SOCIO-ECONOMIC FACTORS AFFECTING THE ADOPTION OF SUSTAINABLE FARMING PRACTICES IN NORTHERN UGANDA: A CASE OF NWOYA DISTRICT

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December, 2014

DECLARATION

I, Anthony Agaba, hereby declare that this dissertation is my own work and has never been presented to this or any other institution of higher learning for any academic award.

Signatureé é é é é é é é é é é é é é ..Dateé é é é é é é é é é

APPROVAL

This dissertation has been submitted for external examination with our approval as supervisors

Signed é é é é é é é é é é Dateé é é é é é é é é

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DEDICATION

I dedicate this research work to my wife who supported me throughout the whole process. I will always be grateful to what she has done.

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LIST OF ACRONYMS

CSA		Community Supported Agriculture
CVI		Content Validity Index
DOI		Diffusion of Innovations
FGD		Focus Group Discussion
GOU	:	Government of Uganda
GOU		Government of Uganda
MAAIF		Ministry of Agriculture, Animal Industry and Fisheries
MFPED		Ministry of Finance, Planning and Economic Development
NAADS	:	National Agricultural Advisory Services
NAP		National Agricultural Policy
NARO		National Agricultural Research Organization
NUSAF	:	Northern Uganda Social Action Fund
PEU		Perceived Ease of Usefulness
PMA		Plan for Modernization of Agriculture
PU		Perceived Usefulness
RuTAM		Rural Technology Acceptance Model
SNV	:	Netherlands Development Organization
SPSS	:	Statistical Package for Social Sciences
TAM		Technology Acceptance Model
UBoS		Uganda Bureau of Statistics
USA		United Stated of America

ABSTRACT

Sustainable farming practices are widely recommended by technocrats in extension and agriculture as key for enabling the improvement in the welfare of farmers. The adoption of sustainable farming practices is becoming increasingly important due to worsening land degradation caused by conventional agricultural practice in Nwoya District. The growing population has always struggled to produce more in order to satisfy the increased demand for foods induce land degradation. The government together with the non-state actors such as NUSAF and SNV Netherlands have for the last decade promoted sustainable farming in northern Uganda. This study examined the relationship between socio-economic factors (farmer characteristics, economic factors and social interaction) and adoption of sustainable farming practices. The farmer characteristics sub variables included risk aversion, education and training, age of the farmer, membership in a farmersô group, land ownership and perceived complexity. Economic factors included cost of inputs/technology, farm size, perceived advantages, availability and access to credit while social interaction included social networks, interaction with change agents and access to information about sustainable farming practices. A crossectional correlational survey and case study designs were used in the study. Quantitative and Qualitative methods were used for data collection and analysis.

The study found out a positive significant influence of farmer characteristics on adoption of sustainable farming practices($r=0.543, p=0.03<0.05$) with predicted variation of 41.2% in adoption of sustainable farming practices. Economic factors such as perceived advantages and accessibility to credit had a positive significant influence on adoption of sustainable farming practices ($r=0.611, p=0.01<0.05$) with a predicted variation of 38.3% while social interaction with a positive significant influence on adoption of sustainable farming practices ($r=0.521$, $p=0.01<0.05$) predicted a 27.7% variation in adoption of sustainable farming practices in the district. The most influential of the three investigated factors were economic factors, farmer characteristics and social interaction in that pecking order.

The study therefore makes key recommendations for the key architects behind the promotion of the adoption of sustainable farming practices to improve on the aspects of farmer characteristics, economic factors, social interaction and also identified gaps for further research.

CHAPTER ONE

INTRODUCTION

1.0. Introduction

The study examined the socio-economic factors affecting adoption of sustainable farming practice in Northern Uganda, a case study of Nwoya district. Sustainable farming involves the production of food, fiber, or other plant or animal products using farming techniques that protect the environment, public health, human communities, and animal welfare. Adopting sustainable farming practices is advantageous to farmers including those in Uganda because such farming practices are environmental friendly and are associated with high yields, high incomes and decreased poverty levels (Odoemenen & Obinne, 2010). To this effect, the government of Uganda through the National Agricultural Research Organization (NARO) and NAADS has been promoting and encouraging farmers to adopt sustainable farming practices such as organic farming, minimum tillage practices, crop rotation, agroforestry, cover cropping and use of organic pesticides since the year 2000(GOU,2010).

This chapter presents background information to the study. This is followed by statement of the problem, purpose, research objectives, questions, scope, significance of the study, conceptual framework and operational definition of terms and concepts.

1.1 Background to the Study

This section presents the background information about the socio-economic factors affecting the adoption of sustainable farming practices. The information was presented under historical, theoretical, conceptual and contextual perspectives.

1.1.1 Historical Background

Agriculture affects the environment, human health, and even social order. Thus, the attainment of a more sustainable agriculture has become a focus of many stakeholders and policy makers in the agricultural sector of many countries with agrarian economies (Horrigan *et al*. 2002 cited in Baide, 2005). Present food systems are dominated by conventional (also known as ôindustrialö) methods of production. This system was developed less than 50 or 60 years ago and has led to several environmental, human health and economic problems around the world. The goals of conventional agriculture focus on increased yields and decreased costs of production and are based on the excessive use of nonrenewable resources, encouraging specialization and economies of scale (Norman *et al*., 1997). These goals are achieved through the use of expensive off farm inputs, excessive use of non-renewable fossil fuels, thus causing environmental degradation and promoting economically inefficient production systems (Horrigan *et al*. 2002 cited in Baide, 2005). Policy makers and agricultural specialists have for the last three decades campaigned for the adoption of sustainable farming practices as an antidote to the above deficiencies of conventional agriculture more so in developing countries (Horrigan *et al*, 2002 cited in Baide, 2005).

Sustainable agriculture helps farmers survive in such a system because it works with nature (Norman *et al*., 1997). Sustainable agriculture reduces the cost of purchased inputs by utilizing farming techniques that incorporate biological cycles and the farmersô knowledge and skills (Norman *et al*., 1997; Pretty & Hine, 2001). It also helps small scale farmers to continue operating through diversification and increased profits from alternative ways of marketing, such as niche markets, value added products, or direct marketing strategies (such as farmer markets

and Community-Supported Agriculture (CSA) (Fazio et al., 2003; Local Harvest, 2005; Horrigan et al., 2002 cited in Baide, 2005).

In the past three decades, a number of studies have been done on sustainable farming and adoption of its practices. For example, Baide (2005), carried out a study on the barriers to adoption of sustainable agriculture practices in the South of United States of America (USA). Findings indicated that conventional agriculture systems of production lead to environmental degradation, economic problems, and even social problems. This qualitative study was based on a semi structured survey instrument designed to establish the barriers to adoption of sustainable agriculture practices. It was found that despite having support from change agents, farmers were rarely adopting sustainable practices.

Rajanna, Vijayalaxmi, Lakshminaryan and Chandregowda (2009), carried out a research to find out the attitude of paddy farmers towards sustainable farming practices in Mandya district of Karnataka State during 2006-07. One hundred paddy farmers were interviewed using a pre-tested schedule. The results revealed that a majority of paddy farmers (51%) possessed favorable attitude towards sustainable farming practices. Education, knowledge about sustainable farming practices, mass media use, participation in training programmes, extension agency contact and extension participation had significant relationship with the attitude level.

Furthermore, Radwan, Gil, Diab, and Abo-Nahoul (2007), studied the determinants of the adoption of organic agriculture (a type of sustainable farming practices) in Egypt using a duration analysis technique. A survey with a representative sample of organic and non-organic

farms in Upper Egypt area was carried out. Using data obtained, they applied duration analysis techniques to assess the effect of different explanatory variables on both the adoption of organic agriculture farming and the timing of this adoption. Their results suggested that the maximum hazard of adopting organic agriculture took place during the first few years after the construction of the farm and managerial characteristics such as his education level and risk behavior together with the farm size seemed to be the most significant factors affecting the likelihood of organic agriculture adoption in Egypt.

Chomba (2004), studied the factors affecting small holder farmersô adoption of soil and water conservation practices in Zambia. This study attempted to measure the factors that could be associated with the adoption of conservation farming practices considering that farmers had multiple practices to choose from and might adopt a given technology package in pieces. Findings revealed that economic factors, education level of the farmers and favorable policy changes by the government were key factors influencing the adoption of soil and water conservation practices.

From the foregoing historical background on adoption of sustainable farming practices, support from change agents, education, knowledge about sustainable farming practices, use of mass media, participation in training programmes, contact with extension agents risk behavior of the farmers and farm size were key factors that affected the adoption of sustainable farming practices in other ecological environments outside Nwoya district. However, none of the above studies on adoption of sustainable farming practices had been done in Uganda. Hence this study.

1.1.2. Theoretical background

This study invokes the Diffusion of Innovations model (DOI), Technology Acceptance Model (TAM) and Rural Technology Acceptance Model (RuTAM). Diffusions of innovations model is one of the most useful theoretical frameworks for explaining adoption of new technologies and evolved from investigations concerning agricultural innovations (Wejnert, 2002; Kincaid, 2004). It was created in the United States by the rural sociologist, Everett Rogers, in the 1940s. Rogers defined diffusion as ñthe process by which an innovation is communicated through certain channels over time among the members of a particular social system; this process includes both planned and spontaneous spread of new ideasò (Haider & Kreps, 2004:3).

According to this theory, individuals pass through five stages on their way to adopting a new practice or behaviour (Rogers, 2003; Gregor & Jones, 1999). These stages include; 1) knowledge stage whereby a person becomes aware of an innovation and has some idea of how it functions; 2) persuasion stage is when a person forms a favorable or unfavorable attitude toward the innovation after they know about the innovation, decision whereby a person engages in activities that lead to a choice to adopt or reject the innovation; 3) the implementation stage is where the person puts an innovation into use, and; 4) confirmation in which a person evaluates the results of an innovation-decision already made and the individual looks for their decision.

Technology Acceptance Model (TAM) was developed by Davis in 1989. It examined perceived usefulness and perceived ease of use as predictors for software application use. It has been used extensively and expanded for the past decade. Moore and Benbasat (1991) enhanced the model to include three other characteristics of technology defined by Rogers (1995) as important

indicators of innovation acceptance. These are; compatibility, demons ratability, and treatability, as well as relative advantage and complexity. TAM offers guidance for understanding individual characteristics, social influence, perceived ease of use and perceived usefulness explaining the intention, adoption, and acceptance of new technologies.

Rural Technology Acceptance Model (RuTAM) was developed by Sirajul (2011). According to Sirajul, there is no such model that explicitly explains the technology acceptance factors related to farmers of poor regions. The model provides a blend that captures the variables that affect the adoption decisions of farmers in poor regions.

In this study of socio-economic factors affecting the adoption of sustainable farming practices in Nwoya, RuTAM was adopted because of its superiority in capturing the socio-economic constructs investigated by this study.

1.1.3. Conceptual Background

Sustainable farming practice was the dependent variable in this study. Sustainable farming is ñconcerned with the ability of agricultural systems to remain productive in the long runò (Herdt & Steiner, 1995). Sustainable farming practices emphasize the efficient use of on-farm resources, non-renewable resources, and the integration of biological cycles (Norman ,1997; Ikerd *et al*. 1997; SWCS, 1995). The economic component of agricultural sustainability seeks to promote the economic viability of the farm (Agunga 1995; Norman 1997; Ikerd *et al*. 1997; SARE 2003). Sustainable agriculture must be profitable in order to allow farmers to keep control over the use of the land. However, economic viability must be achieved at the same time as environmental and social sustainability (Ikerd *et al.* 1997). The preservation or enhancement of quality life for

farmers and society as a whole through supplying human food and fiber needs are the primary social goals of sustainable agriculture (Ikerd *et al*. 1997; Norman *et al*., 1997; SWCS, 1995). Sustainable farming practices were conceptualized in this study to mean uptake of crop rotation practices, use of cover cropping and adoption of minimum tillage practices for soil conservation.

The independent variables in this study were socio-economic factors. Socio-economic factors were conceptualized to mean farmer characteristics, economic power of the household and social systems. According to Thesaurus Dictionary Volume IX (2001), factors refer to things that contribute causally to a result. The Oxford Advanced Dictionary defines factors as attributes that actively contribute to an accomplishment, result, or process or as elements that contributes to a result. Characteristics are attributes that enable description and distinctions to be made between two or more elements. In this study, farmer characteristics referred to the differences amongst the farmers that were most likely to make some farmers to adopt sustainable farming practices than others. They include age, level of education, risk aversion, land ownership, membership in a farmersô group and perceived complexity. Economic factors are monetary considerations. In this study, monetary factors referred to the cost effectiveness, access to credit, perceived advantages and farm size that influence a farmerôs decision to adopt sustainable farming practices and vice versa. Social interactions are conceptualized to mean the social networks among farmers, interaction with change agents and access to information regarding sustainable farming.

The above conceptualized socio-economic factors were thought to be hypothetically related to adoption of sustainable farming practices because once they are favorable, they increase on the propensity of farmers trying out the new innovations, increase on the preparedness with which farmers are as regards to making a decision on taking up new enterprises and enable the farmers

to develop curiosity for even trying out new technologies at a future date.

1.1.4 Contextual Background

Despite the importance of agricultural sector to Uganda, its performance in terms of productivity, particularly the crop sub-sector where sustainable practice ought to be used, has been generally poor (Ministry of Finance, Planning and Economic Development [MFPED], 2009; Peterman, Quisumbing, Behrman & Nkonya, 2010; World Bank, 2006). This is largely attributed to the fact that the sector is mainly subsistence-oriented, with low levels of use of modern sustainable farming practices (Peterman *et al*, 2010; Office of the Prime Minster [OPM], 2009). As a result, the widespread poverty witnessed particularly in rural areas of Uganda has been attributed to among others, the poor performance of the agricultural sector (MFPED, 2009). Looking at agricultural extension and education as a nexus to improving livelihoods of farmers, the government has also promoted the training of specialists at university level by making agricultural extension and education an independent course. In addition, Land use Management, Agroforestry and Agribusiness Management have all been made independent Courses in the Faculties/Schools of Agriculture in public universities.

