases</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compulsory acquisition of all land not under the Scheme</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmers allowed to sell or transfer tenancies*</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tensions over back rent and acquisition costs</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Category: Demand</strong></td>
<td><strong>Opportunities</strong></td>
<td><strong>Constraints</strong></td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------</td>
<td>-----------------</td>
<td></td>
</tr>
<tr>
<td>Import rice from many other countries</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profitability and productivity of NERICA appealing to both women and men</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmers want diversified crop portfolios</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase in production of non-traditional crops</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inclusion of rice into popular Sudanese dishes</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decreased global and domestic demand of traditional crops</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown risks associated with cultivating NERICA and novel crops</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Category: Crop choice</strong></th>
<th><strong>Opportunities</strong></th>
<th><strong>Constraints</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gave farmers more control over crops</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Diversified commercial agriculture</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Facilitated the introduction of NERICA</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Combat economic deficit</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Minimized the role of the Sudanese Gezira Board</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Inaccessible finances and agricultural inputs for smallholder farmers (both women and men)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Official crop restrictions unclear</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Cultivating crops at the expense of others</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

* Note: Identified as both an opportunity and constraint

As outlined in Table 4.1, key informants had identified more constraints with regards to the major aspects of agricultural policies and land tenure, and their subsequent influence on upland rice development. Moreover, the findings showed that the majority of constraints were attributed to the socioeconomic environment and land allocation practices. In reference to the socioeconomic environment, institutional weaknesses and social inequalities were seen as significant barriers to rice production in the Gezira. These statements were echoed by all three female key informants (KI.5, KI.6 and KI.8), who describe the issues as being heavily influenced by failures in governance:
“The government had claimed that petroleum would benefit the agricultural sector, however the benefits were never seen. They were really just trying to further their private interests, by diverting the country’s resources into something they deemed more profitable for them. And this all ties back to mismanagement. The government doesn’t employ people with experience and knowledge in the field, especially women. We’re grossly underrepresented in the political sphere, and largely excluded from management and decision-making positions. However, we used to work very closely with the Ministry in the past, but this collaborative relationship ended when the Bashir government came into power, and now look…projects have failed, the Scheme has fallen apart and farmers are barely able to make a living”.

Key informants also vocalized their skepticism due to the failure of cotton throughout the Scheme; KI.8 describes the situation as:

“Throughout the 1940s to late 70s, the economy was heavily reliant on cotton production, which was very successful. It helped diversify the economy and led to the creation of many subsidiaries such as the textile mills and railways. However, if you compare it to now, cotton is almost non-extent. Cultivation of the crop has plummeted and most of the subsidiaries have been sold off. You know back in the day, the British were exclusively reliant on Sudanese cotton from the Scheme. […] However, the prestige and production of the crop fell off once it became privatized, and unimaginably mismanaged. It’s now a thing of the past; with most of the country’s resources being invested in oil and petroleum export. And now look at the state of oil in Sudan, where is it?”

It should be noted that the region’s history with cotton, was also seen as an opportunity due to the existing infrastructure and the availability of natural resources and skilled workers (Refer to Appendix 3, for opportunistic statements). However, these views were not common, as most key informants (KI. 5 through 10) considered the Scheme’s operational history and previous reform efforts, as potential barriers to rice cultivation. This was supported by KI.10, who recalled a past project aimed at introducing submerged rice into the White Nile State:

“I worked on a rice project in the late 70s, near the Um Takkal Village in the White Nile State. It was completely funded by the Japanese government and implemented by a private company with the support of the Ministry. They wanted to test the feasibility of different rice varieties, prior to its implementation in the Gezira. […] I am sorry to say that the project was mostly conducted by men, from
our technical staff to the labourers we employed. The main staff consisted of Sudanese and Japanese men. The only women I encountered, worked in the research farm office as secretaries or messengers because they assumed men had the technical knowledge and strength to carry out the demanding field work. However, the results were promising both in productivity and yield, so we made our recommendations to the government to introduce the varieties, but to my knowledge, it never happened and we don’t know what they did with our research or the rice samples”.

As such, the lack of development and transparency by the Sudanese government, in addition to the limited opportunities and recognition of women, were seen as a major constraints to implementing upland rice in the Gezira. Also, five out of the ten key informants (KI.5, 6, 7, 8 and 9) identified the government’s centralized management of the Scheme, as being one of the most significant constraints to the introduction and sustainability of NERICA. This was reiterated by one of the university professors, who stated that:

“The centralized structure of the Scheme has led to numerous technical, economic and social inequalities and unfortunately, I don’t see it getting any better unless the Sudanese government and Gezira Board decentralize various aspects of the Scheme. The needs and priorities of the majority are not being reflected in their policies, and it’s led to the liquidation of assets, the downsizing of well-trained staff and the growing tensions between farmers, labourers and management. So in order to successfully introduce NERICA, it would require a more participatory process of development and implementation, involving all stakeholders and beneficiaries, including women”.

It should also be noted that female key informants and university professors were more open to discussing the constraining factors associated with the socioeconomic environment (Refer to Annex 1, for more illustrative statements).

As shown in Table 4.1, key informants had also indicated a substantial number of constraints with regards to land allocation, and more specifically the discrepancy between policies and practices. It’s important to note that, most disputes over agricultural land, have been around the Government’s compulsory leasing and acquisition of all privately
owned land in the Gezira. For that reason, it was a very sensitive topic to discuss and
several respondents chose not to answer or not to be recorded, while answering questions
regarding its impact on NERICA. However, those who agreed to discuss the topic, spoke
about land policies in a general sense, and downplayed their impact. This was the general
response from 6 of the 10 key informants, who were primarily Ministry representatives
and JICA staff members (KI.1 through 5 and 7). Nevertheless, a male representative
from the Federal Ministry (KI.4) did mention constraints with regards to financing and
land acquisition:

“It’s very difficult to get access to land, especially for small scale farmers. But
there might be micro-financing options for them in the future. The ABS
(Agricultural Bank of Sudan) recently established a micro-financing unit, which
has already funded the cultivation of 10,000 feddans of wheat. So it’s encouraging
to farmers and has the potential to carry over to NERICA. However, it’s still very
difficult to get access to land without resources and to be honest, I’d prefer if we
didn’t discuss the topic any further.”

The difficulty in acquiring land for rice cultivation, was also addressed by a female
Ministry representative (KI.5) and a JICA staff member (KI. 2), who stated that:

“The farmers cultivating NERICA, already had access to land, as there is no
possibility otherwise. Nowadays, it’s very difficult for a new farmer to buy a plot of
land in the Gezira, unless he’s able to somehow lease it from the government. But,
land is a significant barrier to upland rice cultivation for smallholder or new farmers”.

Additionally, 4 of the 10 key informants (KI.5 and 8,9,10), who were predominantly
professors, reiterated the difficulties with current land laws and their implications on
future rice farmers. As a female professor (KI.8) notes:

“The government owns most of the land in the Gezira, which they essentially took
from private owners. But if a farmer was somehow able to rent a plot and grow
NERICA, they would be forced to comply with the government’s economic policies
and ridiculous land and irrigation taxes, which they usually can’t afford”.

Similarly, a male key informant (KI.9) described how farmers with limited resources,
were still finding ways to cultivate their crops:

“Although, the government owns most of the land, farmers who can’t afford to rent plots and pay the user fees, will still grow their crops just on unregistered or fragmented land. So, in essence they’re growing them illegally, without cultivation rights and at their own risk”.

Furthermore, three of the ten key informants (K.I. 6, 8 and 9) also mentioned constraints with regards to gender differences in land allocation. A male professor (K.I.9) at Sudan University, believed that the issue was due to failures in upholding land laws and traditional practices:

“There’s no formally recognized land tenure system in Sudan. Land is inherited based on Islamic law, but that’s rarely upheld and even when it is, they’re not guaranteed ownership, because its common practice to transfer ownership to a male relative, who would be responsible for the land. So, it does pose a problem for female farmers because for a long time it wasn’t socially acceptable for them to own tenancies in the Scheme, they could just benefit from their use”.

This gender discrepancy in land allocation, was also mentioned by a female JICA staff member (K.I. 6), who stated that:

“Legally-speaking, female farmers are able to own land in the Gezira and have the same rights as male farmers. However, from a cultural perspective, they usually face more challenges in terms of accessing inputs and managing large plots, in these types of irrigation schemes. As a result, the land is often registered under their husband, son or a male relative ”.

Conversely, two male key informants (K.I.3, and 4) from the Ministry and JICA did not view gender disparities as constraining factors to NERICA cultivation in the Gezira. As key informant 1 states:

“When we were promoting upland rice cultivation, we found now significant gender inequalities in terms of access to land. However, it should be noted that we only dealt with top-notch farmers”.

However, a JICA staff member had indicated that a baseline study was not conducted prior or post project implementation, as such social indicators were largely based on
previous reports. That being said, almost all key informants viewed the current land
tenure system and acquisition practices, as potential constraints to expanding NERICA
throughout the Gezira. The only opportunistic statement was in regards to Gezira Act,
which they described as facilitating the sale of transfer of land, for farmers with propriety
rights or those allocated leases on their tenancies. However, this was mainly viewed as a
constraint due to the stipulations set by the government.

In contrast, key informants had communicated more opportunistic statements with
regards to the demand and the need to allocate more resources towards high value crops
such as NERICA. This point was reiterated by 5 of the 10 key informants (KI.1, 2, 3, 6
and 7), who stated that:

“Nowadays, farmers look for more profitable crops, such as vegetables (i.e.
carrots) and rice, especially farmers in irrigated areas, like the Gezira, because
they tend to have a more commercial mindset. So these types of farmers usually
manage very diverse crop portfolios. Also, traditional crops like cotton have been
suffering from viral diseases, and the climate conditions that are also
unfavourable for wheat cultivation”.

Additionally, key informants described the cultural and gender shift in cropping patterns
in addition to the changing mindsets of farmers, as a response to increasing economic
demands and food instability throughout the region. As a female professor from Sudan
University (KI.8) notes:

“There’s a desperate demand for multipurpose crops, like NERICA, especially
due to the high levels of inflation, food shortages and increasing need for both
women and men to contribute household incomes […] The current situation has
also led many farmers to start growing non-traditional cash crops, like sugar beet
and carrots, in order to provide for their families. However, these crops are almost
exclusively grown by men, while women are usually responsible for food crops,
that require more labour and care. But, that’s why NERICA is so appealing; it’s a
food crop and a high value cash crop, which puts women at the forefront of
production. So it changes the traditional dynamic and increases their financial
contribution to the household”.