The Uganda Government believes that if the country is to reduce poverty among the citizens, then there is need to modernize the agricultural sector (Government of Uganda [GOU], 2010; Chemonics, 2008). In an effort to modernize the agricultural sector and reduce poverty levels, the government of Uganda launched the Plan for the Modernization of Agriculture (PMA) in the year 2000 (GOU, 2000). The mission of the PMA was to eradicate poverty by transforming subsistence agriculture to commercial agriculture. It was hoped that the implementation of the

PMA would, among others, result in increased incomes and improved quality of life of the poor subsistence farmers through increased productivity and increased share of marketed output (GOU, 2000). The success of government efforts to modernize agriculture and improve its productivity depends on among others the adoption of sustainable farming practice by a significant proportion of the farmers as the ensure continuity of farming operations for the socio-economic transformation of the livelihoods of the farmers (GOU, 2010).

Non-state actors have too, promoted the adoption of sustainable farming practice in Northern Uganda, Nwoya District in particular. Key to this development has been NUSAF, CARE and SNV Netherlands that have among others trained farmers into organic farming, organic manure processing, use of organic pesticides as well as mobilization of farmers to adopt agro forestry practices and soil and water conservation practices. These organizations provide extension services, training and provide some financial support to the farmers.

Hans *et al*. (2005) contend that in tropical agro-ecosystems including those of Northern Uganda have not yet adopted sustainable farming practice. The traditional farming systems that farmers have previously employed to sustain their productivity cannot any longer effectively work due to population pressure. With the increasing population and decreasing agricultural productivity per environmental unit, more land is being brought under cultivation subsequently more land is being deforested and degraded (Nakyagaba, Ssekabembe & Osiru, 2005). The traditional co-evolutionary process under which societies and ecosystems used to have sufficient time and space to adjust mutually through complex feedback mechanisms (Norgaard, 1984) no longer exists with the increasing world population.

Nwoya District is one of the most fertile areas in Northern Uganda where extensive cultivation of food crops takes place. It has the most extensive biodiversity (Flora and Fauna) and viable ecosystem. All these offer diverse biodiversity that can be depleted if the local population is left to continue with their present unsustainable methods of agriculture and livestock grazing (Kok & Jager, 2009). The farming practice of the communities in this complex and fragile ecosystem is purely dependent on annual food and cash crop production system and rain fed agriculture. Conventional farming systems are noticeable in the district yet they are environmentally destructive (Naikesa, 2013).

MAAIF (2012,pp 3, 10 and 21) reflected the continued efforts of the Ministry in promoting the adoption of sustainable farming practices through agricultural research, increased access to information by farmers, decentralized extension services and formulation of the National Agricultural Policy[NAP] for ensuring sustainable management and use of agricultural resources. Despite the efforts by MAAIF through NAADS and by other stakeholders such as SNV and NUSAF to promote sustainable farming practice such as rigorous farmer training, partial support to the enterprises of the farmers and dissemination of information on sustainable farming practices, a handful of farmers consistently practice sustainable farming (NAADS, 2008). This presupposes low levels of adoption of sustainable farming practice. This is in consonance with previous efforts by the government of Uganda to modernize agriculture by increasing on the adoption of agricultural technologies have failed as documented by studies (Katungi, 2007; NAADS, 2004; MAAIF & MFPED, 2000) that the rates of adoption have continued to be low. The foregoing situation where there was low adoption despite potential financial returns, availability of social systems and farming community made it necessary to

further understand the socio-economic factors connected to the limited adoption of sustainable farming practices in Nwoya District.

1.2. Statement of the Problem

Adopting sustainable farming practice is advantageous to farmers including those in Uganda because such farming practices are environmental friendly and are associated with high yields, high incomes and decreased poverty levels (Odoemenen & Obinne, 2010). The government of Uganda through the National Agricultural Research Organization (NARO) and NAADS has been promoting and encouraging farmers to adopt sustainable farming practice such as organic farming, minimum tillage practices, crop rotation, agroforestry, cover cropping and use of organic pesticides since the year 2000(GOU,2010). The efforts to promote the adoption of sustainable farming practices include; training of farmers, decentralization of extension services, increasing access of farmers to information and technology as well as emphasis on sustainable land management (MAAIF, 2012). In spite of these efforts by the government to promote adoption of sustainable farming practices among farmers, the adoption rate of these practices across the country is less than optimal, leading to insignificant improvements in farmer productivity (GOU, 2010; Chemonics, 2008; World Bank, 2006).

Nwoya District is not exceptional. The District Annual Development Performance Report (2011) reported that uptake of sustainable farming practices among farmers was poor causing low agricultural productivity and high level of poverty witnessed in the district. Most farmers in Nwoya District still engage in traditional methods of agriculture and yet efforts have been taken by the government and development partners such as SNV Netherlands to promote sustainable

farming practices (District Annual Development Performance Report, 2011). Very little was known about the causes of the low adoption of sustainable farming practices such as crop rotation, cover cropping and use of minimum tillage practice by households in Nwoya district.

If the situation is not investigated, the effective adoption of sustainable farming practice might not be realized in Nwoya. As has been suggested by studies (such as Nowak, 1991; Pretty & Hine, 2001; Cary *et al*., 2001; Vanclay & Lawrence, 1994; Roling & Jigging, 1994), in order to have a more effective impact on promoting wide spread adoption of sustainable agriculture practice, investigating factors limiting adoption and how these can be overcome is crucial. In Uganda, the inability to adopt these sustainable farming practices could be associated with farmer characteristics, economic factors and social interaction factors among others. This study was carried out to investigate the socio-economic factors affecting the adoption of sustainable farming practices by farmers in Uganda with particular emphasis on Nwoya District.

1.3. Purpose of the study

The study examined the socio-economic factors affecting the adoption of sustainable farming practices among households in Nwoya District.

1.4. Objectives of the study

The study was guided by the following objectives:

a) To examine the effect of farmer characteristics on adoption of sustainable farming techniques by farmers in northern Uganda in Nwoya district.
b) To examine the effect of economic factors on adoption of sustainable farming techniques by farmers in northern Uganda in Nwoya district.

c) To establish the effect of social interactions on adoption of sustainable farming techniques by farmers in northern Uganda in Nwoya district.

1.5. Research questions

The study sought to provide answers to the following questions:-

a) How do farmer characteristics affect the adoption of sustainable farming techniques by farmers in northern Uganda in Nwoya district?
b) To what extent do economic factors affect the adoption of sustainable farming techniques by farmers in northern Uganda in Nwoya district?
c) In what ways do social interactions affect the adoption of sustainable farming techniques by farmers in northern Uganda in Nwoya district?

1.6. Hypotheses

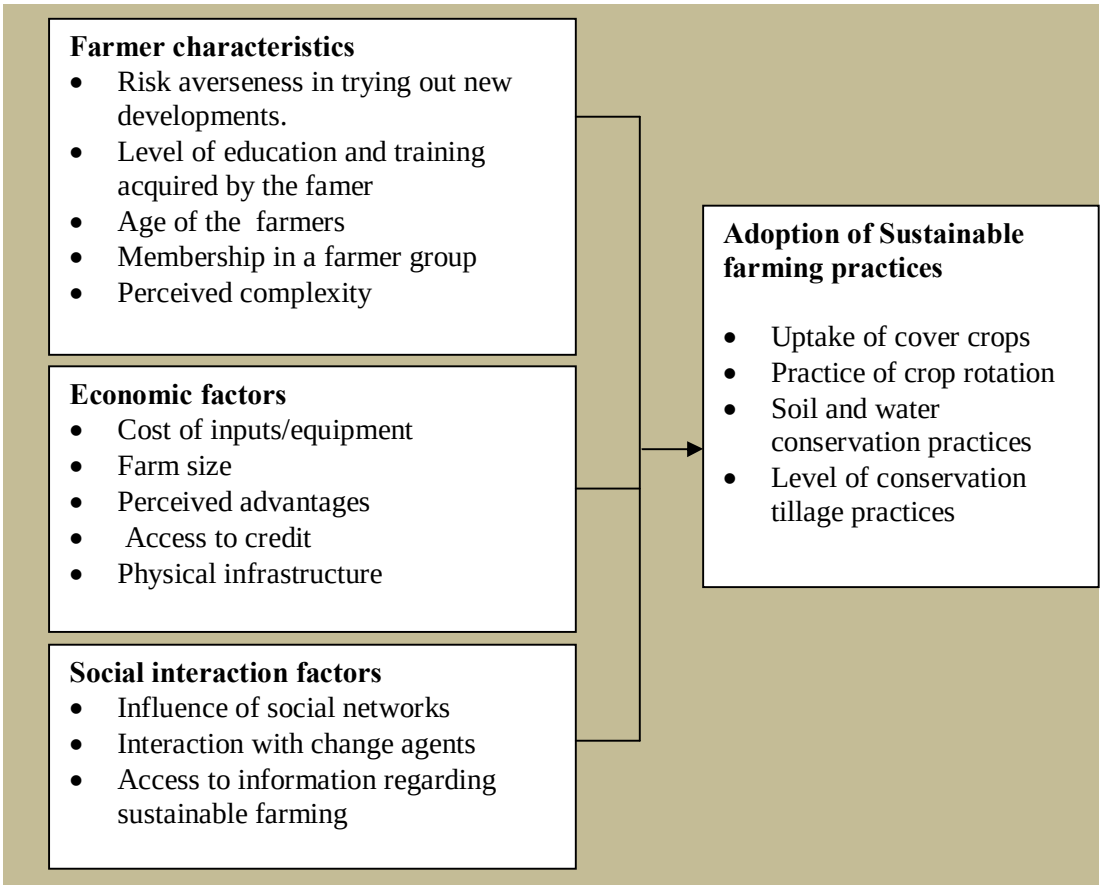
The following hypotheses were tested during the study:-

a) Farmer characteristics significantly affect adoption of sustainable farming techniques among farmers.
b) There is a significant relationship between economic factors and adoption of sustainable farming techniques by farmers.
c) Social interactions significantly affect adoption of sustainable farming techniques by farmers.

1.7 Conceptual framework

Independent variable
Socio-economic factors

Dependent Variable
Sustainable farming practices



Source: Modified and adopted from Dearing, 2004

Figure 1. 1: Conceptual model showing relationship between socio-economic factors and adoption of sustainable farming practices.

The framework in the diagram above suggests that the independent variable (socio-economic factors) were conceptualized into three, namely; individual farmer characteristics, economic factors and social systems while the dependent variable (sustainable farming practice) was

conceptualized as uptake of cover crops, crop rotation, soil and water conservation practices and level of conservation tillage practices. All the concepts were further, conceptualized as shown in Fig 1. Fig 1 further hypothesizes that all the factors had an effect on adoption of sustainable farming practices by farmers in Nwoya District. Improvements in the dimensions of socio-economic factors, holding other factors constant are supposed to bring about a tremendous increase in the uptake of sustainable farming practices.

1.8. Significance of the study

The study findings identified the relative effect of the socio-economic factors promoting and/or hindering the successful adoption of sustainable farming practices in Nwoya District. The study findings may be important to the following;

Planners and Policy makers in the Ministry of Agriculture, Animal Industry and Fisheries may benefit from the study findings as they bring to the fore the contribution of farmer characteristics, economic factors and social interaction on the adoption of sustainable farming practices. The anomalies identified by the study provide a basis for the policy planner and makers to take corrective actions by drawing strategic plans for addressing the loopholes in the factors for improved adoption of sustainable farming practices.

Similarly identification of farmer characteristics, economic and social system factors promoting or hindering the adoption of sustainable farming practices may enable stakeholders in the promotion of rural livelihoods in Nwoya district such as SNV and NUSAF to design appropriate interventions to steer the propensity with which farmers in Nwoya and other districts at large will adopt sustainable farming practices.

1.9. Justification of the study

Previous studies (such as Katungi, 2007; NAADS, 2004; MAAIF & MFPED, 2000) acknowledging efforts by the government of Uganda to modernize agriculture by increasing on the adoption of agricultural technologies have indicated that rates of adoption of new agricultural technologies have continued to be low. Pender and Jagger (2003) studied adoption of sustainable land management policy in Uganda and found out that the adoption of sustainable land management technologies never spilled over to non-participants in local programs and organizations. Pender and Jagger acknowledged the benefits of sustainable land management technologies such as manuring that yield longer-term benefits to farmers.

Whereas studies have been carried out acknowledging the necessity for adopting sustainable farming practices and found out that they lead to an increase in productivity especially in their centrality to promoting the acceleration of economic growth; alleviating poverty and helping to overcome the recurrent food shortages that affect millions of households in Africa, very little study has been carried out on factors associated with low adoption of sustainable farming practices in Uganda and more particularly in Nwoya district, yet sustainable farming practices are a means to ending poverty and food insecurity in the country. This study was thus justifiable to get the real factors as to why this was so.

1.10. Scope of the study

The study concentrated on household characteristics, economic factors and social system factors and their effect on the adoption of sustainable farming practices in the dimensions of soil management practices, land productivity practices, agro forestry, soil and water conservation

practices and conservation tillage practices. The study covered selected households in Nwoya District in Northern Uganda. The study covered the period 2007 to 2013. This study period was selected because it was long enough to enable the researcher capture comprehensive data about changes in the adoption of new agronomic practices in the area as NAADS and other developmental partners such as NUSAF and SNV Netherlands have been promoting the same in the area in particular and Northern Uganda in general since 2007.

1.11 Operational Definition of terms

Adoption: This was operationally defined to mean the acceptance, taking on, implementation or approval of something. In this study, adoption refers to the uptake and practice of growing improved crop varieties and breeds.

Characteristics: These were used in this study to refer to attributes that enable description and distinctions to be made between two or more elements. In this study, farmer characteristics referred to the differences amongst the farmers that are most likely to make some farmers to engage in growing new agricultural technologies than others.