57
Moreover, all key informants added that the cultural shift, with regards to dietary changes, has also contributed to the increasing import demand for rice and the potential of NERICA. A representative from the Federal Ministry (KI.4) describes the situation:

“Sudan imports millions of dollars worth of rice and right now, you could go to any local market and find many different varieties being sold. In comparison to a few years ago, rice has become increasingly popular, as it’s being incorporated into many traditional dishes as a substitute. So, there’s a growing internal demand for the crop […] and with the direction of the economy, I strongly believe that NERICA will be able to supply this domestic demand, and in a few years become one of the country’s main export crops”.

 Additionally, key informants 1 and 2; mentioned that the similarities between Sudan and its primary import country, further highlighting the potential for large-scale domestic production.

“Sudan imports most of its rice from Egypt, which is capable of producing a lot of rice. So in the long run, this can happen in Sudan as well, especially because the two countries are very similar, with respect to the environment and the type of resources available”.

In summary, all key informants considered the current demand for rice, as a chance to introduce NERICA in the Gezira, and help create economic opportunities for both women and men in producing high value crops. As such, not many constraining statements were made with regards to NERICA. Nevertheless, three JICA staff members (KI. 2, 3 and 7) did speak about the decreased demand for traditional crops, which they viewed as a platform for future rice development. As a male staff member (KI.2) notes:

“Traditional crops like cotton and sorghum are no longer in demand, and their value has depleted. So it’s not encouraging for farmers to invest their time and resources into growing these crops, but the domestic demand for rice has soared. Also, NERICA is far more competitive in terms of productivity and value, which is why more policies need to be focused on rice expansion”.

Although, the current environment was seen as opportunistic for upland rice farming, several key informants (KI. 8, 9 and 10) also pointed out that past crop failures may deter
farmers from investing in novel crops, despite their high demands. Refer to Appendix 3 for more constraining statements on the demand.

In reference to agricultural policies on crop choice, key informants mentioned an equal number of opportunistic and constraining statements. Most respondents credited the 2005 Gezira Act, as facilitating the introduction of NERICA and diversified agriculture in Sudan. As a female JICA staff member (KI.6) notes:

“Well the law of 2005 really changed things. It gave farmers the freedom to produce non-traditional crops, such as NERICA and organize their own rotations, without the restrictions of producing cotton and less economically profitable crops”.

This was reiterated by four other key informants (KI. 1, 3, 5, and 6), who also described the Act as giving farmers complete control over production, and encouraging them to diversify their crops based on their household needs. Additionally, both key informants from the Ministry (KI. 4 and 5) highlighted its impact on the development of the National Rice Strategy (NRDS) and the eventual introduction of NERICA in 2010. As a male representative (KI.4) states:

“The NRDS was built off the objectives of the 2005 Act, which permitted the introduction of diversified crop technologies into the Gezira. The long-term goal is to revitalize the Gezira and Sudanese economy through the establishment of a national rice sector. So initially, we wanted to introduce rice-based technology, in order to provide farmers with access to higher quality seeds (i.e. NERICA) that can adapt to the changing environmental conditions, and still provide upland rice farmers with greater yields and profits”.

As such, several key informants seemed to support the current policies around crop choice, which they saw as enabling the development of NERICA. However, these sentiments were not expressed by 5 of the 10 key informants (KI. 6 through 10), who had several concerns with regards to the ambiguous nature of the policies (i.e. lack of
parameters on water and land usage) and their implications on management practices. As
a female JICA staff member describes:

“The policies that are being implemented in the Gezira have reduced the role of the
Board (Sudanese Gezira Board), who used to be responsible for all of the
operational activities and more importantly, they used to specify and monitor each
block, from the cropping patterns, to the cultivation schedules and input uses. So
there used to be official restrictions and checks in production, but now farmers
have complete control over all aspects of their land. And this wouldn’t be an issue,
if they were engaging in efficient cultivation practices, but the cropping intensity
on these plots has led to failures in the pump system and depleted soil qualities, and
significantly low crop yields”.

Additionally, two of the key informants (KI. 6 and 9) had also expressed their displeasure
with the exclusivity of these policies, which they saw as appealing to a wealthier
demographic of farmers and excluding smallholders who had difficulty accessing the
production inputs and financial resources required to diversity their crops.

That being said, the majority of key informants viewed the current agricultural
policies and the increasing demand for alternative crops, as opportunistic factors for
upland rice development. However, they also mentioned the need for more reformative
measures due to constraints in the socioeconomic environment and land allocation
practices.

**Implications of NERICA on gender roles and relations**

Findings from participatory mappings exercises (i.e. seasonal calendar and transect
walk) helped in addressing the second objective, which focused on the gender-specific
implications of NERICA in the rice farming system. A total of 10 participants, which
included 7 male farmers and 3 JICA extension officers (2 female and 1 male) participated
in the construction of the seasonal calendar, as well as the transect walk and diagram. A
mixed group of men and women were recruited in order to provide different gender
perspectives.

Through the construction of a seasonal calendar, participants were able to identify
gender-specific changes in rice farming practices and seasonal changes in livelihood
throughout the year. A summary of the calendar is presented in Figure 4.2a below; refer
to Appendix 5 for the image of the original calendar.

![Seasonal Variability in Rainfall](image-url)
<table>
<thead>
<tr>
<th>Resources &amp; Activities</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Busiest Months</strong></td>
<td>✦</td>
<td>✦</td>
</tr>
<tr>
<td><strong>Farm work (♂/♀)</strong></td>
<td>✦</td>
<td>✦</td>
</tr>
<tr>
<td><strong>Income (♂/♀)</strong></td>
<td>✦</td>
<td>✦</td>
</tr>
<tr>
<td><strong>Expend. (♂/♀)</strong></td>
<td>✦</td>
<td>✦</td>
</tr>
<tr>
<td><strong>Credit Avail. (♂/♀)</strong></td>
<td>✦</td>
<td>✦</td>
</tr>
<tr>
<td><strong>Off-farm work (♂/♀)</strong></td>
<td>✦</td>
<td>✦</td>
</tr>
<tr>
<td><strong>Food Shortages</strong></td>
<td>✦</td>
<td>✦</td>
</tr>
<tr>
<td><strong>Water Availability</strong></td>
<td>✦</td>
<td>✦</td>
</tr>
<tr>
<td><strong>Livestock Forage</strong></td>
<td>✦</td>
<td>✦</td>
</tr>
</tbody>
</table>

Figure 4.2a: Seasonal Calendar
Note: (1 or ✦) below average, (2 or ✦✦) moderate, (3 or ✦✦✦) above average
*Several women also indicated being trained in land preparation
During the construction of the calendar, participants addressed the variability in social, economic and environmental factors of rice farming, in comparison to their traditional crop rotations (i.e. cotton, sorghum, groundnuts and wheat).

The activity began by discussing the different seasons in the Gezira, the wet and dry season, which participants reported fell between June to mid-September and November to mid-May, respectively. In reference to the dry season, they noted unseasonably high temperatures during the months of October to January, which they mentioned had impacted their harvests for sorghum and wheat. Additionally, participants attributed the low yields of the cereal crops and resulting food shortages, to failures in the hydraulic system, and inefficiencies in water allocation. Moreover, unusual fluctuations were also noted during the rainy season. Participants reported below average rainfalls during the months of June and September, in addition to a period of sporadic flooding during July to early August. These inconsistencies in rainfall were reported as having the most significant impact on NERICA, which participants mentioned required consistent intervals of irrigation, and more frequent watering than their other summer crops (i.e. cotton, sorghum and groundnuts). As a result, they also stated that upland rice required more production inputs during the rainy season, in terms of labourers and extra field pumps.

Furthermore, they had specified that the busiest months in upland rice cultivation occurred during the periods of land preparation and harvesting, which they labeled as coinciding with the start and end of the rainy season. As such participants had mentioned that land preparation was carried out three months prior to the first rainfall in June, and harvesting usually commenced three weeks after the last rains, in late October. However,
participants had indicated that issues with land preparation, in addition to irregular periods of rain, had delayed their planting period and subsequent growth and harvesting of NERICA (Refer to Figure 4.2a). This was described by one of the male farmers, who stated that:

“In the Gezira, July to September are crucial months for rice growth, but I wasn’t able to plant my seeds on time because I had some issues with leveling (land preparation) and poor rainfall. Also, the flooding in August impacted my crops, so I wasn’t able to produce as much yield, as the previous year. But, the yield was still more than my other crops”.

This statement was reiterated by several participants, who attributed the inconsistencies in rainfall on the longer cropping season for rice due to its high dependence on rainfall. However, despite its high input demand NERICA was still reported by participants, as producing the highest yields, with the second highest returns, following groundnuts. This was also seen as an opportunity by two of the participants, who spoke about allocating more land towards NERICA in order combat the deficit in their cereal crops and profit from the demand for alternative subsistence crops.

In reference to the social environment of the rice farming systems, participants described it as being highly traditional and structured around the patriarchal system, with a male head of household who controlled all of the financial aspects and was responsible for organizing all of the land labour. As such, they identified the farming system as operating around the male farmer and his family. This was reiterated by one of the male farmers who stated that:

“We’re responsible for all aspects of production, from land preparation to water management and marketing of NERICA. However, we do rely on our family’s contributions during the high demand months, in addition to several wage workers that we employ for weeding and other labour tasks”.

64
Additionally, all of the male participants indicated that it was ultimately their decision to include NERICA into their rotations, which they viewed as an opportunity to maximize their incomes, despite the potential financial risk. As such, the decision-making and on-farm management of NERICA (i.e. arranging the necessary machines and irrigation services, preparing the land, as well as financing labourers) and marketing was considered to be the primary responsibility of the male farmer. This was reflected in their consistent workload and above average expenditure between March to July and October to December, which they identified as the most crucial and costly stages of production and growth.

Moreover, male participants attributed their high degree of managerial and financial responsibilities, as affording them priority access to production resources (i.e. agricultural inputs and extension services) from JICA and the State Ministry, who are also the primary purchasers of NERICA. However, they did mention challenges with procuring payment from the Ministry, in addition to difficulties in accessing microcredit in comparison to women. As one male participant describes:

"We would definitely benefit from microcredit, since the government hasn’t been paying us. But most financial institutions only give out loans to women now, because they think that men are more likely to invest the money into other business ventures and not repay their loans, which happens all the time. So banks often view women as being more trustworthy and reliable”.