Economic factors: In the context of this study, economic factors were conceived to mean monetary considerations. In this study, monetary factors referred to the cost effectiveness and financial viability of adopting the improved crop breeds.

Social interaction: These were taken to mean ease with which farmers easily meet and share with resourceful people in a community.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

This chapter presents a review of related literature on the socio- economic factors affecting the adoption of sustainable farming practices. The first section presents the theoretical framework that provides a holistic overview on the perceived relationship between the study variables. This is followed by related literature on farmer characteristics and adoption of sustainable farming practices; economic factors and sustainable farming practices; social system factors and adoption of sustainable farming practices and; a summary of the chapter.

2.2. Theoretical Framework

2.2.1 Diffusion of Innovations Model (DOI)

The Diffusion Of Innovations is the most widely used framework to explain and predict adoption of new technologies. It was created in the United States by the rural sociologist Everett Rogers in the 1940s. Rogers defines diffusion as ñthe process by which an innovation is communicated through certain channels over time among the members of a particular social system; this process includes both planned and spontaneous spread of new ideasò (Haider & Kreps, 2004:3).

The innovation decision process is characterized by five stages: knowledge, persuasion, decision, implementation and confirmation. In the knowledge stage the individual or household is exposed to the innovationôs existence and gains understanding of how it functions. However, even after knowing about an innovation, individuals may need to be persuaded to use it because they do not regard it as relevant to their situation. The outcome of the persuasion stage is either adoption or rejection of the innovation. The implementation stage is when an individual puts an innovation into use. The final stage is confirmation during which the individual seeks reinforcement for the

decision made.

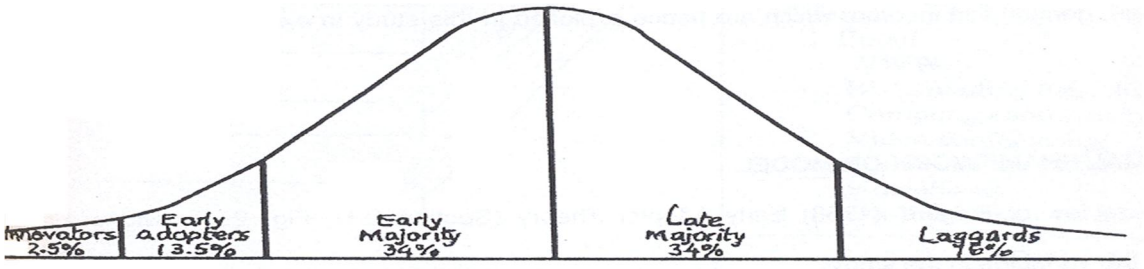


Figure 2. 1*: Adopter categorization on the basis of relative time of innovations*

Source: Rogers, E.M., 2003, Diffusion Innovations. NY Free press

From Figure 2.1, Rogers postulated that innovations spread gradually over time and among people resulting in various adopter categories. The result is an adoption process that forms a normal S-shaped curve when plotted over time (Rogers, 1995). Rogers attributes this distribution of adoption to the role of information, which reduces uncertainty in the diffusion process. Based on this argument, Rogers has classified adopters into five categories: innovators, early adopters, early majority, late majority and laggards.

Innovators are described as individuals who are venturesome, eager to try new ideas and willing to take risks. Early adopters are described as the local opinion leaders in the system who function as the role models and are quick to see the value of innovations. The early and latest majority constitute the largest category of adopters. These people only make a decision after they are convinced of the benefits. The late majority is cautious and skeptical persons who do not adopt until majority others have done so. They are usually the relatively poor and are averse to risk. The last group of adopters is the laggards. They are suspicious of innovations and change agents. They are usually poor and seldom take risks.

Rogers postulated that innovations spread gradually over time and among people resulting in various adopter categories. The result is an adoption process that forms a normal S-shaped curve when plotted over time (Rogers, 1995). According to Rogers (1958, cited in Rogers, 2003), underpinning this adopter classification are individual demographic and other characteristics such as economic power and interaction with relevant change agents, relevant training and so on which were exploited in this study in explaining adoption of sustainable farming practices in Uganda.

2.2.2 Technology Acceptance Model (TAM)

Davis (1989) developed the Technology Acceptance Model (TAM) which examined perceived usefulness and perceived ease of use as predictors for software application use. It has been used extensively and expanded for the past decade. Technology adoption is the decision of a group or individual to make use of an innovation. Beal and Bohlen (1956) state that people accept new ideas through a series of complex mental processes in which adoption is the final action. Rogers (1960:1995) shows technology diffusion in a global perspective to match a classical normal distribution curve which can be explained by the demographic and psychographic characteristics of the adopters.

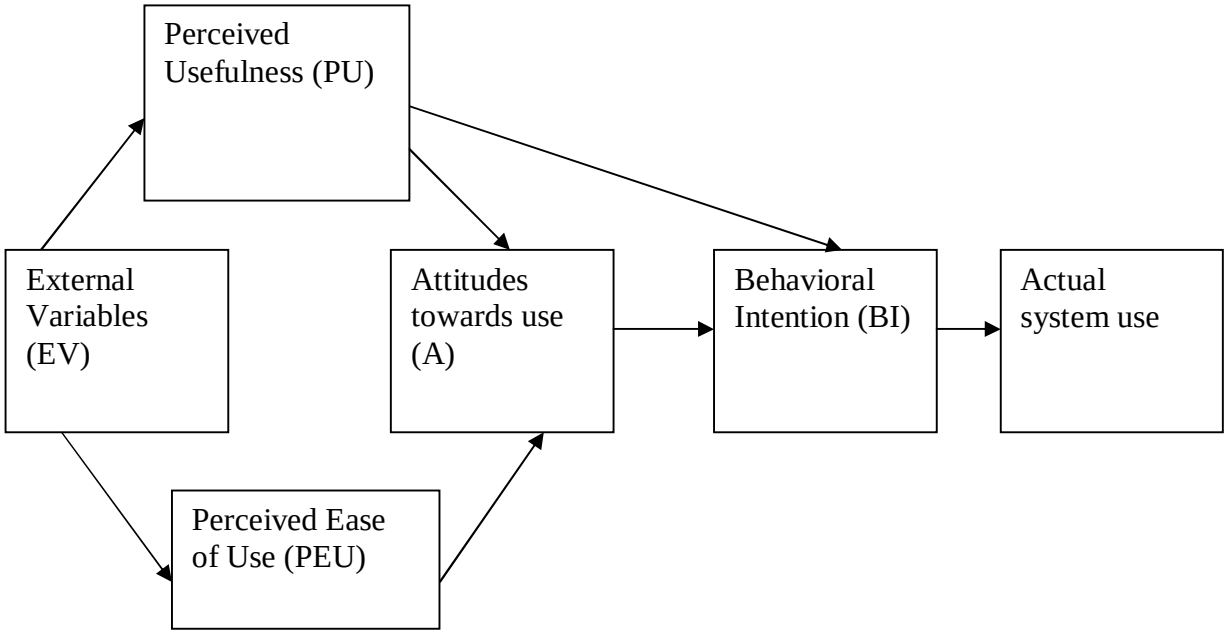


Figure 2. 2: Technology Acceptance Model (TAM) by Davis (1989).

The Technology Acceptance Model (TAM; Davis, 1989) as shown in Figure 2.2, initially developed for new end-user of information systems for organizations, is one of the most influential models in the study of technology use (Gefen & Straub , 2000). TAM explains the factors influencing the behavior of an individual regarding accepting and using new technology. Perceived usefulness (PU) is the key determinant of acceptance, meaning the userôs ñsubjective probability that using a specific application system will increase on their welfareò (Davis *et al*., 1989, p. 985). Perceived ease of use (PEU), is ñthe degree to which the user expects the target system to be free of effortò (Davis *et al*., 1989, p.985). Together, PU and PEU determine the attitude (A) of a person towards using the system. Finally with the influence of PU and Attitude, Behavioral Intention (BI) influences the actual use [adoption] of the system.

2.2.3 Rural Technology Acceptance Model (RuTAM)

RuTAM was developed by Sarajul (2011). Sarajul (2011), posit that there is no such model that explicitly explains the technology acceptance factors related to farmers of poor regions. Itôs on this basis that Sarajul reviewed a number of theories pertinent to technology acceptance in general and mobile technology in particular, to develop RuTAM that incorporates most of the major and commonly used factors in explaining the adoption of new technology.

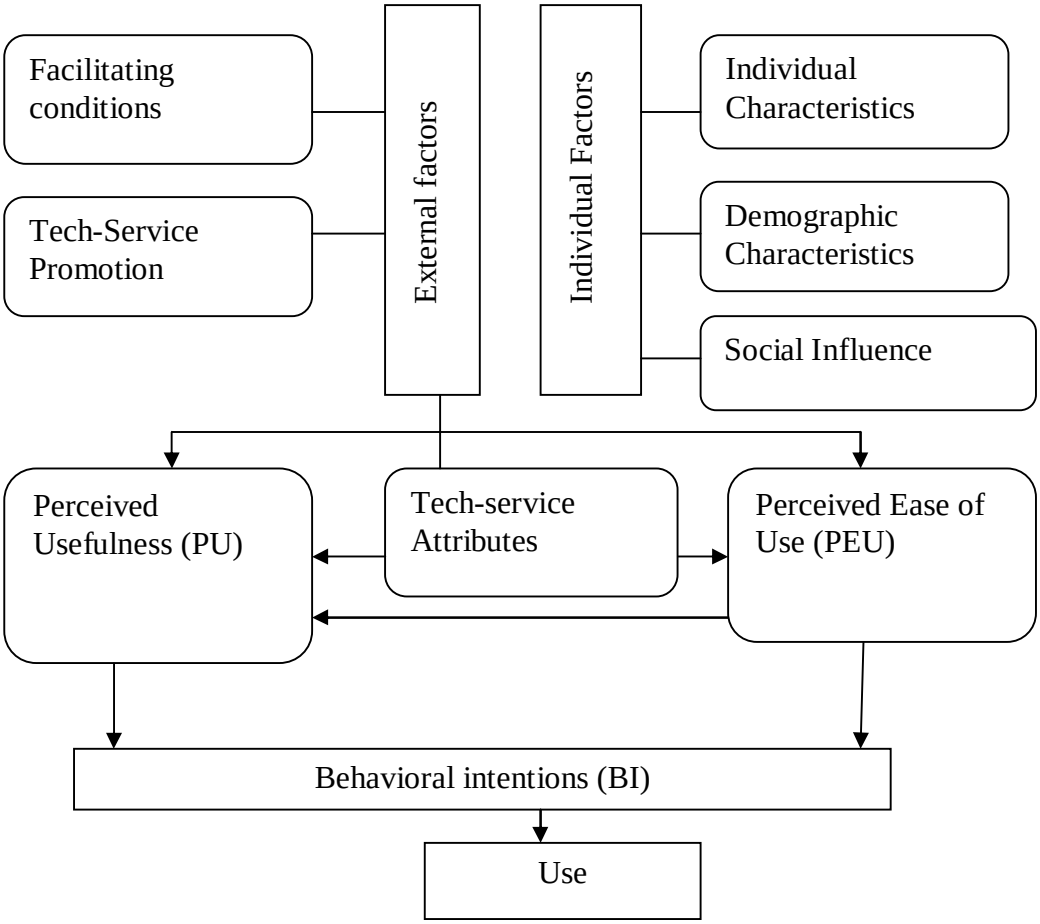


Figure 2. 3: The Rural Technology Acceptance Model (RuTAM) by Sarajul (2011)

Facilitating conditions: Venkatesh *et al.* (2003, p. 453) define Facilitating Conditions (FC) as ñthe degree to which an individual believes that an organizational and technical infrastructure exist to support the use of a systemò. Jain and Hundal (2007), argue that choice of service provider is affected by the facilitating factors such as network coverage, service quality, easy availability of subscriptions and bill payment centers. The list of variables which are commonly found relevant to the adoption of new technology can broadly be categorized as the ófacilitating conditionsô.

Tech-service attributes: Tech-service attributes (TA) refers to the properties or characteristics of a certain technology, system, or service that distinguish it from other technologies, systems or services. Adesina and Baidu-Forson (1995) find that farmers' perceptions of technology characteristics significantly affect their adoption decisions.

Tech-service promotion: While awareness is the individualôs extent of alertness and ability to draw inference in a certain time and space towards an object or situation, influence is the process of creating this awareness. Kalish (1985), characterizes awareness as one of the steps towards adoption and subsequently defines it as ñthe stage of being informed about the product search attributesò (p. 1569). Doss (2003), finds that lack of awareness is one of the main reasons for farmers not adopting the new technology. Cook (2006) therefore, suggested need for initiatives in order to create awareness among the users.

Social influence: According to the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975; Qingfei et al. 2008) behavioral intention of a person is influenced by subjective norms which in

turn are influenced by the significance of referentsô perceptions (or normative beliefs) and motivation to comply with those referents. In addition to neighbors, there are some other sources of influence also evident in the literature, such as relatives, friends, and seniors or influential persons in the community (Wong & Hiew, 2005; Kargin & Basoglu, 2007; Biljon & Kotzé , 2007).

Demographic factors influence adoption of new technology. According to RuTAM, variables that are important in this category are age, gender, culture and ethnicity, income and household, occupation and education.

Individual factors: Sultan and Chan (2000) argue that individual characteristics are more significant than technology properties in the technology adoption process in general. Gatignon and Robertson (1989) suggest that information processing capability is a factor that separates the adopters from the non-adopters. This capability is framed by the individualôs extent of observability or awareness (Huff & Munro, 1989; Vishwanath & Goldhaber, 2003). From the above description, this study based on RuTAM to investigate the relationship between individual characteristics, economic factors and social interaction as key socio-economic factors influencing the adoption of sustainable farming practices in Nwoya.

2.3 Farmer Characteristics and Adoption of Sustainable Farming Practices

2.3.1 Risk Averseness and Adoption of Sustainable Farming Practices

Risk can be a great limitation for adoption of environmental practices. Often environmental innovations may require farmers to give up their income during transition, so cost of adopting

increases. Many farmers may not be in a situation to take the risk of failure. Souza and Filho (1997) found that farmers perceived an increase in risk when trying to convert to organic farming and hence became a significant barrier to adoption of organic farming by Brazilian farmers. In order to adopt sustainable agriculture practices farmers need to be able to overcome the transition period. Souza and Filho (1997) found that the financial risk of the transition time represented a significant barrier to adoption of organic farming. The findings of Souza and Filho (1997) were based on organic farming which is a constituent of sustainable farming practice. This left a knowledge gap for the current study that investigated influence of risk averseness on three constituents of sustainable farming, namely; crop rotation, minimum tillage and cover crop growing. In addition, the findings were based on the case of Brazil. Study findings revealed that farmers in Nwoya District who considered investment in sustainable farming practices as a risky venture continued to rely on conventional farming practices. The levels of adoption were higher for farmers who perceived investment in adoption of novel agronomic practices as a less risky venture and vice versa.

2.3.2 Level of Education and Training and Adoption of Sustainable Farming Practices

The role of education in technology adoption has been extensively discussed in the literature. Education enhances the allocative ability of decision makers by enabling them to think critically and use information sources efficiently. Farm-families with higher levels of education should be aware of more sources of information and are more efficient in evaluating and interpreting information about innovations than those who are less educated. Education was found to positively affect the adoption of improved maize varieties in West Shoa, Ethiopia, (Alene, Poonyth and Hassan, 2000). Education is underscored by Alene *et al*.(2000) as a major factor

influencing the adoption of new agronomic practices. However, their findings were based on adoption of improved maize varieties and yet this study was on sustainable farming practices not adoption of improved crop varieties. The study findings on farmers from Nwoya District indicated that education is a significant factor that affects the adoption of new farming gear. Literate and enlightened farmers were thus more receptive to new innovations in the area as compared to their counterparts. Education is thus a strong predictor of adoption of new farming innovations.

2. 3.4 Membership in a Farmer Group and Adoption of Sustainable Farming Practices

Notwithstanding, the limited availability of empirical data on the potential role played by farmer associations in absorbing some of the transactionôs costs of input procurement, Kelly, Crawford, and Jayne (2003), reported that farmer associations in the irrigated rice zone of Mali have reduced costs for their members by using transparent bidding procedures for sourcing inputs and by securing bank loans to guarantee timely repayment to suppliers. Additionally, to decrease the transaction costs of inputs acquisition and output marketing, some NGOs have promoted the establishment of and consolidation of farmer associations. The findings of Kelly et al., were made in the context of Mali and never hinted on sustainable farming practices. The study in Nwoya district revealed that farmer associations provide a thread of connection between farmers and increase the likelihood of adoption of new farming innovations largely because most farmers that belonged to farmer groups had adopted some forms of sustainable farming practices.

In her study, Suri (2005), provided a succinct overview of the determinants of maize technology adoption in Kenya and showed that technology profitability, farmer learning as well as observed

and unobserved differences among farmers and across farming systems were major determinants of adoption. Learning through social networks (Jackson & Watts, 2002), may also be an important determinant of technology adoption. Suri (2005), demonstrated that aggregate adoption rates may remain low or stagnant despite high average returns to new maize technologies, either because marginal returns to adoption are low, or because the farmers with comparative advantage in adoption have already done so. This finding implies that farmersô organizations provide fora through a farmer can copy and implement the activities copied from fellow farmers. Suri, however, used the context of Kenya, where farmers could be having individual characteristics different from those of Nwoya District farmers, hence, leaving a gap for this study. In addition, Suri generalized his findings and yet this study was particular on sustainable farming practices. It was found out that in Nwoya District, there were few farmers organizations. Thus, the farmers had not benefitted from the attributes of belonging to a farmersô group, that among others include ease in accessing credit as a group, benchmarking of ideas and ñcross pollinationò of interesting ideas.

Munshi (2004), compared wheat and rice growing villages in India to demonstrate that adoption based on observing neighbors is less likely in areas with heterogeneous populations where a farmer may not be able to control for differences in neighborsô characteristics. Using a data set that had measures of individualsô social networks, Bandiera and Rasul (2002), demonstrated that individual networks were important sources of information sharing that affect the adoption decision. They found an inverse-U relationship between the probability that a farmer would grow sunflowers in Mozambique and the number of known adopters in his or her network.

The findings portrayed geographical and scope contextual gaps since, they indicated findings

from sunflowers and rice as well as examples of India and Mozambique which could be at different levels of development with Uganda. Moreover, they didnôt throw any light on sustainable farming practices. The fewer farmer networks as established by the study in Nwoya District meant that farmers seldom shared best practices for adoption of sustainable farming practices and as well were not easily mobilized in case need be. Little wonder that the levels of adoption of sustainable farming practices were low.

2.4 Economic Factors and Adoption of Sustainable Farming Practices

2.4.1 Cost Of Inputs/Equipment and Adoption of Sustainable Farming Practices

The decision to adopt is often an investment decision. According to Caswell *et al*, (2001) this decision presents a shift in farmersô investment options. Therefore, adoption can be expected to be dependent on cost of a technology and on whether farmers possess the required resources. Most farmersô lack experience with these technologies leads to a low quality of implementation, a higher risk of trial failure, and an unavailability of resources required for implementation (Marra *et al*. 2004). The ecological setting of Nwoya is a region conceived to have the most impoverished households due to the more than a decade political insurgency by LRA could imply that costs of adoption were limiting factors for the adoption of sustainable farming practices. The study findings cleared this doubt and indicated that costs of adoption of the technology were higher for an average farmer in the post conflict Nwoya district.

2.4.2 Farm size and Adoption of Sustainable Farming Practices

In some situations farmers might be obligated to use conventional and sustainable systems at the same time (e. g. when working with own and rented land). Bell *et al*. (2001) found that the desire

to have a uniform implementation of practices in all the operation was a significant barrier to adoption of sustainable practices in Iowa farmers. Having to manage both rented plots and owned plots, in different ways will be less cost affective and take them more time and effort.

Bell *et al.* (2001) used the case study of Brazil. No mention was made of Uganda. In addition, the study was based on generalized sustainable farming practices and yet the current study was on three aspects of sustainable farming practices; crop rotation, cover cropping and minimum tillage.

Fernandez-Cornejo and McBride (2002), using data from a US survey at one point in time (1998), found that adoption of HT maize was positively related to farm size. The same study also analysed Bt maize but drew no clear conclusion on the effect of this variable. Other variables, such as education, experience, corn borer infestation and economic risk reduction (by contracting locks in prices or by lowering the likelihood of yield losses due to insect pressure), had a positive and significant impact on adoption of both genetically modified maize types. Based on the same survey data, in 1998 Fernandez-Cornejo *et al*. (2002), found that larger farms and better educated farmers have responded positively to adoption of HT soybean in the USA. The findings of McBride left a contextual gap. Different from what the situation is as enlisted by Fernandez-Cornejo et al where in USA, the farmers are educated and operate intensive farm units leading to high levels of adoption, this study in Nwoya District established that the farmers operated extensive farm holdings and the majority were illiterate. This finding thus implies that the adoption levels reported by the authors were different from those of Uganda.

2.4.3 Perceived Advantages and Adoption of Sustainable Farming Practices

Agricultural technology adoption models are based on farmersô utility or profit maximizing behaviours (Pryanishnikov & Katarina, 2003). The assumption here is that farmers adopt a new technology only when the perceived utility or profit from using this new technology is significantly greater than the traditional or the old method. While utility is not directly observed, the actions of economic agents are observed through the choices they make.

A study of the key factors associated with the adoption of hybrid maize in Latin America and the Caribbean region by Kosarek, Garcia, and Morris (2001), reported that farmersô decision to adopt hybrid maize was determined by the expected returns of the technology, the availability of hybrid seed, and risks associated with uncertainty regarding the expected outcomes of the new technology. Moreover, they found that the structure of the seed market, the organization of the seed industry, and the cost of technology generation and development were key determinants of the profitability of supplying hybrid maize seed. As established by the study, in Nwoya, the farmers who adopted sustainable farming practices perceived them as worth paying as compared to conventional agriculture. Therefore, the scores of farmers who perceived the sustainable farming practices as worthless clung on conventional farming practices. The latter category of farmers constituted the majority of the sample.

2.4.4 Access to Credit and Adoption of Sustainable Farming Practices

Recognizing the potential contribution of credit in enhancing the adoption of hybrid maize among smallholders, the government of Malawi has been pursuing a credit policy that seeks to promote hybrid maize production. The government of Malawi, through the Smallholder

Agricultural Credit Administration (SACA), started providing joint liability loans to smallholder farmers as far back as 1973, three years before the Grameen Bank was created (Diagne, *et al.,* 2000). The credit whose main purpose was to promote smallholdersô production of high value crops (first maize, then later in the 1990s also tobacco) was mainly given to farmers in the form of in-kind loans such as fertilizer and seed. However, despite such concerted efforts by the government, and more recently non-governmental organizations in promoting the cultivation of hybrid maize, its adoption remains low. By 2003, more than half of the total maize land was allocated to local varieties (GOM, 2004). This finding indicates that even when credit is made available to the farmers, they may or may not adopt a given set of technology. This study investigated the significance of credit availability towards the adoption of sustainable farming practices in Uganda, particularly Nwoya District and established that farmers who were assured of accessing credit were more responsive to adoption of farming innovations, sustainable farming practices inclusive.

Significant positive effects of access to credit on the adoption of improved maize varieties was reported by Feleke and Zegeye (2006). The logit result for the adoption of improved maize varieties suggests that use of credit will result in more adoption of improved maize varieties. It had a positive coefficient and was significant at p= 0.05.). Farmers having access to credit can buy improved maize seed as well as other inputs and hence, higher adoption was seen than those with no access to credit. Of the total respondent farmers, about 68% did not use credit in their operations although the physical distance between farms and credit centers such as bank, finance company and cooperatives are not more than 5-7 kilometers. This is due to the reasons that credit provided by financial institutions as well as credit cooperative groups was not so encouraging

due to unfavorable policies, delay in timely transactions, higher interest rate which may cause high cultivation cost and period of repayment. This indicates that easy access to credit may possibly influence the farmerôs decision to adopt improved maize varieties. Similar effects on adoption of fish enterprise were observed by Matiya *et al.* (2005). This study never invoked the logit model and therefore came up with dissimilar or differing results. The study used descriptive statistics and inferential statistics (correlation and regression analysis), but still established that access to credit greatly influenced the adoption of innovations by farmers. Therefore, though a different approach was used in analysis of the data, the study findings collate with those of Matiya *et al* who used the logit model that access to credit increases on the preparedness of an individual to adopt innovations.

2.5 Social interaction Factors and Adoption of Sustainable Farming Practices

2.5.1 Effect of Social Networks and Adoption of Sustainable Farming Practices

Dearing (2004), Kincaid (2004) and Haider and Kreps (2004) claim that social influence is more likely to occur through opinion leaders of the social systems. Dearing (2004:27) explains: ñopinion leaders, through communicating or social modeling, do the rest [of diffusion] as long as: their attitudes are favorable toward the new practice [and] others positively identify the opinion leader with the innovationò. On the other hand, the opposite may occur when opinion leaders show a passive or active rejection of the innovation, adoption may be hindered (Dearing, 2004). This study investigated to establish the existence of networks of farmers in Nwoya district and relate their availability and /or absence on the adoption of sustainable farming practices in the district. Findings of the study in Nwoya established that there existed fewer farmer networks. The identified farmer networks were in peri-urban areas and grossly nonexistent in the rural

areas. The adoption of sustainable farming practices was thus apparently higher near and around peri-urban settings as compared to the rural and upcountry parts of the district because of the absence of dynamic farmer networks.

Many sustainable agriculture practices are highly complex (Nowak 1991; Souza & Filho 1997). Thus, adopting them imposes a need for increased learning. The intellectual cost of adopting environmental innovations is usually greater than conventional innovations because they require a better understanding of farm systems, cropping systems, or chemicals. Thus farmers may not be attracted to changes that require such intellectual investments (Vanclay & Lawrence 1994).
One of the reasons for non-adoption reported by Norman et al. (1997) is that sustainable agriculture practices are management intensive and require great commitment to constant learning. Nowak (1991) states that one reason for farmers being unable to adopt is their inadequate managerial skills. He explains that the issue is exacerbated by the fact that residue management systems often are designed for average or above average managers, and local assistance networks are also oriented to this group. Similarly, farmers in Brazil found lack of knowledge as a barrier to adopt organic farming (Souza & Filho 1997). The case study of Nwoya district filled this gap since case studies above used the context of Brazil , the spokes nation of all developing countries. In Nwoya, most farmers were illiterate. Continuous learning would thus materialize if it were preceded by Functional Adult Literacy (FAL) classes in the area.

Katungi (2007), used a probit model to estimate the probability of using improved banana management practice and participation in an association. It is also demonstrated that information generated by early adopters diffuses through sparse social networks contrary to the assumption

of free availability in the whole village. It was identified that some factors associated with levels of knowledge of innovation included innovation proneness and utilization of mass media influences. The case study of Nwoya district on sustainable farming practices was set to establish the influence of mass media on the levels of adoption of crop rotation, minimum tillage and growing of cover crops.

2.5.2 Interaction with Change Agents and Adoption af Sustainable Farming Practices

Haider and Kreps (2004:5) point out that a very important component of the DOI model is the change agent. They define change agent as an ñindividual who influences clientsô innovation decisions in a direction deemed desirable by a change agencyò. The change agent is considered to plays the following roles: ñdevelop a need, establish the information exchange relationship, diagnose problems, create an intent in the client to change, translate an intent to action, stabilize adoption and prevent discontinuance, achieve a terminal relationshipò(Haider & Kreps 2004:5).