As such, several male participants reported that female farmers were more likely to satisfy the loan requirements, despite the fact that male farmers tended to own more assets (i.e. machinery, vehicles and livestock). However, participants briefly mentioned alternative credit opportunities, through the informal sheil system, although none of them reported borrowing through this method. That being said, all male participants expressed
their frustrations with credit allocation and the lack of financing options for NERICA, as opposed to government crops, such as cotton and wheat. Nevertheless, despite the challenges they faced by male farmers with regards to accessing income and credit, all participants still viewed men as having a more dominant presence in upland rice farming. A summary of their seasonal variability in workload and capital is displayed in Figure 4.2b below.

![Seasonal variability in workload and capital among men in upland rice farming in the Gezira](image)

Figure 4.2b: Graph displaying the seasonal variability in workload and capital among male farmers

As shown in the above figure, male farmers were relatively involved in almost all areas of upland rice farming, throughout the year. In comparison, participants noted that women were still underrepresented with regards to the technical aspects of rice production (i.e. application of rice-based technology during land preparation), despite their increased access to microcredit and the absence of any physical restrictions. They attributed these limitations to the increased social and domestic pressures of women (i.e. caregiving, maintaining the household and other non-agricultural activities).

Additionally, participants explained that the added time constraints on women limited
their participation to seasonal activities (i.e. wage work) and restricted their ability to travel for work. As one female participant describes,

“I have a lot of friends, who have had to leave work because the income they bring in doesn’t cover their household expenses, in terms of childcare and household maintenance. So they’ll just pick up temporary assistant jobs, when they can. But, the majority of women working on NERICA, are usually Falata (West African) labourers living around the production sites”.

As such, participants indicated a below average level of expenditure due to their low transportation costs, as the majority resided near the production sites. Moreover, women were described as having a more pronounced role in upland rice farming, in comparison to the other cash crops (i.e. cotton and groundnuts). Participants attributed this to their increased level of responsibilities and leadership during the intensive months, when sowing; weeding and harvesting took place. Also, they mentioned that the responsibility of crop protection was relegated to women. As such, participants indicated a substantial reliance on female labourers, especially those of African origin, due to their history and experience with rice and several other crops in the Scheme. As one male participant described:

“The Scheme is very old and most of the Falata (West African labourers) grew up working on it, so they have a lot of labour experience. So they’re able to complete all of the work without affecting or damaging the crops, and some of them actually weed and harvest, while carrying their babies. So, they’re very effective and we rely on them exclusively during the high demand months”.

This was reflected in Figure 4.2a, in the workload of women, which was identified as above average during the labour intensive months, from June to August, and between October to December. Additionally, participants indicated that the incomes of female labourers were relatively greater in upland rice farming, due to their increased responsibilities and long hours. However, participants indicated that the seasonal nature
of their work resulted in many women participating in multiple crop rotations, in addition to their considerable off-farm efforts. As such, several participants credited women with conducting most of the off-farm activities, such as livestock herding, handcrafting and cheese and yogurt making, in addition to unpaid domestic duties. It’s important to note that, the group identified women with a higher level of education, as being more involved in assistant-type roles in rice farming, such as extension and administration. However, female participants indicated that despite their higher level of education, a substantial portion of their income was still allocated towards the household budget. The seasonal variability of women in upland rice farming is displayed in Figure 4.2c below.

Figure 4.2c: Graph showing the seasonal variability among women in upland rice farming in the Gezira

Additionally, to supplement information from the seasonal calendar, participants took part in a transect walk, which ultimately led to the construction of the diagram presented in Figure 4.3 below; refer to Appendix 6 for images of the constructed diagram and zones.
<table>
<thead>
<tr>
<th>Crops</th>
<th>Vegetat.</th>
<th>Soil Type</th>
<th>Vegetat.</th>
<th>Soil Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundnuts</td>
<td>N/A</td>
<td>clay soil</td>
<td>Sorghum</td>
<td>N/A</td>
</tr>
<tr>
<td>Sorghum</td>
<td>N/A</td>
<td>clay soil</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>NERICA</td>
<td>N/A</td>
<td>clay soil</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Cotton</td>
<td>N/A</td>
<td>soil</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Acacia tree</td>
<td>N/A</td>
<td>clay soil</td>
<td>Acacia tree</td>
<td>N/A</td>
</tr>
<tr>
<td>Savannah grass</td>
<td>N/A</td>
<td>clay soil</td>
<td>Savannah grass</td>
<td>N/A</td>
</tr>
<tr>
<td>Goats, sheep</td>
<td>N/A</td>
<td>clay soil</td>
<td>Goats, sheep, cattle</td>
<td>N/A</td>
</tr>
<tr>
<td>N/A</td>
<td>N/A</td>
<td>clay soil</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Problems</th>
<th>Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inaccessible roads</td>
<td>Off-farming opportunities</td>
</tr>
<tr>
<td>Congested classrooms</td>
<td>Proximity to village</td>
</tr>
<tr>
<td>Weeds</td>
<td>Training</td>
</tr>
<tr>
<td>Diseases</td>
<td>Off-farming opportunities</td>
</tr>
<tr>
<td>Roads difficult to access</td>
<td>Maintenance of roads</td>
</tr>
<tr>
<td>Prayer space congested</td>
<td>Proximity of mosque to village</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Low production</th>
<th>Poor sanitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor soil fertility</td>
<td>Transport.</td>
</tr>
<tr>
<td>Disease and pests</td>
<td>Unemployment</td>
</tr>
<tr>
<td></td>
<td>High price of agric. inputs</td>
</tr>
<tr>
<td></td>
<td>Inadequate health facilities</td>
</tr>
<tr>
<td></td>
<td>Shortage of water</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weed control</td>
<td>Regular maintenance</td>
</tr>
<tr>
<td>Training and improved agricultural practices</td>
<td>Improved irrigation</td>
</tr>
<tr>
<td>Available land</td>
<td>Pest control</td>
</tr>
<tr>
<td>Drought resistant seeds</td>
<td>Drainage System</td>
</tr>
</tbody>
</table>

Figure 4.3: Transect Diagram

In each of the zones that were visited, male and female participants described the different land uses, vegetation and soil types, as well as the availability and distribution of resources. In addition, various socioeconomic opportunities and challenges were addressed. One of the most prominent features throughout each of the zones, were the naturally flat clay plains, which participants attributed to facilitating the introduction of NERICA and a variety of non-native crops.

In reference to the zones that were visited, zone 1 and 3 were the principle production sites for both cash and subsistence crops. In zone 1, male participants stated that they allocated 5faddans to sorghum cultivation, which they grew in concert with
5 feddans of groundnuts. They indicated that groundnut cultivation, in addition to sorghum residues and grass plants provided adequate amounts of feed for goats and sheep, and helped create off-farm opportunities for women. Additionally, the group mentioned that the combination of sorghum and groundnuts was practiced to improve the soil fertility and increase the productivity of their crops. This seemed to be a significant concern as several participants discussed past issues with soil alkalinity, and cropping intensity, which they attributed to decreased yields of sorghum. However, most participants also stated improvements with regards to the agricultural practices and technical efficiencies of farmers. That being said, they still specified challenges with regards to stagnant waters and poor drainage, which female participants attributed to the high volume of household malaria cases. Correspondingly, unpaved roads were also identified as a major transportation barrier, to and from the production sites.

The same transportation difficulties were also described in zone 3, which was the primary area of most crops. However, mobility throughout the zone was identified as being more manageable due to the presence of wider roads and decreased flooding incidences. In zone 3, participants spoke about cultivating 2.5 feddans of wheat, 5 feddans of cotton and between 2.5 to 4 feddans of NERICA. They mentioned cultivating wheat and cotton, primarily due to their established market channels, and moderate profitability and yield. That being said, some participants attributed the successful introduction of NERICA, as a reflection of their technical capabilities and relative improvements in the irrigation system, as well as the availability of experienced female labourers, arable lands and high quality rice seeds. However, several challenges, in addition to transportation, were also communicated. Participants continually expressed their frustrations with
regards to the high input costs of crops; especially NERICA, which farmers had estimated at 49,000 SDG per site (Refer to Appendix 7 for Total Operational Costs of major crops). Also, female participants spoke about decreases in crop yields due to technical inefficiencies by farmers (i.e. improper land leveling techniques and limited employment of labourers). Furthermore, female participants mentioned that the challenges in zone 3 were heavily reflected in the inadequate living conditions of villagers in the nearby zone.

The production sites were in close proximity to the village (zone 4), where the majority of wage labourers resided with their families. Participants had indicated that the average household consisted of 5 to 7 people, with an increasing number of female-headed households. This was largely seen as an advantage due to the availability of labourers and increased decision-making potential of women. However, several male participants also mentioned issues with regards to increases in land pressures and subsequent decreases in production, which significantly reduced their budget for wage labourers. Participants had attributed these budget cuts to the rising unemployment levels within the villages, although they did mention future economic opportunities through upland rice farming, which was described as providing greater financial rewards.

Moreover, participants discussed off-farm opportunities for villagers through livestock herding, as goats, sheep and cattle were seen throughout the area. Although, several participants expressed concerns due to drought conditions, water shortages and mobility, which were identified as barriers to animal management, crop production and access to basic health services.
Although, many challenges were identified within the area, participants mentioned that a number of services had been established within walking distance of the village. In zones 2 a school was built for both girls and boys in the village and in zone 5 a road have been cleared, in order to permit transportation to the mosque, in zone 6. There were some visible issues with overcrowding, due to the high population, however participants highlighted that development efforts were being made to expand the facilities.

In summary, both exercises highlighted the implications of NERICA on the socioeconomic conditions of both men and women, within the rice farming system.

**Level of personal empowerment experienced through NERICA**

Findings from the focus group discussions helped in addressing the third objective, which investigated the level of personal empowerment experienced by men and women through upland rice farming. As mentioned in the previous chapter, focus group discussions were carried out with two groups: male rice farmers and a mixed-group of JICA extension officers. As a result, both female and male participants were able to identify various social, economic and political factors, which they described as contributing to the level of empowerment they experienced through NERICA. These included: changes in self-esteem and self-confidence, access and control over resources, decision-making, participation, and skills development opportunities. Summaries of the findings are presented in Figures 4.4 and 4.5 below.

**Female Perspectives on Empowerment**

<table>
<thead>
<tr>
<th>Perspectives of Female Extension Officers</th>
<th>Enabling</th>
<th>Constraining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self Esteem and Self Confidence</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

72
The findings in Figure 4.4 showed that female participants had experienced several positive changes through upland rice farming. The most prominent changes were reported in their self-esteem and self-confidence. Additionally, their outlook towards participation seemed to be more positive. Moreover, several women credited NERICA as providing them with opportunities and responsibilities that allow them to utilize their strengths and develop their skills (i.e. involvement in seed preparation and production). As a result, women also indicated that they had become more self reliant and confident in their work, which they regarded as helping them to advance in their careers and enter male-dominated aspects of rice farming. As one participated noted:
“I’m always telling my husband that women have become more self reliant and driven in Sudan. And you see this with our increased presence in universities, offices, and even in the field. We depend on ourselves financially and professionally. For example, I was able to complete my education here and secure a job with JICA. Also, I’ve been involved in many different stages of the NERICA, from seed dressing to land leveling, which used to be only men, as well as planting and harvesting. So we’ve made strides and I certainly think that women can be successful in rice production”.

As such, several participants credited their increased economic and professional responsibilities, as allowing them to gain personal income and greater decision-making power at work and in the household. Moreover, all of the women reported progressive efforts, with regards to their inclusion in training workshops. As one female participant describes:

“We (female extensionists) are very well trained. For example, several of us just flew in from Uganda. We were there for two weeks, learning about all of the technical aspects of NERICA, and not just NERICA4 but all of the varieties. And this isn’t our first time traveling for workshops; we were also able to go to Egypt last year, to learn about irrigation and water management of NERICA. So if there was ever an issue on one of the sites, we’d be able to work with the farmers to address the problem.”

Moreover, two of the 5 women described being trained in land preparation, specifically harrowing and leveling. As such, female participants were more optimistic towards the expansion of agricultural and extension services.

However, they did report certain gender disparities during the implementation of NERICA. As 4 out of 5 women described feeling “excluded” and ”undervalued” during the early stages of the project. They revealed that their male colleagues were often encouraged to participate and attend the general meetings and rice forums in Khartoum, while they were rarely asked. Nevertheless, all female participants described feeling more confident and capable through their active participation and increased responsibilities in upland rice farming.
However, it should be noted that as of August 2014, no female farmers were involved with the project. That being said, all 5 of the women reiterated the importance of female labourers in upland rice farming due to their extensive cultural knowledge on the crop, and their high regard within the Scheme. As such, participants described female labourers as having more economic opportunities and responsibilities through upland rice farming. As one participant noted:

“Farmers greatly value and trust the (female) labourers that they employ because of their efficiency and positive reputation in the Gezira. Also, the success of rice really depends on their input and management during the labour intensive months. So farmers place a lot of the responsibility on them, but it also gives them the opportunity to develop their skills and take on new tasks. And of course they’re paid more for their work”.

As such, all participants viewed NERICA as an instrument of empowerment for female labourers, as well.

**Male Perspectives on Empowerment**

<table>
<thead>
<tr>
<th>Perspectives of Male Farmers and Extension Officers</th>
<th>Enabling</th>
<th>Constraining</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Self Esteem and Self Confidence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leadership roles</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Able to share ideas and opinions</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Able to produce high yields</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Praise amongst JICA and the Ministry</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Positive attitude towards learning and expansion</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Lack of commitment</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td><strong>Access and control over resources</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to extension services</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Able to generate higher incomes</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Must cover all costs (labour, land, irrigation and milling)</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Dependency on the Ministry</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td><strong>Decision-making</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organize their own crop rotations</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Determine amount of rice they want to cultivate</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
Collaboration between extension officers and farmers

<table>
<thead>
<tr>
<th>Participation</th>
<th>Enabling</th>
<th>Constraining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Given priority during recruitment and selection</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Involved in all areas of production</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Invited to attend meetings and conferences</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Assumptions about government association</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Increased attendance in training workshops</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

Skills Development

| Developing technical efficiencies to cultivate NERICA | ✓        |              |
| Inefficient water management practices |              | ✓            |

The findings in Figure 4.4b showed that male farmers and extensionists had experienced more positive changes through involvement in upland rice farming. They had indicated more prominent changes with regards to their level of participation, decision-making power, in addition their self-esteem and self-confidence. These improvements were most noticeable among farmers, who credited their treatment by JICA and their increased responsibilities, as raising their self-esteem. These thoughts were shared by 6 of the 8 farmers, who described their experience:

“We heard about the project through JICA, when they recruited us. They said they wanted us to participate because of reputations and successes with other crops. So they assumed we’d be more successful at incorporating NERICA and attracting other farmers in our community. They also wanted us to assume a leadership role, and take on more responsibilities. So all of the decision-making and on farm management is handled by us, however, they do provide us with the seeds and support services, if we need it”.

Additionally, 5 out of 8 farmers stated that they felt more confident in their work, due to their collaboration with extensionists, which they saw as an opportunity to strengthen their skills and apply their knowledge. As one farmer expressed:

“We’ve been working with JICA (extensionists) to apply the strategies they’ve shared with us. And they’ll stop by every now and then, to check in on our progress and we’ll work through the issues. It’s challenging at times, but we’re adapting and most of us have already seen success in our yields. For example I was able to produce 1.2 tons in the first season, 1.4 in the second and 1.8 in the
third. So we know how to organize our rotations. Also, we want to be able to compete with (rice) farmers in Egypt”.

Moreover, three farmers mentioned that their on-farm successes had been praised and broadcast on several media platforms. They also described their experiences at various events, where they were encouraged to speak to others and share their techniques and strategies for cultivating NERICA. As such, these farmers regarded their successes and subsequent acknowledgement, as contributing to their overall self-confidence and worth.

Despite the number of positive changes indicated by farmers, several had also expressed frustrations with regards to their lack of funds and their dependency on the Ministry. Seven of the eight farmers, identified this dependency as a significant constraint to empowerment and rice expansion:

“Our success has the potential to attract others to start cultivating NERICA. But we’re having problems purchasing electricity for our milling machines, and the Ministry either delays paying us or only give us half of our money. I mean we can grow NERICA but how are we going to mill it? We’re very passionate about our work and we’re willing to deal with the challenges, but they just need to supply us with proper electricity so we can mill the rice. No one at the local market will buy bagged rice, so we end up selling it to the Ministry, who consistently withhold our payments, so this obviously sends a negative message to other farmers wanting to grow NERICA”.

Additionally, 2 out of the 8 farmers indicated plans to discontinue with NERICA and return to their previous rotations because of their unaddressed concerns and association with the Ministry. However, the majority described their overall experience as positive, and emphasized their desire to continue with the crop.

Similar sentiments were echoed by male extension officers, who attributed the positive changes in their self-esteem and self-confidence, to the opportunities provided through upland rice cultivation. Several extensionists considered JICA’s initial offer to participate in the initiative, as improving their self-esteem and status at work. They
mentioned that only a few of their colleagues had been asked to join the project team, as extensionists had been selected based on their knowledge and experience, in addition to their connections with farmers. Moreover, all 8 extensionists indicated that were often asked to attend and present at the general meetings and rice forums. They had described these events as a chance to share their experiences, advertise NERICA’s potential and network with representatives from the Ministry and private investors. As such, most extensionists regarded their involvement as a reflection of their importance and value on the project team. As one extension officer described:

“I’ve been asked to attend (rice forum) on a number of occasions, to represent our team and share my experiences on the field. And it’s been relatively successful because most of our concerns have been addressed, so they take our opinions seriously”.

Extensionists also spoke positively about the training workshops, offered to them domestically and abroad. They considered their attendance and participation in these workshops, as allowing them to strengthen their skills and acquire new knowledge on rice-based technology. Also, these opportunities were attributed to their increased level of confidence in their work and abilities. Moreover, extensionists indicated that they were able to effectively utilize the technology and support farmers throughout the production process. As such, the majority of extensionists, 7 of the 8, considered their involvement with NERICA, as positively contributing to their personal growth and empowerment.

**Summary**

In summary, Chapter 4 outlined the development and livelihood implications of upland rice farming and described its contribution to empowerment for female and male rice stakeholders. As such, factors that enabled or restricted their capacity to participate were also identified. With regards to the development context, key informants had
labeled the country’s agricultural policies and land tenure practices, as barriers to upland rice cultivation. They indicated that the newly developed policies failed to address the needs of women and smallholder male farmers, choosing instead to prioritize the private interests of wealthy stakeholders (i.e. government and large-scale farmers). They had also specified that land and inheritance laws were rarely upheld, especially for women who were considered secondary to men. Instead, unfair cultural practices of land allocation were enforced. As such, the current system was described as excluding women and smallholder male farmers from cultivating NERICA and subsequently limiting their economic opportunities.

With regards to the livelihood strategies, noticeable changes were identified in the level participation of both women and men. Although, female farmers were excluded during recruitment, female extensionists described their presence in other male-dominated areas of production such as seed and land preparation, to a certain degree. Moreover, all of the labour-intensive aspects were conducted by female wageworkers. As such, women were thought to have higher incomes with NERICA, in comparison to their other crops. Although, they did report challenges with regards to income allocation and access to resources, namely land. In contrast, male farmers and extensionists were identified as having greater access to production inputs (i.e. land and machinery) and more control over their incomes, which were also higher with NERICA. However, they did indicate challenges due to their high level of expenditure and their inability to access credit, in comparison to women. That being said, men were generally more visible than women, throughout the production process and marketing of the crop.
Lastly, both female and male respondents reported self-improvements through their involvement in upland rice farming. Female respondents attributed this to positive changes in their self-esteem and self-confidence due to their increased access to training workshops, inclusion in pre-production and land preparation tasks, in addition to their increased responsibilities and collaborative relationship with farmers. Similarly, male respondents also described positive changes in their self-esteem and self-confidence due to their increased responsibilities on and off the field, access to extension services, in addition to their elevated decision-making power and leadership role throughout the process. As such, upland rice farming was identified as contributing to the level of personal empowerment experienced by women and men in the Gezira.
Chapter Five: Discussion

Introduction

For the last few years, the Sudanese government has been focused on revitalizing the agricultural sector, in hopes of diversifying the economy and increasing the economic opportunities for both women and men. Moreover, by strengthening the sector, the government hoped to lessen the socioeconomic impact of falling oil revenues and the primary reliance on the commodity. That being said, most revitalization efforts have been concentrated in the Gezira State, with the introduction crop diversity, specifically non-traditional crops like NERICA upland rice and novel technologies such as rice-based farming.

NERICA was initially introduced in 2010, due to its multipurpose nature as a cash and subsistence crop, as well as its potential to narrow the gender gap, in terms of economic participation (CARD, 2012). However, not much research has been conducted since (CARD, 2012). Thus, the implications of upland rice farming and the associated gender dimensions are largely unknown. As such, the qualitative study sought to explore the nature of crop diversity, specific to NERICA cultivation, and its contribution to gender empowerment for rice stakeholders in the Gezira State.