According to a change agent ñtwo drivers determine whether a farmer will adopt a new technology: if he thinks itôs profitable and if his peers accept itò (Bearenklau, 2005:5). The degree to which this type of influence will affect adoption of technologies may depend upon the degree of risk of the technology. Bearenklau (2005) specifies that the neighbor effect may have more importance for smaller, less costly and reversible decisions. According to Vanclay *et al*. (1993), for innovations high in apparent risk or uncertainty, diffusion occurs through an interpersonal process. In such a process social influence will either facilitate or impede adoption. However Marra *et al*. (2001) argue that social influences are not as relevant as others state. In their study about adoption of transgenic cotton, they found that potential adopters were more

likely to be affected by information they consider as important (effective) in their decision than by neighbor effects or popularity of the innovation.

2.5.3 Access To Information and Adoption of Sustainable Farming Practices

Information is acquired through informal sources like the media, extension personnel, visits, meetings, and farm organizations and through formal education. It is important that this information be reliable, consistent and accurate. Thus, the right mix of information properties for a particular technology is needed for effectiveness in its impact on adoption. Adoption, defined as a mental process in which an individual passes through a series of stages from first hearing about an innovation, called an awareness stage, to collecting information about the technology's perceived benefits in terms of its profitability and fit into the farmer's operation, the evaluation stage.

Acquisition of information about a new technology demystifies it and makes it more available to farmers. Information reduces the uncertainty about a technologyôs performance hence may change individualôs assessment from purely subjective to objective over time (Caswell *et al*., 2001). Prior to trialing, the farmerôs assessment of a technology or practice relies strongly on information from outsiders. At this stage, social and information networks would be important influences on the decision to proceed to trial, but after trailing has commenced, personal experience gained in that way is likely to be the main influence on further decisions (Marsh *et al.* 2000). This has implications for the role of extension to promote adoption, as previously discussed.

The introduction of new technologies creates demand for information useful in making decisions. Agricultural extension organizations supply useful information about agricultural technologies. Access to such sources of information can be crucial in the adoption of improved varieties. Furthermore, risk associated with the adoption of agricultural technologies has been an important factor in adoption decisions (Shiyani, Joshi, Asokan & Bantilan, 2002). In the context of Nwoya District farmers, there was limited access to varied information sources owing to the fact that majority of the farmers were illiterate. This greatly hindered the adoption of sustainable farming practices since access to information about the modern farming gear is a prerequisite for the farmers to rightly apply the procedures.

2.6 Summary of Literature Review

From the preceding literature reviewed farmer characteristics, economic factors and social systems play an immense role in steering or inhibiting adoption of sustainable farming practices. The authors cited in the literature acknowledge the superiority of the above factors. However, most of the scholars used case studies of developed countries and developing alike, excluding Uganda. Their findings have been critiqued and the methodological (such as Feleke & Zegeye, 2006 who used a logit model), contextual (such as Fernandez-Cornejo & McBride, 2002 in USA.) and subject gaps(such as Diagne et al.,2000 whose study was on provision of loans to small holder farmers in Malawi to promote production of high value crops) .

CHAPTER THREE

METHODOLOGY

3.1. Introduction

This chapter outlines the methodology that was used to conduct the research. It constitutes the research design, population of study, sample size and selection, data methods and instruments, reliability and validity of instrument, data management and analysis.

3.2. Research design

According to Kumar (2005), a research design serves as a plan, structure or strategy of investigation, or the arrangement of conditions for collection and analysis of data. The study adopted a cross-sectional survey design. The design was used for profiling, defining, segmentation, estimating, predicting, and examining associative relationships. Cross-sectional studies easily provide a quick snapshot of whatôs going on with the variables for the research problem (Odiya, 2009). A case study design was used to provide a systematic way of looking at events, collecting data, analyzing information and reporting the results especially for areas where rates of adoption have been consistently low. Case studies emphasize detailed contextual analysis of a limited number of events or conditions and their relationships and bring about an understanding of a complex issue and can extend experience or add strength to what is already known through previous research (Oso & Onen, 2005).

3.3 Study population

Population refers to the group of people, events or things or elements of interest that researcher wishes to investigate (Denscombe, 2003). Oso and Onen (2005) posit that population is the total number of subjects or the total environment of interest to the researcher while Amin (2005) look

at population as a complete collection or the universe of all the members or units of a group that is of interest in a particular study. Nwoya District has 12,390 households (UBoS, 2011). Nwoya District has four sub counties; Anaka, Alero, Purongo and Koch Goma.

3.4. Sample size determination

In this study, the researcher was guided by Krejcie and Morgan 1970 table as cited in Amin (2005:454) to determine the sample size for each category because it is easy to use and thus saved time. To be able to get appropriate representatives, the researcher stratified the accessible population according to sub counties. Each sub county formed a stratum. The researcher used simple random sampling to select the households while census sampling technique was used in selecting key informants respondents because they were knowledgeable about sustainable farming practices and factors affecting their adoption through their own experiences.

Table 3. 1: Sample Size and selection Per Category

Category	**Population Size (N)**	**Sample Size (n)**	**Sampling Technique**
Households	12390	375	Stratified Sampling, Simple random sampling
NAADS staff	4	4	Purposive sampling
NUSAF Staff	2	2	Purposive sampling
Community Development Officers	4	4	Purposive sampling
Agricultural Officers	4	4	Purposive sampling
Local Council III Officials	4	4	Purposive sampling
Total	12,425	393	

Source: Adopted from Krejcie and Morgan (1970)Table of Sample size Determination

3.5 Sampling procedure

The study used stratified sampling technique and then after a simple random sampling method (lottery approach) was used to select the respondents from each stratum. The sub counties formed the strata. The sampling technique was used because it enabled a balanced representation of a study area as the constituents of a given area are subdivided and respondents selected from each sub division (stratum). Simple random sampling was used in each stratum. The selection of the technique was attributed to its key advantage of eliminating bias and giving all the targeted respondent equal chances of participating in the study.

Purposive sampling was also used in selecting knowledgeable staff. According to Katebire (2007), this technique is sometimes referred to as judgmental sampling where a researcher on his/her own judgments targets specific subjects to participate in the study because they have perceived knowledge or experience in relation to the study under investigation. Purposive sampling was used to select the key informants such as sub county Agricultural officer, Church leaders, Local Council III officials, NUSAF, NAADS staff and Community Development Officers.

3.6. Data collection Methods

The researcher used the following techniques to collect data for the study;

3.6.1 Face-to-face interviews

An interview is a purposeful discussion between two or more people (Saunders, 1997). Sekaran (2003) asserts that one method of collecting data is to interview respondents to obtain information on the issues of interest. These targeted the (35) key informants who were interviewed using interview guides and they were engaged in in-depth discussions on issues of

socio-economic factors affecting adoption of sustainable farming practices. Interviews were conducted because they allow the researcher to obtain information on issues of interest, and above all, data was obtained more efficiently in terms of the researchersô time, energy and costs.

3.6.2 Questionnaire Method

Amin, (2005) defined a questionnaire as a form consisting of interrelated questions prepared by the researcher about the research problem under investigation, based on the objectives of the study. Questionnaires were administered to the selected household heads. The researcher carried out the study with he the help of 2 research assistants who were trained before the data collection exercise began. A questionnaire was used because it facilitates collection of relevant information from the respondents as they are given time to think before giving their opinion and is a less costly method (Sekaran, 1992).

3.6.3 Focus Group Discussions

Four Focus Group Discussions were conducted from the four Sub Counties using a Focus Group Discussion guide. The researcher assumed the role of a moderator. Each group had 10 to 14 participants with the same characteristics. The discussions were focused particularly on reasons of adoption/non adoption (How, Why), support mechanisms and types of support (Government, Non-government and Civil Society) among others. The researcher chose only those who were active during the study to participate because they were considered capable and knowledgeable about the issues related to the study. The participants in the FGDs were selected during the process of administering questionnaire surveys. Probing was used to supplement the responses that were considered lacking. Responses were recorded by use of pen and paper.

3.6.4 Documentary Review And Analysis

Oso et al (2005) defined documentary analysis as a critical examination of public or private recorded information related to the issue under investigation. It is used to obtain unobtrusive information at pleasure of the researcher and without interrupting the researched. Official documents such as registers of the farmers with NAADS, registers of the farmers with NUSAF and other relevant information were utilized. This method was used because it enabled a researcher to come up with more data that is used to corroborate findings obtained through primary means.

3.7. Data Collection Instruments

3.7.1 Questionnaire

The researcher designed a set of questions and produced questionnaires basing on the objectives of the study and research questions in chapter one. The questions were mainly be closed ended to increase ensure easy data analysis. Section A covered background information of the respondents; Section B covered independent Variables (farmer characteristics, economic factors and social interaction factors). Section C covered adoption of sustainable farming practices which were measured by opinions on whether farmers were practicing or once practiced crop rotation, minimum tillage practices and cover cropping. Responses to a five point Likert scale were used to measure data for all the above variables of the study. A five point Likert scale ranging from strongly agree (5) to strongly disagree (1) was used because it is the most common and above all it assesses the strength of respondents feelings or attitude towards a subject. The

questionnaire has been selected as the main data collection tool because it is cheap to administer and covers a wide geographical area; it provides a hard copy that was filed for reference purposes. The questionnaire was equally used because the information had to be collected from a large sample in a short period of time (Sekaran, 2003).

3.7.2 Interview Guide

An interview guide was used in the study to collect detailed data from the key informants. The researcher used an interview guide in order to gather information on farmer characteristics, economic factors, social interaction factors and adoption of sustainable farming practices from NAADS, NUSAF, Community Development Officers, LC III officials, Agricultural Officers and Church Leaders. The instrument was used in data collection because it enabled researchers to get in-depth information about the study in question. In addition, an Interview guide is flexible and therefore allows the researcher to adjust the questions so as to tap the required information from the respondents (Odiya, 2009).

3. 8. Validity and Reliability

3.8.1 Validity

According to Katebire (2007:29), validity refers to the extent to which that data collection instrument collects data that have the characteristics or attributes the researcher wants to measure. Odiya (2009:198) defined validity of an instrument as the ability of the instrument to collect justifiable and truthful data; that is, measuring what it is developed to measure (Odiya, 2009:198). My supervisor and other experts in the field were consulted about the content of instruments, relevancy of question items and their relevancy. Therefore, the instrument(s) were

given to raters who rated the relevancy of each item. Validity of the questionnaire was tested using the content validity test (CVI).

$$CVI = \frac{R}{R + N + IRR}$$

Where;

Relevant (R), Neutral (N), Irrelevant (IR).

The closer to 1 the CVI, the more valid is the instrument (Odiya, 2009).

The closer to one the CVI the more valid is the instrument. The results of the CVI are shown in Table 3.2 below.

Table 3. 2: Content Validity Index of the study variables

Variable	**Total Number of items judged(relevant, neutral and irrelevant)**	**Number of items judged relevant**	**CVI**
Farmer characteristics	28	23	0.82
Economic factors	14	12	0.85
Social interaction	16	13	0.81
Sustainable farming practices	15	13	0.87

Source: From expert judgment

The computed CVIs were above the 0.60 threshold postulated by Odiya (2009) implying that the tools that were used in collection of the data contained valid questions.

3.8.2 Reliability

Reliability deals with the accuracy of the instrument and the consistency of the data collection by it (Katebire, 2007). Amin (2005) defined reliability as the consistency of the instrument in measuring whatever it is intended to measure. The questionnaire was pretested in Pader District. The reliability of the questionnaire was assessed using Cronbachôs Alpha at 0.05 level of

significance. According to Odiya (2009: 197), Cronbachôs alpha is used if the instrument has more than two responses provided for each item. Cronbachôs alpha coefficient was used to test for internal consistency of the research variables to test for the reliability of the questionnaire. The following formula was used;

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum \sigma_k^2}{\sigma^2}\right)$$

Where

× ů^2_k = the sum of the variances of the k parts (usually items) of the test.

ů = standard deviation of the test (items in the instrument).

Ŭ = reliability coefficient.

The results obtained was compared to the threshold of 0.60 recommended for social research by Odiya (2009).

The results obtained were as follows;

Table 3. 3: Reliability Analysis

Variable	**Number of items**	**Cronbach alpha coefficient**
Farmer characteristics	23	0.90
Economic factors	12	0.76
Social interaction	13	0.86
Sustainable farming practices	13	0.73

Sources: From primary data reliability test in SPSS

Table 3.3 above shows the alpha values of farmer characteristics = 0.90; economic factors = 0.76; social interaction = 0.86 and sustainable farming practices = 0.73 which are higher than 0.60 recommended for social research by Odiya (2009) suggesting that all the items used to measure each variable were consistent.

3.9 Procedure of Data Collection

After the proposal defense, the researcher got a cover letter from UMI allowing him to proceed to collect data and prepare the report thereafter. This necessitated the researcher to present this letter to the local authorities where the study was conducted for permission. Reliable and validated questionnaires were administered to the respondents by the researcher assisted by his research assistants. With regards to face-to-face interviews, the researcher contacted the key informants and provided them with a snap-shot of the study was about and thereafter requested for their consent to participate in the study.

3.10 Data Analysis

3.10.1 Quantitative Data

All the variables in the research as laid down in the questionnaire were measured on a nominal scale. All the returned questionnaires were edited and cleaned to ensure that the required information has been captured so as to facilitate easy analysis. The demographic characteristics of the respondents were analyzed using descriptive statistics in order to give an accurate description. Descriptive statistics using mean and standard deviation were used in analyzing the responses to each of the variables investigated under socio-economic factors and adoption sustainable farming practices. Pearsonôs Correlation and multiple regression analysis were used in establishing the relationship between the variables as hypothesized by the study and the nature of the effect of the independent variable on the dependent variable.