As outlined in Chapter 3, a multi-method participatory approach was employed, with the subsequent findings being presented in Chapter 4. This chapter will further discuss the research findings, and address the socioeconomic factors in upland rice farming, as well as their influence on gender empowerment. Moreover, the discussion will be presented in accordance to the research objectives.
Influence of agricultural policies and land tenure practices

The recent shift towards agricultural revival and diversification has increased pressure on the Sudanese government to develop effective policies, which promote economic participation and productivity in novelty crops, in addition to land and structural reforms. In response to these demands, the Sudanese government, in collaboration with JICA and the World Bank, developed and implemented: the 2005 Gezira Scheme Act and 2010 National Rice Development Strategy (NRDS). Both policies were expected to change the mode of production in the Gezira, and challenge the traditional gender dichotomy through upland rice (NERICA) farming. Moreover, the policies were thought to coincide with the Millennium Development Goals (MDGs) and article 15 of the Sudanese constitution (INC), which promotes gender equality in all aspects of society and focuses on empowering women through education attainment and economic participation. As such, the Sudanese government had strongly backed the policies and labeled NERICA as a high value multipurpose crop, as female and male farmers could produce it. Moreover, its cultivation was intended to provide economic opportunities throughout the Gezira, and transform the traditional cropping system. However, the nature of transformation remains to be seen. As such, in order to examine the contribution of upland rice farming and the associated gender dynamics, the influence of these agricultural policies and land tenure practices had to be determined.

The data collected through key informant interviews and secondary sources identified a number of constraints to the current policies and practices facilitating upland rice farming. These constraints were mainly attributed to institutional and infrastructural
inequalities within the socioeconomic environment, as well as unjust practices for land allocation throughout the Gezira.

This was exhibited through the underrepresentation and exclusion of key stakeholders (i.e. female farmers and small-scale male farmers) during policy development and implementation. These stakeholders, particularly female farmers, are often restricted in their level of economic participation due to traditional practices and value systems. As such, their contributions are often overlooked, which makes it difficult for them to obtain social and political recognition. Respondents attributed these biased practices to the exclusion of female farmers during the development of the Gezira Act and NRDS. Both policies were developed based on recommendations and efforts of the Gezira Farmers Union (GFU). The union is responsible for promoting the interests and defending the rights of both female and male farmers in the Gezira. That being said, the GFU is dominated by male farmers and only selects representatives from this group, as such their needs are always prioritized and filtered into the design and implementation of policies. As a result of this gender blindness, the perspectives of female farmers are often overlooked or thought to coincide with male farmers. This was the situation with the Gezira Act and NRDS, which failed to recognize the gender-specific challenges and power imbalances in upland rice farming. As such, stipulations and provisions should be allocated towards securing female representation in workers unions, in order to ensure that their needs are communicated and included in policy recommendations. Additionally, the Sudanese government needs to develop gender responsive institutions in order to promote gender policies and strategies at the national and state level.
That being said, the current system seemed to prioritize the needs and interests of the wealthy stakeholders (i.e. large-scale farmers and private investors), in hopes of promoting participation and investment into upland rice farming. As they were believed to be have a higher chance of productivity and economic success with NERICA. As a result, more attention and effort was directed towards improving the management and delivery of services (i.e. irrigation, technical support and land attainment) to this group.

This was most prominently reflected in the advantages they were provided through the land article of the Gezira Act. The Act was recognized as the first legal policy in over 40 years that attempted to reform the land tenure system in the Gezira. The main objective was to provide farmers with more control over production, by enabling them to sell, rent or use their land as collateral. It attempted to accomplish this by restructuring the centralized system of ownership and transferring titles and lease deeds to farmers within the Scheme. The Act also intended to increase agricultural productivity of NERICA and other strategic crops, by expanding the land under cultivation. This was accomplished through the compulsory acquisition and compensation of privately owned land, outside the Scheme (World Bank, 2010).

Needless to say, the Gezira Act had many issues and failed to resolve most of the conflicts surrounding ownership and compensation of poorer stakeholders (i.e. female and small-scale male farmers). As outlined by the Options Report (2000), there were significant disagreements over the amount of compensation and the sector responsible for paying farmers. There were also challenges with transferring titles and deeds, as second and third generation farmers had and continued occupy most lands. Additionally, the government lacked the technical capacity to handle the verification process that was
required to issue the land titles and deeds. Moreover, land allocation was primarily targeted towards male farmers, as cultural practices prevented women from possessing land and registering the land in their name. As such, their landholdings were often registered under an appointed male relative or representative, which made it difficult to obtain land titles and lease deeds under the Act.

Conversely, the Gezira Act was described as providing wealthier stakeholders (i.e. large-scale farmers and the private sector) with access to large landholdings and a significant amount of collateral, as this group was rarely held to the parameters and procedural terms of the Act. As such, wealthy stakeholders were able to purchase and rent land more freely. Most respondents acknowledged that biased practices enabled the monopolization of land and resources by the wealthy at the expense of the poor, who were subjected governmental parameters. Moreover, their accessibility of land was attributed to their increased participation and greater potential for success in upland rice farming. However, the difficulties faced by female and small-scale male farmers limited their capacity to participate and benefit from upland rice farming, as land is considered to be a fundamental production asset. These shortfalls in national and state policies were recognized as increasing vulnerabilities among key stakeholders and contributing to the low levels of trust and support for governmental institutions. As such, the majority of respondents recognized that the current system “failed to serve the needs of farmers” and perpetuated practices that infringed on the rights of women and other marginalized groups.

In conclusion, government policies and practices were identified as furthering the dominance of wealthy male stakeholders and created conditions that enabled their
economic success in upland rice farming. As a result, respondents believed that governmental efforts should be geared towards the provision of “human and financial resources, rather than legislation and policies on paper “.

**Implications of NERICA on gender roles and relations**

As indicated by the literature and displayed through the previous objective, engendering reform initiatives can provide a clearer understanding of the problem, as it considers the needs and priorities of all stakeholders. This can aid in developing and implementing more effective strategies, which are better in quality, relevance and coverage (i.e. impact on women and men). This can have a substantial impact on NERICA, as the crop attracts both women and men, due to its high value and yield. That being said, rice has always been mostly grown by women in Sudan, as such the involvement of men was acknowledged as a shift in the traditional gender dynamics (CARD, 2012). Moreover, women are rarely involved in the production of high value crops, so their participation in NERICA was also recognized as a shift, and an opportunity to improve their social and economic power. However, the gender aspects of upland rice farming in the Gezira, have yet to explored. As a result, many questions regarding the gender roles and relations, access and control over resources and various influencing factors, still remained. Therefore, in order to identify the implications of NERICA on the livelihood of rice stakeholders, gender-specific dimensions had to be examined.

In reference to the roles and relations of women and men in upland rice farming, the data collected through participatory mapping exercises indicated progressive changes in the traditional methods of production, and the economic participation of both groups.
Participants attributed these changes to the socioeconomic challenges in the Gezira, which facilitated the introduction of non-traditional crops and necessitated the liberation of gendered cropping patterns and activities for both women and men in upland rice farming. As such, NERICA was also introduced as means to rectify gender disparities in production.

Participants identified the social and cultural dynamics of the Gezira as a major contributor to gender disparities and a significant barrier to equality in upland rice farming. Moreover, the Gezira was recognized as operating under traditional gender ideologies, which were structured around the patriarchal system (World Bank, 2010). As such, men were identified as having primary power and authority over all aspects of society (i.e. politics, religion, economy and socially) and within the family domain (i.e. absolute control over wife and children). This was also reflected in the many social privileges afforded to them, specifically in regards to their:

- Social recognition and influence within the community
- Active role in the Gezira Farmers Union
- Access and control over resources (credit, land, irrigation, machinery and vehicles)
- Business and marketing relationships with farmers, millers and traders
- Production relationships with the Ministry
- Exclusive access to training and extensive services

As a result, the social environment was recognized as working for men, which enabled them to assume central roles in agricultural production and marketing. Additionally, their authoritative role over the household afforded them primary decision-making power and
freedom to take risks and cultivate crops, which they considered profitable. As such, participants indicated that men were more likely to grow novelty crops, like NERICA and other high-value cash crops. Although, these crops were primarily attributed to men, female labourers were occasionally employed. However, “production technologies and “cost-cutting strategies” were substantially reducing their need in production. As such, their contributions to cash crops were often undervalued due to their minimized roles. Nevertheless, women were recognized as producing most of the subsistence crops (i.e. sorghum and wheat). However, as their crops were not sold and mainly used for household consumption, their contributions were still overlooked (World Bank, 2010). As such, participants indicated that women were largely considered to be complementary workers, and as a result were still expected to take on various jobs for livelihood support (i.e. livestock herding, handcrafting, cheese making) in order to help finance the production of “her husbands crops and other business ventures”. Additionally, gender expectations attributed all of the domestic responsibilities on women, who were described as the “chief providers for reproduction and maintenance”. These increased domestic pressures were recognized as placing substantial time and geographic constraints on the production roles of women and confining them to income generating opportunities (World Bank, 2010). As such, women were identified as having less social and economic freedoms, despite their large contributions. Moreover, they were also said to experience more social constraints due to their:

- Low social recognition and influence
- Minimal representation politically and economically
• Difficulties accessing land (usually sublet plots), irrigation, machinery, vehicles in their own name
• Preferential treatment in accessing credit but minimal bargaining power (no assets), usually resort to sheil system or self-finance
• Difficulties in managing and controlling the financial aspects of production
• Often require an intermediary (i.e. male relative) to market crops
• No effort to train women on production technology (emphasis on training men)
• Difficulties accessing extension services and Ministry support

In summary, participants attributed the low economic participation of women to social constraints and domestic pressures imposed by gender expectations. Thus, the traditional ideologies and expectations placed on women and men, were believed to dictate the types of crops they could produce, the agricultural and non-agricultural activities they engaged in, as well as the location, time and methods of production.

However, despite the inequalities in the traditional system, participants described the recent social and economic instabilities (i.e. income inefficiencies, food shortages and increases in female-headed households), as progressively changing the cultural and traditional ways of thinking. These changes were credited as facilitating the introduction of NERICA and enabling the economic participation of women in traditionally male dominated activities (CARD, 2012). This was observed through the training and participation of female extension officers during the second phase of land preparation (i.e. leveling), which is usually carried out by men. Also, women are rarely trained on how to effectively utilize new technology, so this was regarded as a progressive change. Additionally, more trust was placed in their abilities and as a result they were afforded
more control and responsibilities over various aspects of upland rice farming (i.e. seed preparation, planting and harvesting). Besides, men were rarely present during these activities, even though they were identified as crucial stages of rice production. Additionally, women were also engaging in substantially more off-farm activities (i.e. livestock production) during this time, as crop residues from NERICA (i.e. rice stalks) and groundnuts, provided them with supplementary feed for livestock. This was a significant improvement, as feed shortages and nutritional inadequacies were higher during this time due to minimal grazing areas. Also, as women are responsible for most off-farm activities (i.e. livestock production), this helped improve their financial situation.

That being said, they were still excluded from overseeing production, as women were considered to “lack the capacity and financial resources” to effectively manage and produce the crop. Moreover, the marketing aspects of NERICA were the primary responsibility of men, as women experienced more difficulties establishing business relationships with millers, traders and other farmers. Also, they were thought to have less negotiation power due to their subordinate status, which was also attributed to their higher risk of manipulation by traders (Elnager & Eltigani, 2011). Moreover, it was regarded as socially inappropriate for women to be engaging in these types of transactions without a male intermediate. As such, their low social status and influence was considered to be a barrier to upland rice expansion, so they mainly participated in labour and assistant type roles in upland rice farming. Nevertheless, they were still able to participate in several phases of upland rice production and bring in higher wages for private use, and to supplement their household budgets.
In contrast, men were recruited and encouraged to participate in all aspects of upland rice farming, as their success was thought to influence other farmers to cultivate NERICA. As a result, most support services were offered to them, as a means to effectively transfer the seed technology, and help them to obtain higher yields. Moreover, male farmers were able to dictate the quantity of rice they wanted to grow, as well as the price they would sell it for. As such, men were recognized as having “absolute control over NERICA” and were responsible for all of the management and financial aspects of the crop. As a result, not much changed with regards their roles and responsibilities, as they were still considered to have primary power and authority over production. However, they did transfer most of the on-farm responsibilities to female labourers during the planting and harvesting stages. Additionally, they tended to more financial responsibilities with NERICA, as the demand for labourers, irrigation and milling was substantially more than their other crops. This was considered a significant issue because men were experiencing difficulties in obtaining credit, as banks preferred to loan to women. However, NERICA was still considered more profitable than their other crops and brought in higher returns.

Therefore, the findings from the study showed that the traditional gender roles and relations in the Gezira still presided over various aspects of upland rice farming, as technological adoption and cultivation of NERICA was primarily targeted towards men. However, progressive changes were identified with the inclusion of women in traditionally male dominated areas of production. Moreover, the training services offered to women, afforded them more on-farm responsibilities and control over production. As such, participants regarded NERICA as a strategic crop, due to its potential to address
gender imbalances in power, economic participation and resource allocation among women and men. Additionally, the findings from the study highlighted the importance of gender mainstreaming, as both women and men were seen as contributors to production. However, their experiences with NERICA tended to vary due to the social and cultural expectations imposed on them. As such, understanding the gender dynamics in upland rice farming was crucial to identifying the impact of NERICA and addressing the disparities in production.

**Influence of NERICA cultivation on individual empowerment**

Empowerment is a difficult concept to define, due to the fact that its highly subjective and strongly influenced by the beliefs, values and experiences of individuals (Jupp & Ali, 2010). However for this study, it was recognized as a multidimensional process that helps individuals gain control over their lives (Jupp & Ali, 2010). That being said, the influence of NERICA on individual empowerment was still unknown. As such, it was important to measure how female and male rice stakeholders, perceived their experience as contributing to empowerment. This was accomplished by measuring positive and negative changes in categories that may facilitate empowerment (i.e. self-esteem/self-confidence, decision-making, access and control over resources, participation and skills development). Moreover, the data collected through focus group discussions indicated positive changes in the overall capacity of female and male participants involved in NERICA cultivation. Also, both groups had identified improvements in their self-esteem and self-confidence, which they attributed to their prominent roles and increased responsibilities with NERICA. That being said, the experiences of female and
male participants were also influenced by various socioeconomic factors, which were recognized as enabling or constraining empowerment.

In general, female participants described their experience with NERICA as positive, due to progressive changes in their level of self-confidence and participation. Additionally, changes in the socioeconomic environment (i.e. economic hardships and increases in female-headed households) and cultural attitudes (i.e. reluctance of young men to work in agriculture, redefining economic roles of women) were recognized as enabling women to participate in novel aspects of production. This was reflected in the inclusion of female participants in training workshops, which were said to have helped them strengthen their skills and acquire new knowledge on rice-based technology. As a result, female participants were also offered more on-farm responsibilities, outside of their traditional labour roles. This was recognized as contributing to their self-confidence. Additionally, their ability to effectively utilize technology, allowed them to support and collaborate with male farmers and colleagues. Moreover, their increased participation and responsibilities helped them secure higher-level positions in production (i.e. extension and administration). This was regarded as contributing to their self-esteem, as women were traditionally barred from holding higher-level positions, which were predominately reserved for men (World Bank, 2010). Also, the inclusion of women in extension and administrative roles was thought to contribute to collective empowerment, as it had the potential to attract female farmers to cultivate NERICA. So, participants were also viewed as role models for other women. This was regarded as major change in cultural attitudes and behaviours, as it was traditionally uncommon for women to assume such
prominent roles and interact with men in this capacity (i.e. attendance in mixed gender training sessions) (World Bank, 2010).

Nevertheless, participants also identified constraints in their level of participation due to persisting social barriers (i.e. subordinate status and exclusion from general meetings) and difficulties in accessing resources (i.e. equal pay). However, their overall experience with NERICA was still described as progressive, due to the economic and financial independence gained. This was also identified as a contributing to their decision-making power and overall self-reliance. As such, female participants viewed their experience with NERICA as helping them to advance in their careers and gain control of their lives.

Similarly, male participants (i.e. farmers and extension officers) also described positive changes in their personal lives through their involvement with NERICA, as they credited the crop with increasing their self-esteem, confidence and worth. This was largely attributed to their preferential treatment throughout production and the added opportunities afforded to them over their female colleagues. This was likely due to prevailing gender ideologies, which placed most of the social and economic responsibilities of the crop on male participants. Also, men were thought to possess the capabilities (i.e. leadership, technological skills, access to resources) needed to effectively produce NERICA. This was reflected in their priority recruitment and selection during project development. Additionally, they were also offered more social privileges through NERICA (i.e. complete control over production, access to inputs and training opportunities and higher incomes), as their success was thought to influence other farmers to participate in cultivating the crop. Moreover, these incentives were said
to have created an enabling environment for participants to develop their skills and familiarize themselves with the newly developed technology. As a result, male participants indicated positive changes in their self-confidence and ability to effectively utilized rice-based technology. This was also reflected in their added responsibilities and increased control over production. However, male participants did encounter difficulties in accessing resources (i.e. milling services and payment), due to inadequacies in management and commitment failures of main buyer. This was recognized as disempowering participants, who no longer strived to attain higher levels of productivity. However, the majority still regarded their experience as positive, due to their increased roles and responsibilities with NERICA, and the social recognition it garnered.

**Summary**

In summary, NERICA rice cultivation was identified as a novel initiative that was intended to reform the traditional gender dichotomy in upland rice farming, and contribute to empowerment for rice stakeholders in the Gezira. Moreover, its introduction was intended to provide income stability and food security for women and men through upland rice farming.

Nevertheless, the findings from the study indicated significant challenges with regards to the policies (i.e. 2005 Gezira Act, and NRDS) and practices being implemented in the Gezira. As failures to include women in consultation and policy development, limited their coverage and effectiveness. Moreover, laws to protect the rights of women and other marginalized groups were rarely upheld. This was recognized as furthering gender inequalities in resource attainment (i.e. education, healthcare, land, credit), which limited the economic participation of women in upland rice farming.
However, despite the political barriers and difficulties in accessing production assets, progressive changes in the traditional gender roles and responsibilities were observed, as more efforts were being made to train and include women in male-dominated areas of production. Moreover, the prominent participation and investment of men into rice (i.e. a subsistence crop) was considered to be a novelty. This was largely attributed to the rapidly changing environment (i.e. internal conflict, economic hardships and increased female-headed households) and shifting cultural attitudes and behaviours (i.e. educational opportunities for women and redefinition of economic roles).

Moreover, the increased roles and responsibilities of women and men were said to have contributed to their overall empowerment. Both rice stakeholders, indicated positive changes in their self-esteem and self-confidence due to their economic and financial independence with NERICA.
Chapter Six: Conclusion and Recommendations

Introduction

This chapter provides a summary and conclusion of the key research findings pertaining to NERICA cultivation and its contribution to gender empowerment for rice stakeholders. Moreover, the chapter concludes by offering recommendations for various stakeholders and discussing potential areas for future research.

Final Summary

As previously mentioned, crop diversity and novel technologies were introduced into the Gezira State, as a way to restructure the traditional farming system and promote economic participation and self-reliance among women and men. This was seen through the introduction of NERICA and rice-based technologies, which intended to address the gender dichotomy in rice farming and improve the lives of rice stakeholders. However, the nature of these efforts was largely unknown. As such, the goal of the research study was to explore the nature of crop diversity, specific to NERICA rice cultivation, and its contribution to gender empowerment for rice stakeholders in the Gezira. This was accomplished through a multi-method approach that highlighted various enabling and constraining factors within the policies, gender dynamics and capacities of women and men involved in upland rice farming.

In reference to the policies contributing to upland rice farming (i.e. NRDS and Gezira Act), the research findings identified substantial constraints in their development, implementation and effectiveness. Additionally, the shortfalls in the NRDS and Gezira Act were recognized as furthering the vulnerabilities of key stakeholders (women and small-scale male farmers) and contributing to their lack of support for governmental
reform efforts (i.e. upland rice production). This was largely due to biased cultural practices and value systems, which failed to recognize the roles of women and small-scale male farmers. Moreover, their difficulties in obtaining socially recognition were also reflected in their exclusion during policy formulation and implementation. As a result, women and small-scale farmers were unable to benefit from the articles pertaining to land and structural reforms, as they failed to acknowledge gender-specific challenges and power imbalances in upland rice farming. Conversely, government policies and practices were identified as furthering the dominance of wealthy male stakeholders, whose needs and priorities were filtered into the design and implementation of the NRDS and Gezira Act. As such, they were believed to have monopolized most of the production assets (i.e. land, irrigation, rice-based technology and services), which enabled their economic participation and success in upland rice farming. Thus, the current policies facilitating upland rice farming were widely recognized as furthering the gender inequalities and power imbalances among female and male rice stakeholders.