3.10.2 Qualitative Data

Qualitative data collected from interviews and documents review were sorted and grouped into

themes. The researcher analyzed the adequacy of information in answering the research questions through identifying categories and parameters that emerged in response to the study variables (Mugenda & Mugenda, 1999). While analyzing qualitative data, summaries were made on how different themes/variables were related. Narrative statements were used as well as verbatim quotations from the key informants. The qualitative findings were integrated with the quantitative data in order to give a holistic picture about the status of adoption of sustainable farming practices in Nwoya District as affected by farmer characteristics, economic factors and social interaction.

CHAPTER FOUR

PRESENTATION, ANALYSIS AND INTERPRETATION OF THE FINDINGS

4.1 Introduction

This chapter presents analyses and interprets the findings. The study investigated the socio-economic factors that affect adoption of sustainable farming practices Northern Uganda, Nwoya District. The objectives of the study were: to examine the influence of farmer characteristics on adoption of sustainable farming techniques by farmers in northern Uganda in Nwoya district; to examine the effect of economic factors on adoption of sustainable farming techniques by farmers in northern Uganda in Nwoya district and; to establish the influence of social interactions on adoption of sustainable farming techniques by farmers in northern Uganda in Nwoya district.

Frequency tables were used accordingly as a way of presenting statistical data. This study employed a triangulated design, therefore the interpretations and analysis of data was derived from open and close-ended questions in the questionnaire and structured interviews for selected key informants. The main research instrument and tool was the questionnaire.

4.2 Response rate

Out of the 375 questionnaires that were distributed, 300 were returned, yielding a response rate of 80.0%. All the 35 key informants targeted were interviewed resulting into a response rate of 100%. The response rate for this study was high since it surpassed the 70% as the lowest limit for social science research.

Table 4. 1: Summary of response rate from Nwoya District

Category of Respondent	Questionnaire			Interview guide		
	No of questionnaires distributed	Returned	Response rate	Targeted	Accessed	Response rate
Farmers	375	300	80%	-	-	-
Key informants	-	-	-	18	18	100%
Overall Response rate						80.9%

Source: Primary Data

The response rates for both the questionnaires and interview guides administered during the study were higher than the world standard of slightly above 22% (Ulengin & Uray, 1998). The high response rates of 80% and 100% respectively. The overall response rate was 80.9% which indicated that majority of the respondents were interested in the study. The interaction with key officials in Nwoya District as well as the farmers partly explains the high response rate. This rhymes the observation made by Asiimwe (2007) who stated that his past association with many of the respondents at various functions influenced the response rate`. However, to ensure that such interaction did not bias the responses, the objective of the research was explained in the introductory remarks in which the respondents were requested by the researcher to answer the questionnaire objectively and that their responses would be kept confidential and anonymous.

4.3 Background information of the Respondents

The researcher sought to obtain data on selected socio-economic characteristics of the respondents which included sex, age, highest academic qualifications and working experience. This section presents a summary of the findings about the sex, age, education and the working

experience of the respondents.

4.3.1 Gender of the Respondents

Respondents were asked to indicate their sex as stated in the self-administered questionnaires and the interviews. The following results were obtained;

Table 4. 2: Sex of the respondents

Sex	Category of Respondents			
	Farming households (n=300)		Key Informants (n=18)	
	f	%	f	%
Male	226	75	10	56
Female	74	25	8	44

Source: Primary Data

As indicated in table 4.2 above, male respondents were 226(75%) for staff and 10(56%) for key informants while female respondents were 74(25%) and 8(44%) for farmers and key informants respectively. There was a domination of male respondents over the females. This finding reflects the position that women have held since pre-colonial times; they have always been left out in some aspects where they would have been represented and where representation is observed, then it is imbalanced.

This finding does not mean that women are not (would not make) good administrators and decision makers as well as key in taking up new innovations but the stereotypic beliefs that have been carried over to the 21st Century continue to deny them balanced representation in aspects that involve decision making. This finding also implies that the study results reflect the views of both categories of gender. Males were more likely to contribute to adoption of sustainable farming practices in Nwoya District because of the higher propensity with which they get involved in the making of decisions pertaining to agriculture operations.

4.3.2 Age of respondents

The respondents were asked to indicate the age range in which they belonged. The following results were obtained;

Table 4. 3: Age of the respondents

Age	Category of Respondents			
	Farmers (n=300)		Key informants(n=18)	
	f	%	f	%
Below 20 years	20	7	-	
20-30	50	17	-	
31-40	221	73	14	78
41 +	9	3	4	22

Source: Primary Data

According to table 4.3, 20(7%) farmer respondents were below 20 years of age. None of the key informants were below 20 years of age. In the 20-30years age bracket, were 50(17%) farmers. The study findings further indicated that majority of the respondents 221(73%) and 14(78%) farmers and key informants respectively belonged in the 31-340 age brackets while 9(3%) and 4(22%) farmers and key informants were aged 41 years and above. This finding implies that the study was comprehensive since it covered a cross section of different age brackets. The age bracket of 31-40 years offers greater potential for adoption of sustainable farming practices as it comprised majorly of the respondents from both categories (farmers and key informants). The majority of the respondents in the 31-40 age bracket reflected that in Nwoya District, the possibility of adopting sustainable farming practices was higher, as along as other key influencing factors are addressed. This is largely so because the age bracket of 31-40 provides a cadre of farmers that have rich experience in farming and can thus easily adapt to or adopt new agronomic practices.

4.3.3 Level of education

The respondents were asked to indicate their highest academic qualification that was applicable to them as stated in the questionnaires and interviews. The following results were obtained;

Table 4. 4: Level of education of the Respondents

Level of Education	Category of Respondents			
	Farmers(n=300)		Key informants(n=18)	
	f	%	f	%
No formal education	156	52	-	
Primary	117	39	-	
Secondary	20	7	5	28
Tertiary	7	2	13	72

Source: Primary Data

Table 4.4 shows that 156(52%) of the farmers had no formal education, 117(39%) had completed primary education, 20(7%) had completed secondary education while 7(2%) had pursued tertiary education studies. The study findings also did not show that none of the key informants were primary school leavers nor had not had any formal education, 5(28%) had completed secondary education while 15(72%) had completed tertiary education. The number of illiterate farmers was high and this had the possibility of reducing on the uptake of innovations given the fact that the very farmers can hardly decode information associated with the new farming packages. However, though small, the study findings indicated that there were some progressive and enlightened farmers in Nwoya District who could be early adopters and early majority adopters of new farming innovations in the district.

Among the key informants, the high level of education among the respondents was largely because the positions they hold had formal training beyond primary school level as a minimum standard. The different levels of academic qualifications indicated a mixed category of

respondents who participated in providing data for this study. By implication, the findings of the study are informative largely because they captured the views of the respondents from different academic calibers.

4.3.4 Farming/working experience of the Respondents

The respondents were equally asked to indicate the number of years they had engaged in farming/ worked in their respective positions. This investigation was based on the proposition that the more the number of years, the greater would be the level of experience and therefore the more would be the knowledge they exhibit on the study variables. The following results were obtained**;**

Table 4. 5: Working experience of the Respondents

Working experience	**Category of Respondents**			
	Farming experience (farmers, n=300)		**Working Experience(Key Informants, n=18)**	
	f	%	f	%
Less than One year	-	-	2	11
1-5 years	12	4	15	83
5-10 years	265	88	1	6
More than 10 years	23	8	-	-

Source: Primary Data

As reflected in table 4.5 above, none of the farmers had practiced farming for less than one year, 12(4%) indicated that they had been in farming for 1-5 years, 265(88%) were into farming for 5-10 years while 23(8%) were into farming for more than 10 years. The study findings showed that 2(11%) of the key informants had a working experience of less than one year, 15(83%) had worked for 1 to 5 years, 1(6%) had worked for 5-10 years while none had worked for more than 10 years. As is common in formal organizations, the employees have term limits, some are laid off, others transferred while some work on contracts and therefore serve for a period not

exceeding 10 years. From the above table, majority of the respondents had served for more than 5 years in their respective designations. The long experience in these respective areas provided a basis for the accumulation of knowledge about the variables investigated by this study.

The higher response rate from the farmers and key informants that had practiced farming and worked in the organizations steering the transformation of farming activities respectively for more than 5 years implied that the respondents had potential for bringing about the effective adoption of sustainable farming practices since they had a wide stretching experience. The more experienced the farmers were, the higher was the propensity of venturing into sustainable farming practices.

4.3.5 Description of the respondents according to the source of income

The farmers were asked to indicate their source of income. The following results were obtained;

Table 4. 6: Description of the farmers by source of income

Source of Income	**Frequency**	**Percentage**
Selling farm produce	235	78
Have non-farm sources	60	20
Both farm and non-farm sources	5	2
Total	**300**	**100**

Source: Primary Data

Table 4.6 shows that 235(78%) of the farmers indicated that their source of income was from sales of farm produce, 60(20%) indicated that their source of income was from non-farm produce while 5(2%) indicated that their source of income was from both sales of farm produce and non-farm sources. Majority of the farmer respondents relied on proceeds from sales of farm produce

as their major source of income. The over reliance on income from sale of farm products means that the income of the farmers is very erratic given that the traditional and conventional form of farming hitherto engaged in is very prone to the vagaries of weather. This could be a limiting factor for the large-scale switching of farmers from conventional to sustainable farming practices in the district.

4.4 Research Question One: How do Farmer Characteristics affect the Adoption of Sustainable Farming Practices?

The first research question of the study was to determine how farmer characteristics affected the adoption of sustainable farming practices in Nwoya district. Farmer characteristics were conceptualized into seven constructs: risk aversion; influence of age of the farmer; influence of education and training; membership in a farmersô group, land ownership and perceived complexity. In addition, the study aimed at testing the hypothesis: ñFarmer characteristics affect the adoption of sustainable farming practicesò.

The following section presents and interprets the general perception of the respondents about sustainable farming practices, the general perception about characteristics of farmer respondents, the correlation coefficient between farmer characteristics and adoption of sustainable farming practices and the regression analysis of farmer characteristics and adoption of sustainable farming practices.

4.4.1 Description of sustainable farming practices according to farmer respondents

The respondents were asked to indicate their opinion on the main concepts of sustainable farming practices that were investigated by the study. The following results were obtained;

Table 4.7: Descriptive statistics showing the rating of the responses on the levels of adoption of sustainable farming practices

Practice of Crop Rotation	N	Mean	St.Dev.
1. Crop rotation protects soil from nutrient loss	300	3.03	1.21
2. I practice crop rotation to reduce soil compaction	300	3.19	1.97
3. I practice crop rotation to lessen the need for pest control using inorganic chemicals	300	2.67	1.11
4. I adopted crop rotation in orders to reduce the spread of soil-borne disease	300	2.13	1.22
Use of cover crops			
5. I use cover crops to improve soil properties on my farm	300	3.22	1.32
6. Cover crops decrease weed populations in my gardens	300	2.97	1.17
7. I plant cover crops to reduce water runoff and soil erosion	300	3.06	1.01
8. Cover-crop mulching offers me opportunities by increasing soil fertility and improving weed management	300	4.82	0.87
9. I grow cover crops to conserve nitrogen in the soil	300	2.31	1.33
Use of minimum tillage practices			
10. I till my plot minimally to avoid wind and water erosion	300	2.37	1.42
11. I use minimum tillage to conserve soil moisture	300	1.89	1.09
12. With Minimum tillage practice, less organic matter is lost	300	3.36	1.10
13. Minimum tillage increases on soil organic matter (SOM)	300	3.11	1.15

Key:1.00-2.99=Disagreed, 3.00=Not Sure, 3.01-5.00= Agreed
Source: Primary Data

From Table 4.7, majority of the respondents agreed to the benefits of using sustainable farming practices. Findings of the study as shown in Table 4.7 show that majority of the respondent agreed that use of crop rotation protects the soil from nutrients loss (Mean = 3.03, St. Dev = 1.21) and further agreed that they decided to practice crop rotation because it helps to reduce on

the compaction of soil as the soil is not over tilled but, rather given enough resting time (Mean =3.19, St. Dev = 1.97). The use of crop rotation brings about retention of soil nutrients and further reduces the possibility of compaction of soil particles. Crop rotation is thus a key sustainable farming practice largely because it mitigates the occurrence of flash floods that normally occur when the soil has become compact and developed a hard pan. The flash flooding causes the leaching of soils leading to the development of lateritic soils which only support murrum quarrying and livestock grazing rather than arable farming which supports the livelihoods of over 95% of the population in Nwoya District.

Through interviews with the respondent key informants constituted by NAADS, NUSAF staff and sub county agricultural officers, findings of the study indicated that a score of farmers in Nwoya District had adopted and were practicing sustainable farming practices. The respondents indicated that the possible determinant of adoption was that sustainable practices carried potential benefits for farmers who adopted them. The respondent (technical) key informants mentioned above revealed the various benefits realized through adopting sustainable practices such as crop rotation, minimum tillage and growing of cover crops such as beans, sweet potatoes and ground nuts. For example, conservation tillage can reduce costs, minimize erosion, and increase soil health. In addition, the NAADs key informants revealed that these practices also provide social benefits, such as providing products for the local community, or maintaining the farm for future generations. The perceived benefits from these specific sustainable practices such stimulate a farmer to adopt a sustainable practice. As evidenced through informal interviews with farmers, if a farmer is dissatisfied with conventional practices, these benefits are even more enticing.

The key informants summed the innumerable benefits of sustainable farming practices cited above in the following statements;

> *"…, sustainable farming practices are the way to go…, they ensure continuity among the farmers because the lost nutrients from the soil easily get replenished. Practically, if most if not all the farmers in this district in particular and other parts of Uganda massively adopt some or all the sustainable farming practices, poverty will be given a big blow because the productivity of the farmers will grow manifold, income from farming will more than double and the mighty of Uganda as a regional food basket will be rejuvenated…"* (NUSAF Official, Nwoya District, 10th January 2014)

Equally too, the NAADS staff echoed the perceived benefits of adopting sustainable farming practices by farmers of Nwoya District. One Staff had this to say;

> *"…, sustainable farming practices serve as an all-time solution to the problems that have hitherto faced the farmers as well as threatening their capability to attain food security given the bounty of natural resource endowments in the district. Sustainable farming practices once adopted serve as a PIN code to unlock all the structural problems that have been brought about by conventional such as declines in farmer productivity and the consequent food insecurity…"*(NAADS Official, Nwoya District, 7th January 2014)

The study findings also indicated that majority of the respondents disagreed that they practiced crop rotation to lessens the need for pest control using inorganic chemicals (Mean =2.67,

St,Dev =1.11) while the respondents equally disagreed that they had adopted crop rotation to reduce on the spread of soil borne diseases (Mean =2.13, St. Dev =1.22). These findings show that most farmers in Nwoya District lacked practical information about the viability of crop rotation in reducing the need to use inorganic chemicals that are detrimental to the soil as they affect the micro living organisms which are necessary for the soil to retain its fertility. The respondents were not aware that the practice of crop rotation too, has a significant impact on reducing the spread of soil borne diseases. The lack of knowledge among the farmers has thus brought about the limited uptake of crop rotation as a sustainable farming practice in Nwoya District.

The key informants further indicated that crop rotation was the central farming practice. A root crop, such as potatoes, is supposed to be followed by one year of grain, seeded out to simsim, followed by other crops such as maize then to millet for one to two years then back to root crops. This would result in what is typically known as a four-year rotation, although the actual length varied by farm from four to six years. However, the study findings indicated that farmers were not strongly committed to strict crop rotation practices. The respondents revealed that the few farmers who were engaged in crop rotation as a sustainable farming practice acknowledged crop rotation as an effective measure in weed control, soil conservation and in sustaining organic matter and other elements in the soil. This was attributed to the subsistence nature of the farming operations coupled with lack of sensitization about the viability of practicing crop rotation among most of the farmers in the district. One of the Sub County Agricultural Officers had this to say;

> *"…, much as crop rotation is a major sustainable farming practice, most farmers in Nwoya District seldom practice it. However, basing on the attribute of planning of the farmers here basing on their farming calendars, the feasibility of crop rotation becoming an admirable practice among the farmers is higher…, the missing link in the matrix is nothing but intensive sensitization …"*(Sub County Agricultural Officer, Nwoya District, 18th January 2014)

Majority of the respondents as per Table 4.7 indicated that they used cover crops to improve on soil properties and yields on their farms (Mean=3.22, St. Dev =1.32), planted cover crops to reduce on water runoff and soil erosion (Mean =3.06, St. Dev =1.01) as well as the impact of cover crop mulching that offered them opportunities of increasing the fertility of the soil as well as improving on weed management (Mean=4.82, St.Dev= 0.87). Cover crops such as ground nuts, beans, sweet potatoes and sim sim improve on soil fertility because they fix nitrogen in the soil (the legumes like beans and ground nuts) and reduce on the water run-off and soil erosion after it has rained because the uniform crop cover prevents the direct hitting of the strong rain drops on the soil particles. This protects the soil from splash, sheet and rill erosion. However, the respondents disagreed that they grew cover crops to decrease the weed populations in their gardens (Mean=2.97, St.Dev =1.17) as well as growing the cover crops to conserve nitrogen in the soil (Mean=2.31, St. Dev = 1.33). The findings meant that farmers disagreed that cover cropping minimizes the growth of weeds and conserves nitrogen in the soil because they have not been adequately sensitized by the promoters of sustainable farming practices about the contribution of cover crops in conserving nitrogen in the soil as well as minimizing the rate of

growth of weeds. This could partly explain why the numbers of farmers growing cover crops as a sustainable farming practice is very low in some parts of Nwoya such as Purongo.

The key informants further revealed that increased levels of organic matter and improved soil structure, including soil aggregation occur under organic fertility-building schemes, rotation cropping and conservation tillage methods, resulting in greater soil water-holding capacity and infiltration In addition, the residues left on the soil surface through reduced tillage or use of groundcovers improves drought resilience by decreasing evaporation rates, increasing water infiltration, and reducing raindrop impact and runoff velocity. Minimum tillage has improved plant-rooting conditions as well as increasing water-use efficiency. The NAADS officials revealed that itôs on the basis of these numerous benefits of cover cropping, use of minimum tillage and practice of crop rotation that some farmers in Nwoya district have adopted the trio, though on average, the biggest percentage of farmers in the district have continued to practice conventional agriculture.

The study findings indicated that majority of the farmers who participated in the study disagreed that they minimally tilled their plots of land to avoid wind and water erosion (Mean=2.37, St. Dev = 1.42) and equally disagreed that the used minimum tillage to conserve soil moisture (Mean=1.89, St. Dev = 1.09). However, they agreed that with minimum tillage, less organic matter is lost (Mean=3.36, St. Dev = 1.10) while they also agreed that practicing minimum tillage increased on the soil organic matter (Mean=3.11, St.Dev =1.15). Though some farmers were aware the practice of minimum tillage increased on the soil organic matter as well as

reducing on the loss of organic matter, they were not aware about the impact of minimum tillage on controlling soil erosion and soil moisture conservation and yet these are key aspects of sustainable farming as opposed to conventional agriculture commonly practiced by farmers in Nwoya district.

4.4.2 Description of farmer characteristics according to farmer respondents

The respondents were asked to indicate their opinion on the farmer characteristics that were investigated by the study. The following results were obtained;

Table 4.8: Descriptive statistics showing the rating of the respondents on farmer characteristics

Risk aversion	**N**	**Mean**	**St.Dev**
1. Perceived risks never deter me from trying out any innovations in my farming activities	300	3.25	1.08
2. I always venture into a new farming activity irrespective of the likely increase in costs	300	2.01	1.23
3. Financial risks never prevent me from uptake of a new farming investment	300	4.21	0.74
4. New farming innovations are less risky to the environment than conventional farming practices.	300	3.00	1.03
Effect of education and training			
5. I have always received training on how to make wise decisions regarding my farming activities	300	1.97	1.23
6. I easily decode information about new farming packages	300	2.97	1.91
7. Training by extension workers increases my willingness to try out new farming practices	300	2.42	1.21
8. Training has improved on my managerial skills	300	2.66	1.17
9. Demonstrations on farmer field schools make me to drop the doubts on a new farming innovation.	300	3.33	1.00
Effect of age of the farmer			
10. My experience with a farming activity affects my decision to try out a new farming innovation	300	2.79	1.22
11. I take time to perceive a new innovation before I switch to it	300	4.43	0.56

12. I am less receptive to new innovations and prefer continuity with the traditional farming practices	300	3.82	0.99
Membership in a farmers' organization			
13. I belong to a farmersô group for knowledge sharing	300	4.00	0.89
14. Members in our farmersô organizations impart skills in me on aspects like marketing and better agronomic practices	300	1.82	1.43
15. I always copy and implement what farmers in my group do	300	2.44	1.21
Land Ownership			
16. Land property rights affect my decision to adopt a new farming innovation	300	2.50	1.20
17. Land tenure system in this area is not favorable for implementation of some innovative farming practices	300	2.61	1.18
Perceived Complexity			
18. New farming innovations are usually compatible with traditional farming activities	300	1.44	1.26
19. Sometimes, new faming innovations are difficult for me to try out	300	4.63	0.69
20. Usually, new farming practices are not divisible as compared to traditional ones	300	3.82	1.00
21. Farm characteristics at times affect my willingness to try out new farming innovations	300	2.22	1.14

Key:1.00-2.99=Disagreed, 3.00=Not Sure, 3.01-5.00= Agreed
Source: Primary Data

From Table 4.8, majority of the responses showed that most of the farmers characteristics were unfavorable as shown by mean values below 3.00. Table 4.8 shows that majority of the respondents agreed that while they chose to try out any new innovations in their farming operations, any incidence of perceived risk never deterred them (Mean=3.25, St.Dev,=1.08) and further agreed that financial risks never prevented them from uptake of a new farming innovation. However, the respondents disagreed that have always ventured into a new farming activity irrespective of the likely increase in costs (Mean=2.01, St.Dev=1.23) and were equally not sure whether new farming innovations were less risky to the environment (Mean =3.00, St.Dev=1.03).

Education and training are conceived to be key factors that induce the decision making of an individual in taking up a new activity. Education and training as well help to create confidence in an individual to venture into a hitherto perceived risky activity because after training, one can easily decode all the procedures that accompany the innovation. Tableé shows that majority of the respondents disagreed that they always received training on how to make wise decisions regarding their farming activities (Mean= 1.97, St. Dev =1.23) and equally disagreed that they easily decoded information about new farming packages (Mean=2.97, St. Dev =1.19). The respondents further disagreed that the training they got from extension workers increased on their willingness to try out new farming practices (Mean=2.42, St. Dev =1.21) and disagreed that training increased on their managerial skills (Mean=2.66, St. Dev =1.17). Though these findings indicate that the farmers never derived benefits from the extension by for example arguing that the training they received from the extension workers was not strategic in a way that it would induce a farmer to decide and take up new farming innovations. However, the respondents agreed that demonstrations on the farmer field schools made them drop the doubts on new farming innovations introduced in the area (Mean=3.33, St. Dev=1.00). Demonstrations on farm field schools therefore offered the opportunities of achieving high levels of adoption of sustainable farming practices in the district.

Findings of the study indicated that the key informants revealed that farmer characteristics greatly affected the adoption of farming innovations in Nwoya district.In general, farmers learned from one another. There was a great deal of sharing of information, ideas and manpower and equipment. The key informants indicated that traditional farmers possessed a great deal of wisdom in farming operations and therefore more susceptible to adopting sustainable farming

practices. Findings of the study further indicated that though old farmers didn't have a lot of formal education, however, they were very wise and proved more adaptive to new farming practices. The emphasis on the wisdom of the farmers in Nwoya was stressed by the Sub County Agricultural officers when one of them said;

> *"…, a farmer in Nwoya who has never gone to school is a practical farmer…, the techniques used in determining the harvesting months, ploughing time, seeding time and weeding exactly manifests a cadre of people that can ably take up new and modern agronomic farming practices with a mere sensitization through for a such as farmer field schools or show casing in exhibitions and expo by the model farmers…"*(Sub County Agricultural Officer, Nwoya District, 16th January 2014)

Table 4.8 shows that majority of the farmers disagreed that their experience with a farming activity affected their decision to try out a new farming innovation (Mean=2.79, St. Dev,=1.22). However, majority agreed that they took time to perceive a new innovation before they switched to it (Mean=4.43, St.Dev.= 0.56) and equally agreed that they were less receptive to a new innovations and preferred continuity with the traditional farming practices(Mean=3.82, St.Dev=0.99). This finding therefore showed that the farmers in Nwoya district would adopt farming practices they likened to their conventional farming practices as compared to those that appeared more new to them. This finding implies that the adoption of a farming innovation in the district as is the case with other places where innovations in farming have been adopted is preceded by familiarization. Therefore, the more novel the technology, the more time it would take to be assimilated into the farming domain of the district.

Formal extension efforts provided by the farmer groups can greatly influence the adoption of sustainable farming practices as revealed by the key informants in the area. The respondents underscored the importance of one-on-one contact as golden in the dissemination of a great deal of information to the farmers. In such a case, the passing on of the credible information about the importance of sustainable farming practices would most likely induce the farmers to drop the conventional farming practices and adopt the sustainable farming practices.

Belongingness to a farmersô group was considered an ideal condition likely to induce a member farmer to consider the uptake of a new farming innovation. Findings of the study indicated that majority of the respondents agreed that they belonged to a farmerôs group for knowledge sharing (Mean=4.00, St.Dev=0.89). However, they disagreed that members in their farmersô organization and /or group imparted skills in them on aspects like marketing and better agronomic practices(Mean=1.82, St.Dev=1.24) and as well disagreed that they always copied and implemented what fellow farmers in their groups did(Mean=2.44, St.Dev=1.13). The influence of farmers organizations in imparting skills among the farmers as well as grooming role models that would be emulated by the members in their quest to adopt new farming innovations was very negligible in Nwoya District and therefore led to low rates of adoption of new farming innovations. Such thus provided antecedents for the low adoption of sustainable farming practices in Nwoya district.

Like other developments in farming, the study sought to establish whether land ownership was a key factor influencing the adoption of new farming innovations. Study findings indicated that the respondents disagreed that land property rights affected their decision their decision to adopt a new farming innovation (Mean=2.50, St. Dev=1.20) while they also disagreed that land tenure

system in Nwoya District was not favorable for implementation of some innovative farming practices (Mean=2.61, St.Dev=1.18). Land property rights and land tenure system affected the adoption of sustainable farming practices in the area. Whereas ownership of land, leased or hired land can still be favorable for the implementation of the new farming gear, sustainable farming practices are easily adopted by farmers who own land as it at times involves resting some land or tilling sparingly under minimum tillage farming practices. Therefore, in the context of Nwoya district, the low rate of uptake of sustainable farming practices was to some extent caused by the land property rights and the land tenure system in the area.

Perceived complexity of farming innovations is likely to either favour or otherwise the possibility of an individual farmer taking up a new farming innovation. Findings of the study indicated that majority of the respondents agreed that sometimes, new farming innovations were difficult for them to try out (Mean=4.63, St.Dev=0.69) and as well agreed that usually, the new farming practices were not divisible as compared to the traditional ones (Mean=3.82, St Dev=1.00). The respondents disagreed that the new farming innovations were usually compatible with the traditional farming activities (Mean=1.44, St. Dev=1.06) and as well disagreed that farm characteristics at times affected their willingness to try out new farming activities(Mean=2.22, St. Dev=1.10). The complexity of the sustainable farming practices made it difficult for farmers to drop the hitherto familiar conventional farming systems. This was made worse by the indivisibility of the sustainable farming techniques which unlike the traditional farming practices obliged the farmers to implement a set of activities and yet the farmers were used to piecemeal activities under that latter.