In reference to gender dynamics in upland rice farming, the findings indicated progressive changes with the inclusion of women in traditionally male-dominated aspects of production. This was largely attributed to the changing socioeconomic environment (i.e. income inefficiencies, food shortages and increased female-headed households), as traditional gender expectations and social inequalities often limited their economic roles to complementary-type work (i.e. wage labour). However, through NERICA women were given access to training services, which allowed them to effectively utilize the technology and participate in land preparation (i.e. leveling). Additionally, they were afforded more responsibilities over seed preparation, planting and harvesting, which also
provided them with higher wages. However, gender inequalities were still seen in various aspects of production, as women were excluded from managing and marketing NERICA, due to their perceived inabilities and limited bargaining power. In comparison, technological adoption and cultivation of NERICA was primarily targeted towards men, due to their perceived power and authority within society. This was reflected in their dominant roles throughout the production and marketing of NERICA. Moreover, in addition to the aforementioned political advantages, men were also afforded many social privileges, in order to enable their participation and success in upland rice farming. This was primarily due to their reputation and influence within the community. As such, their success was thought to encourage other farmers to participate in upland rice cultivation.

As a result, not much change was observed with regards to the traditional roles and responsibilities of women and men. However, NERICA was still recognized as strategic crop, due to its short-term impact and potential at addressing larger gender inequalities and power imbalances (i.e. economic participation and resource allocation) among women and men.

Moreover, the findings revealed positive changes in the capacities of female and male rice stakeholders, which were identified as contributing to their personal empowerment. In reference to the female rice stakeholders, they attributed their increased self-confidence and decision-making power to the changes in the socioeconomic environment (i.e. redefinition of economic roles), which facilitated their inclusion and participation in training workshops and on-farm activities. As a result, female rice stakeholders also described positive changes in their capacity to utilize rice-based technology and capitalize on the opportunities they were being afforded. This was
reflected in the growing number of women who were able to secure prominent positions (i.e. administrative and extension) in upland rice production. Moreover, this was recognized as a major shift in the traditional gender dynamics, as higher-level positions were typically reserved and held by men. Though, traditional gender ideologies still existed, as unfair practices were identified (i.e. exclusion of women from general meetings, unequal pay and office allocation). However, female rice stakeholders still regarded their involvement with NERICA as contributing to their empowerment, as they were able to advance in their careers and gain financial independence.

Conversely, the existence of traditional practices were recognized as contributing to empowerment for male rice stakeholders, as they were shown preferential treatment and afforded more opportunities through NERICA (i.e. control over production, access to inputs and training opportunities, higher incomes and invitation to key events). This was recognized as contributing to their increased self-worth and confidence in their skills and abilities. Nevertheless, significant constraints were identified in regards to their difficulties in accessing post-harvest machinery and obtaining payment. However, the majority of male rice stakeholders still considered their experience with NERICA as empowering, due to the success and social recognition attained from cultivating the crop. As such, it can be said that the female and male rice stakeholders considered their involvement with NERICA, as contributing to gender empowerment in the Gezira.

**Conclusion**

Two major conclusions can be made from this study:

1. Failures in policy development and implementation were said to have limited the capacity of women to access resources and participate in NERICA cultivation
The changing realities in the Gezira were said to have contributed to the institutionalization of gender sensitivity and equality in the INC, Gezira Act and NRDS. As such, both women and men are recognized as having equal social, political and economic rights (World Bank, 2010). However, the gender-gap in political participation was said to have contributed to absence of women during policy development (Elnager & Eltigani, 2011). As a result, most recommendations were made on their behalf, which was said to have negatively impacted the promotion and protection of their rights. Additionally, legal policies and Islamic principles were commonly overruled by traditional practices and patriarchal norms in the Gezira. This was recognized as significantly impacting the land rights of women, as traditional practices restricted them from inheriting, owning and managing property in their name. As a result, only 13% of women in the Gezira were identified as having access to land, despite the lack of legal barriers (World Bank, 2010). Moreover, as access and control of land is thought to contribute poverty reduction, self-sufficiency and entrepreneurship, JICA only recruited and selected farmers with proprietary rights (i.e. male farmers). As such, the difficulties faced by female farmers in accessing land automatically excluded them from project consideration, which was recognized as furthering their social and economic vulnerabilities. Therefore, in order to promote gender empowerment and facilitate the adoption of NERICA by female and male farmers, women need to be involved in the development and enforcement of laws that protect their land rights.

2. Shortfalls in governmental and organizational capacity
One of the major constraints to empowerment for male stakeholders was their inability to access resources and services (i.e. technical and financial support). This was largely due to the lack of commitment by the main buyer (i.e. Ministry of Agriculture) and inefficiencies in technical and financial support by JICA. These failures were recognized as furthering the production costs and vulnerabilities of farmers, who now lacked the capacity to produce and market NERICA. As a result, farmers described feeling marginalized and used through their involvement, and communicated their lack of trust and support for both JICA and the Ministry. Additionally, failures to address these insufficiencies resulted in several farmers leaving the project and returning to their traditional rotations. This was recognized as a significant barrier to collective empowerment, as the perceived successes of farmers was thought to influence other “follower-type” farmers to invest and participate in upland rice farming. As such, JICA’s top-down approach to upland rice expansion was said to be ineffective due to the continuous reliance on the Ministry and JICA for provisions and services. Therefore, in order to promote self-reliance and empowerment, better-institutionalized support for capacity building (i.e. cooperatives) need to be established.

**Recommendations and Future Research**

Based on the findings of the study, recommendations for future research can be made and directed towards JICA and participants involved in upland rice production. These include:

1. Recognizing and developing the capacity within the central government (i.e. Ministry of Agriculture), in order to support both female and male farmers in
participating in upland rice cultivation. This could aid in addressing the gender disparities in accessing land by implementing laws and practices that protect the rights of women and men in the Gezira.

2. Allocate more time and effort towards understanding the needs and capacities of local women and men in the Gezira. This could help in promoting NERICA and allowing stakeholders to define and participate in their own development, which could be empowering.

3. Female and male stakeholders should be encouraged to organize themselves into cooperatives. This could as act as a support mechanism for stakeholders, as they could save and borrow amongst themselves, which can help promote self-sufficiency and reliance. This might also assist them in renting the necessary machinery to mill NERICA, in order to sell it. Moreover, their organization into cooperatives would allow farmers to learn from each other, which could help them deal in dealing with on-farm issues and increasing their productivity. Also, their collaborate learning and saving could potentially attract youth and other members in the community to participate in upland rice farming. As such, their involvement in cooperatives could potentially lead to personal and collective empowerment.

4. Female and male rice stakeholders should be encouraged to seek out investment (i.e. local agribusinesses) and marketing opportunities (Refer to Appendix 8 for potential value chain) that are independent of JICA and the Ministry. This could help promote entrepreneurship, self-sufficiency and personal empowerment.
Moreover, as the project is on going, these recommendations will be shared with JICA as they continue to work with both female and male rice stakeholders in the Gezira.

In summary, the research study aimed to provide insight into the nature of crop diversity and its contribution to gender empowerment, through a case study on NERICA cultivation in the Gezira State. Moreover, as NERICA was initially introduced into the Gezira, a purposive sample was drawn from JICA staff, participants and educational institutions affiliated with the Gezira branch. This was meant to provide a descriptive exploration into the contribution of NERICA on a small sample of female and male rice stakeholders, who had been involved with the project since its implementation. Moreover, as empowerment is highly subjective, the findings of the study were not meant to generalized. However, as NERICA is now being cultivated in 5 other states, expanding the sample population may provide more insight into its contribution among female rice stakeholders, who were under represented in this study. Additionally, as most research outlines the ineffectiveness of measuring empowerment purely from an outsider perspective, future efforts can focus on collaboratively defining the term and establishing indicators based on the perspectives of key stakeholders. This may enable the researcher to compare the level of empowerment among female and male rice stakeholders in different states.
References


http://understandingsudan.org


JICA. (2014). *Capacity Building Project for the Implementation of the Executive*
Programme for the Agricultural Revival. Retrieved from
http://www.jica.go.jp/project/english/sudan/001/materials/c8h0vm0007vrgs5-att/interview_01.pdf


Retrieved May 16, 2014, from


Khartoum: Council of Ministers General Secretariat.


consultation.nri.org/summaries/wp5.pdf


Appendices

Appendix 1- Glossary

- **Empowerment**: multi-dimensional social process that helps people gain control over their own lives
- **Feminism**: complex set of political ideologies used by the women’s movement to advance the cause of women’s equality and to end the sexist theory and practice of social oppression
- **Crude oil**: liquid mixture of hydrocarbons and organic compounds that is commonly found in underground areas called reservoirs
- **Novelty crops**: crops that are not traditional grown in Sudan
- **Hawasha**: Standard tenancy (plot of land)
- **Feddan**: unit of area used in Sudan
- **Tenant farming**: agricultural system in which landowners contribute their land and a measure of operating capital and management while tenants contribute labour with various amounts of capital and management, the returns being shared
- **Land tenure**: legal or customary relationship defining land utilization and allocation among people, individuals or groups
- **Usufruct rights**: the rights of an individual to use and enjoy the property of another, as long as the property is not damaged or destroyed
- **Sharia Law**: moral code and religious law of a prophetic religion, covers topics related to crime, politics, economics, as well as personal matters
- **Mosque**: religious place of worship
- **Gender blindness**: inability to perceive different gender roles and responsibilities
Appendix 2- Questions from Key Informant Interviews

Interview questions:
Crop diversity and rice production
1. Cotton, sorghum, groundnuts and wheat have been the predominant crops in the Gezira State for the last few decades. However, over the past few years there has been a shift away from the traditional cropping system, to crops that are more diverse, such as NERICA4 upland rice. Why do you think this is?
2. Do you think that rice crops are more economically feasible in the Gezira state, than traditional crops? Please explain.
3. In your opinion, can NERICA rice production meet the current needs (i.e. income stability and food security) of both female and male farmers in Gezira State as well as the larger population? Please explain.
4. What are the main barriers and opportunities of rice production for farmers (both men and women) in this region?
   a. Has rice production, led to a change in the level of participation of either gender in various activities?
5. In reference to rice production, do you think that farmers (both men and women) have equal access to land, credit, and extension services? Please explain.

Land Tenure
1. What type of land tenure system exists for state, private and communally owned land in Sudan?
2. In your opinion, what impact has the current land tenure system had on rice production in the Gezira state?
   a. Are men and women impacted differently?
3. What are the current barriers to either men or women acquiring land rights in the Gezira state?
   a. Do you think this has contributed the level of participation of either gender in rice production? Please explain.
4. In your opinion, has legislation, such as the 2005 Gezira Act, and current economic and agricultural policies contributed to crop diversity (i.e. rice production)? Please explain.
5. In your opinion, what can government and non-government organizations do to assist farmers in producing rice?
Appendix 3- Key Informant Statements

Socioeconomic Environment

In reference to the socioeconomic environment, key informants 1 through 10 emphasized that the lack of investment and proper management practices, as posing a significant constraint to NERICA cultivation.

“There aren’t many agricultural projects and initiatives in Sudan because of the lack of investment, which is definitely preventing non-traditional crops, like NERICA from succeeding. I mean the capital will be there initially, but then the political agenda will shift, and the government will lose interest. Also, people don’t want to participate in these types of projects because they rarely make it out of the demonstration stage due to these issues, so the benefits are never seen”. (KI.9)

“In my opinion, it’s immoral they way they’ve been managing and operating it (the Scheme). It doesn’t require much input or resources, and everything is available in Sudan from the labourers, to farmers, to the land and water […] Agricultural development could happen so easily, if it were properly managed by anyone other than the Government”. (KI. 8)

Although, the majority of statements reported were constraining, participants had also mentioned opportunistic factors in reference to the availability of natural resources and experienced farmers and labourers.

“In the Northern states, farmers are producing high yielding novelty crops, like soybeans, sunflower and maize. And although the land isn’t as arable in these regions, production of alternative crops has started and has the potential expand throughout Sudan. Just to put this into perspective, one time I accidentally dropped a few seeds on the ground around my around, and when I came back a few weeks later I found them fully grown, without any input at all. So the potential is there, I truly believe that almost any crop can be grown in Sudan. It’s just a matter of getting access to resources and investment from the government and private sector, because the farmers are more than capable of producing alternative crops, like NERICA”. (KI.8)

“Agriculture is such a vital part of our economy, especially compared to the rest of the world. We have so many natural resources that could be effectively utilized, with the irrigation being the most obvious. For example, in Saudi Arabia, they have cast amounts of land, which the government desperately wants to utilize for agricultural production, however their limited in terms of irrigation, soil and arable land, which is all readily available in Sudan”. (KI.6)
“The Gezira has the greatest potential compared to all other states because of the history of the Scheme, and the existing infrastructure (i.e. irrigation channels, canals, and flat lands). Also, the region has a large number of experienced farmers and labourers, who have been in and around the Scheme for years” (KI. 6)

**Demand**

In reference to the demand, 7 out of the 10 key informants reiterated the many opportunities of NERICA due to its high demand.

“People’s interest in rice has expanded and you see this with its growing presence in the market, and local stores. Although, its still not considered a staple crop, like it is in West Africa and Japan, but the potential is there. So there’s definitely a market for NERICA and I think that in about 6 to 10 years, NERICA will be able to satisfy domestic demand, and could eventually start to be exported to neighbouring countries like Ethiopia and Eritrea”. (KI. 2)

That being said, not many constraining statements were made, as most key informants viewed the high demand as an opportunity for expansion. However, 3 out of 10 key informants did mention the potential risks associated with the crop, despite its high demand.

“Most farmers consider novelty crops, like NERICA, to be too high of a risk because of its unknown impact soil fertility and its increasing demand on water. Also, with the current economic environment and subpar functioning of the Scheme, most farmers can’t afford the production loss” (KI.9)
Appendix 4- Questions from Participatory Exercises

Seasonal Calendar
During construction of seasonal calendar:
1. How does rainfall vary over the year in this region?
2. What are the busiest months of the year for rice production?
3. How does water availability for drinking vary over the year?
4. How does livestock forage availability vary over the year?
5. At what time of the year is food most scarce?
6. In reference to rice production, when (i.e. what season) is most of the farm work carried out by:
   a. By men
   b. By women
7. In reference to rice production, when (i.e. what season) is most of the off-farm work carried out by:
   a. By men
   b. By women
8. How does income from rice production vary over the year:
   a. For men
   b. For women
9. How does expenditure on rice farming vary over the year:
   a. For men
   b. For women
10. How does credit availability for rice production vary over the year:
    a. For men
    b. For women
11. When are the holidays/special times throughout the year?
    a. And how many days do you typically have off a month?
    b. When would be the most appropriate season for additional activities for men and women?
12. What time or resource constraints do you think exist in rice farming?

After construction of seasonal calendar:
• What patterns do you see (e.g. labour demand and wage.)?
• Are there differences between rice crops and other major crops in terms specific work demand (i.e. land preparation, sowing, weeding, fertilization, harvesting)? If so, do these differ among men and women? Please explain.

Transect Walk
Questions will be focused on land use, soil types, resources, problems and interventions.
During walk:
1. What is this area predominantly used for?
   a. Which areas are designated for rice crops?
   b. Which areas are designated for other major crops (i.e. cotton, sorghum, millet, wheat)?
c. What are the major activities carried out in each area? Do they differ between men and women?

2. What are the soil types in this area?
   a. Do these soil types provide an advantage or disadvantage when it comes to rice production or production of other major crops?

3. In relation to rice production, what resources are abundant or scarce in this area? Who uses them and for what purpose?
   a. Do resources vary throughout the area? If so, please describe how?
   b. Do men and women have equal access to resources in this area?
   c. Which resources are there the most problems with?
   d. Where do people collect water?
   e. What types of livestock, if any, are raised in this area?

4. What constraints or problems exist with rice production in this area?
   a. Do they differ between men and women?
   b. Have there been any previous intervention strategies to address these issues?

5. In relation to rice production, what possibilities or opportunities exist in this area (i.e. services, infrastructure and economic opportunities)?
   a. What changes have been made in this area over the last few years?

Following walk and transect diagram construction:

1. Based on your observations, what patterns of differences exist between land usage, resource availability and soil types? Why do you think these patterns or differences exist?

2. What are the most common problems in relation to rice production?

3. How do opportunities for rice production differ among the various areas? Do men and women have equal access to these opportunities?
Appendix 5- Seasonal Calendar and Post Activity Worksheet

Image: Seasonal calendar constructed by participants in the Gezira (Photo by Meysoon Amin)

Seasonal Calendar Document Sheet: Post Activity

<table>
<thead>
<tr>
<th>Method Used</th>
<th>Seasonal Calendar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilitator</td>
<td>Student Researcher</td>
</tr>
<tr>
<td>Location</td>
<td>Hudayba Site</td>
</tr>
<tr>
<td>Participants</td>
<td>10 (8 men, 2 women)</td>
</tr>
<tr>
<td>Time and Duration</td>
<td>10 am, 1.5 hours</td>
</tr>
<tr>
<td>Advantages</td>
<td>Safe environment for both men and women to share their thoughts and experiences with NERICA, as well as highlight the potential problems and areas for development</td>
</tr>
<tr>
<td></td>
<td>Able to identify seasonal variations associated with rice farming and discuss how they contribute to their livelihoods (vulnerability, risk and access to resources)</td>
</tr>
<tr>
<td></td>
<td>Able to discuss coping strategies and ways to minimize risk during times of income variability and high risk</td>
</tr>
<tr>
<td>Disadvantages</td>
<td>Questions needed to be direct at first in order to help facilitate activity and discussion</td>
</tr>
<tr>
<td></td>
<td>Participants had a hard time remembering precise details</td>
</tr>
<tr>
<td></td>
<td>Difficulty in ensuring that all participants views and opinions were heard and given equal value</td>
</tr>
<tr>
<td>Additional</td>
<td>Minimal female participation (1:4 ratio), however female participants were generally more vocal</td>
</tr>
<tr>
<td>Information</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 6- Images from Transect Walk and Diagram & Worksheet

Image: Zone 1- Road/Roadside pond (Photos by Meysoon Amin)

Image: Zone 2- School (Photos by Meysoon Amin)
Image: Zone 3: Crops (Photos by Meysoon Amin)

Image: Zone 4: Village (Photos by Meysoon Amin)
Zone 5: Road (Photos by Meysoon Amin)

Zone 5: Mosque (Photos by Meysoon Amin)
<table>
<thead>
<tr>
<th>Transect Walk Document Sheet: Post Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Method Used</strong></td>
</tr>
<tr>
<td><strong>Facilitator</strong></td>
</tr>
<tr>
<td><strong>Location</strong></td>
</tr>
<tr>
<td><strong>Participants</strong></td>
</tr>
<tr>
<td><strong>Time and Duration</strong></td>
</tr>
<tr>
<td><strong>Advantages</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Disadvantages</strong></td>
</tr>
<tr>
<td><strong>Time consuming</strong></td>
</tr>
<tr>
<td><strong>Additional Information</strong></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Appendix 7- Total Production Costs of NERICA and other Major Crops (2013)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Cost (SDG/Feddan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop</td>
<td>NERICA</td>
</tr>
<tr>
<td>Land &amp; Water Charges</td>
<td>35,500</td>
</tr>
<tr>
<td>Labour Cost (w/ land prep)</td>
<td>123,680</td>
</tr>
<tr>
<td>Inputs (seeds, fertilizers/herb, packaging)</td>
<td>N/A</td>
</tr>
<tr>
<td>Transportation &amp; Services</td>
<td>31,200</td>
</tr>
<tr>
<td>Administrative Charge</td>
<td>18,000</td>
</tr>
<tr>
<td>Total Production Cost:</td>
<td><strong>208,380</strong></td>
</tr>
</tbody>
</table>

*Total costs based on 2014 JICA Terminal Report & Gezira Board Socioeconomic Unit
**1 SDG= 5 CAD in 2015

Note:
- Costs for material inputs (i.e. seeds), in addition most administrative services (i.e. workshops, training sessions, building fees and promotional days) are covered by JICA and the State Ministry of Agriculture and Forestry.
- Farmers were given a total allowance of 10,000SDG prior to land preparation, from JICA and the Ministry.
- The Ministry purchases the un-milled bagged rice from the farmers at 4SDG/Kg:
  - Paid 112,000 SDG in 2012 and 37,150 SDG in 2011
  - Were not paid in 2013
- Wholesale price NERICA (milled and bagged): 6SDG/kg
Appendix 8- Potential Value Chain for NERICA in Sudan

Note: primary level (purple), secondary level (red) and tertiary level (blue)