Findings from interviews with the key informants revealed that sustainable practices that were easier to implement, or more compatible to the geographical area and to the needs of the farmer, were more frequently adopted than those that are not. Practices such as crop rotation and rotational grazing have thus been widely adopted in Nwoya district as compared to practices such as organic production or large-scale composting that continue to be adopted on a much more limited scale. The latter practices are usually not as similar to or compatible with conventional strategies as the former and require more of a learning and time commitment to adopt successfully. Therefore, the adoption of sustainable practices required a significant commitment of time and learning. NUSAF staff indicated that while they have been at the forefront of ensuring that farmers in the district adopt farming practices that are friendly to the environment as well as boosting the capacity of farmers to produce to the maximum for both income and food security, the time factor element continues to become a barrier to the uptake of technologies among the farmers. Below is a summation of the impact of time on the adoption of sustainable farming practices in the district;

> *"…, as per my experience with farmers in this region and my formal training in crop and animal husbandry from university, adoption of new agronomic practices is a child of time and learning…, it calls for commitment from farmers and is amplified by the supportive and conducive extension services provided from time to time. While it would be our wish to be near to the farmers to provide due guidance, the logistical and structural rigidities in the area such potholed roads and the skyrocketing fuel prices make us incapacitated!…"*(NUSAF official, Nwoya District, 13th January 2014)

The above finding from the interviews implies that farmers in Nwoya needed more extension and outreach services. Such, over a period of time would enable the farmers to accumulate more knowledge about the sustainable farming practices and thus help to increase on the propensity of adoption.

4.4.3 Correlation between farmer characteristics and adoption of sustainable farming practices

A correlation coefficient was used to establish whether there was a relationship between farmer characteristics and adoption of sustainable farming practices. Pearson correlation matrix was used to establish the relationship between the variables of the study because they were numerical. Table 4.9 provides a summary of farmer characteristics and adoption of sustainable farming practices.

Table 4.9: Correlation table showing the effect of farmer characteristics on adoption of sustainable farming practices

		Farmer characteristics	Adoption of sustainable farming practices
Farmer characteristics	Pearson Correlation	1	.543(*)
	Sig. (2-tailed)		.003
	N	300	300
Adoption of sustainable farming practices	Pearson Correlation	.543(*)	1
	Sig. (2-tailed)	.003	
	N	300	300

* Correlation is significant at the 0.05 level (2-tailed).

Table 4.9 shows that the correlation coefficient for farmer characteristics and adoption of

sustainable farming practices was r=0.543, p=0.03<0.0.5. These imply that there is a significant positive correlation between farmer characteristics and adoption of sustainable farming practices. Therefore, favorable characteristics of farmers or improvements in the characteristics of the farmers lead to improvement in adoption of sustainable farming practices.

4.4.4 Regression analysis testing the research hypothesis

A regression analysis was conducted to measure the extent to which farmer characteristics and adoption of sustainable farming practices using the adjusted R^2 values, standardized beta values, t values and the significance measured at 0.05 confidence level. The results are tabulated in table 4.10 below.

Table 4.10: Showing Regression results between farmer characteristics and adoption of sustainable farming practices

Predictor	Adjusted R Square	Df	Mean square	F	Sig.
	0.412	1	2.384	8.044	0.005[a]
			Standardized coefficients	t	Sig.
	Adjusted R square	Std error	Beta (*B*)		
Constant		0.289		4.864	0.000
Farmer characteristics	0.412	0.124	0.368	2.707	0.005

a. Predictor: (constant), Farmer characteristics
b. Dependent Variable: Adoption of sustainable farming practices

The regression model in table 4.10 above shows adjusted R^2 value of 0.412 between farmer characteristics and adoption of sustainable farming practices suggesting that farmer characteristics predicted 41.2% of the variance in adoption of sustainable farming practices suggesting that farmer accounted for a variation in adoption of sustainable farming practices in

Nwoya District of 41.2%. The Beta Value (= 0.368) implies that farmer characteristics have a positive impact on adoption of sustainable farming practices such that an improvement in favorable farmer characteristics or any improvement in farmer characteristics brings about an increase in the adoption of sustainable farming practices by 36.8 times. Therefore, the hypothesis that farmer characteristics significantly affect the adoption of sustainable farming practices is accepted by this study. The implication is that to achieve the expected adoption levels of sustainable farming practices, the government and non-state actors such as SNV should devise strategies to address the deficiencies in the farmer characteristics at all times as a means of making the farmers receptive to new farming innovations. In other words achievement of high levels of adoption of sustainable farming practices is based on training of famers and equipping them with skills, sensitization of the farmers to make the technologies and innovations appear less complex as well help to expose the farmers to avenues of addressing the perceived risks associated with new technologies.

4.5 Research Question Two: To what extent do Economic Factors affect Adoption of Sustainable Farming Practices?

The second research question of the study was to determine the extent to which economic factors affected the adoption of sustainable farming practices in Nwoya district. Economic characteristics were conceptualized into four constructs: cost of inputs or technology, perceived benefits of adoption, availability and access to credit and availability of infrastructure. In addition, the study aimed at testing the hypothesis: ñeconomic factors affect the adoption of sustainable farming practicesò.

The following section presents and interprets the general perception about economic factors, the

correlation coefficient between economic factors and adoption of sustainable farming practices and the regression analysis of economic factors and adoption of sustainable farming practices

4.6.1 Descriptive statistics on the effect of economic factors on the adoption of sustainable farming practices

Table 4.11: Descriptive statistics showing the rating of the respondents on economic factors influencing the adoption of sustainable farming practices in Nwoya District.

	Cost of inputs/technology	N	Mean	St.Dev
1.	I have resources to support trial of new farming innovations	300	2.80	1.02
2.	The cost of switching from a traditional farming technique to a new innovative technique is low	300	2.32	1.00
3.	I normally get subsidies from central/local government to support my decision to adopt a new farming innovation	300	2.17	1.23
	Farm size			
4.	The size of my farm determines my decision to take up an innovation	300	2.63	1.06
5.	Small sized farms are better for trying out new farming practices	300	2.21	1.09
	Perceived advantages			
6.	I am willing to take a new farming activity as long as I am convinced that its worth/profitable	300	4.33	0.36
7.	I always compare between an old practice and a new one before making a decision	300	3.42	0.89
	Availability and access to credit			
8.	Financial institutions easily give out credit to me	300	2.00	1.11
9.	I use more of credit to buy farm inputs than my savings	300	3.27	1.22
10.	Interest rates on credit are favorable for me	300	2.17	1.04
11.	I need more credit because new farming innovations are more costly than traditional ones	300	3.99	0.97
	Infrastructure			
12.	Availability of well surfaced feeder roads have influenced my intake of new farming practices in this area	3.00	4.11	0.73

Key:1.00-2.99=Disagreed, 3.00=Not Sure, 3.01-5.00= Agreed
Source: Primary Data

From Table 4.11, majority of the respondents indicated that most of the economic factors were unfavorable with mean values below 3.00 (7 items). The cost of the inputs and /or the technology was investigated by the study to establish their degree of effect on the adoption of new farming innovations. Study findings indicated that the majority of the respondents disagreed that they had resources to support the trial of new farming innovations (Mean=2.80, St.Dev=1.02) and further disagreed that the cost of switching from a traditional farming technique to a new innovative technique was low(Mean=2.32, St.Dev=1.00) and also disagreed that they normally got subsidies from the government both at Central and local level to supported their decision to adopt a new farming innovation(Mean=2.17, St.Dev=1.23). The inavailability of subsidies and inadequacy of resources to support and sustain the trails of new innovations has thus hampered the decisions of the farmers to adopt new agricultural technologies, sustainable farming practices such as crop rotation, cover cropping and minimum tillage inclusive.

The respondents most particularly NAADS, NUSAF and sub county agricultural officers revealed that though sustainable farming was the way to go for the farmers in Nwoya District, the willingness to adopt the farming practices was high among the farmers but hampered by the economic base of the farmers. Given the susceptibility of the farming enterprises to the vagaries of weather, the financial institutions were seldom willing to loan out money to the farmers because the repayment of the principal and the interest rates attached were very dim. This effect of lack of credit was emphasized as a key barrier in the adoption of sustainable farming practices in the following statements;

> *"…, the availability and accessibility of credit to farmers is a fundamental factor that determines the choice of a*

> *farming enterprise or an agronomic practice…, a farmer who lives in abject poverty considers spending their meager money amidst the insatiable wants a loss, a wrong choice, a disaster. The farmers we support and sensitize sometimes rarely access the money required for their farming enterprises… they have become negative and most of the time question why we introduce practices that we cannot adequately fund.."* (NUSAF official, Nwoya District, 13th January 2014).

In such a situation therefore, agronomic practices that compel farmers to seek for credit will rarely be adopted given the fact that the farmers in Nwoya are rarely considered credit worthy by the financial institutions in the area.

Regarding farm size, findings of the study majority of the respondents disagreed that the size of their farm determined their decision to take up an innovation (Mean=2.63, St. Dev=1.06) while they also disagreed that the small sized farms were better for trying out new farming practices (Mean=2.21, St. Dev =1.09). The results of the study on the basis of farm size therefore meant that large size was a pre-requisite for the adoption of new agricultural innovations in Nwoya and therefore, farmers with small sized farms were not capable of adopting sustainable farming practices such as crop rotation that entails a farmer to rotate from one portion of the farm to the other assuming the chunk of land is consolidated or rotating from plot to plot in case the land pieces were fragmented. Land size therefore was a limiting factor to the uptake of sustainable farming practices in the district.

Findings from interviews with the key informants were in support of the responses of the farmers. They revealed that the shortage of arable land in the district grossly affected the willingness of the farmers to adopt sustainable farming practices such as crop rotation that entails a farmer to rest some part of their land to allow it regain fertility as well as grow different crops. The key informants also indicated that though some practices like cover cropping never required big sized land, however, others at large such as crop rotation and minimum tillage required a farmer to have a big sized land. Therefore, farmers with sizeable plots of land are left out when new farming innovations are piloted in the area.

The study assessed whether the perceived advantages of a given farming innovation induced its uptake among the farmers in Nwoya District. Findings of the study indicated that majority of the respondents agreed that they are ever willing to take up a farming activity as long as they are convinced that its worth or profitable (Mean= 4.33, St. Dev=0.36) and further agreed that they always compared between and old practice and a new one before finally making a decision to implement a new farming innovation (Mean=3.42, St.Dev=0.89). The higher the degree of benefits anticipated by a farmer or any other commercial enterprise, the higher is the propensity with which they decide to engage in the same. The respondents agreed that their chose to engage in the sustainable farming practices was largely because the net benefits were higher than those from the conventional means, let alone the recurrence of the benefits as compared to the conventional system of farming they hitherto practiced.

According to the key informants who were interviewed, the perceived advantages of sustainable farming practices have induced the farmers to adopt sustainable farming practices in the district.

However, the key informants reiterated that though the perceived advantages were a necessary condition for a farmer to adopt sustainable farming practices, they were not sufficient enough to cause the adoption of sustainable farming practices in the district since cost overruns, availability of credit and farmer characteristics were more key.

The availability and access to credit was investigated as a key factor the increased on the propensity with which a farmer would consider taking up a new practice or innovation to broaden the scope of their activities. The respondents were asked to indicate whether the financial institutions in Nwoya district easily gave them credit to finance their farming activities as well as to finance their venture into new farming practices. The findings of the study indicated that the respondents disagreed that the financial institutions in the district easily gave them credit (Mean=2.00, St. Dev=1.11) and equally disagreed that the interest rates on the credit they accessed were favorable to them. The failure of the farmers to access credit from the financial institutions in Nwoya District as well as the high interest rates in case they got any limited the expansion, modernization and upgradation of the techniques used in conventional system. The findings of the study further indicated that the respondents agreed that that they used more of credit to buy farm inputs as compared to their savings (Mean= 3.27, St. Dev=1.22) , they agreed that they needed more credit because new farming innovation were more costly as compared to the traditional farming practices (Mean=3.99, St. Dev=1.04). The high cost of adopting the new farming innovations has worked hand in hand with the limited access to credit to bring about a low rate of adoption of the new farming technologies, sustainable farming practices inclusive.

The study findings also indicated that the respondents strongly agreed that the availability of well surfaced feeder roads had an effect on their uptake of new farming practices (Mean=4.11, St. Dev=0.73). This finding means that availability of well laid road network is a potential factor affecting the possibility of the farmers taking up new innovations. Well laid transport by road network is necessary for distribution of inputs and affects the degree with which the farmers can team up with others as well as increasing on the outreach of the extension service providers.

4.5.2 Correlation between economic factors and adoption of sustainable farming practices

Table 4.12: Correlation table showing the relationship between economic factors and adoption of sustainable farming practices

		Economic factors	Adoption of sustainable farming practices
Economic factors	Pearson Correlation	1	.611(*)
	Sig. (2-tailed)		.01
	N	300	300
Adoption of sustainable farming practices	Pearson Correlation	.611(*)	1
	Sig. (2-tailed)	.01	
	N	300	300

* Correlation is significant at the 0.05 level (2-tailed).

Table 4.12 shows that the correlation coefficient for economic factors and adoption of sustainable farming practices was r=0.611, p=0.01<0.0.5. These imply that there is a significant positive correlation between economic factors and adoption of sustainable farming practices. Therefore, favorable economic factors or improvements in the economic environment lead to improvement in adoption of sustainable farming practices.

4.5.3 Regression analysis testing the research hypothesis: "Economic factors have a significant effect on adoption of sustainable farming practices"

A regression analysis was conducted to measure the extent to which economic factors related to adoption of sustainable farming practices using the adjusted R^2 values, standardized beta values, t values and the significance measured at 0.05 level. The results of are tabulated in table 4.13 below;

Table 4.13: Regression results between economic factors and adoption of sustainable farming practices

Predictor	Adjusted R Square	Df	Mean square	F	Sig.
	0.383	1	3.014	5.432	0.006[a]
			Standardized coefficients	t	Sig.
	Adjusted R square	Std error	Beta (*B*)		
Constant		0.231		5.567	0.000
Economic factors	0.383	0.164	0.355	2.567	0.006

a. Predictor: (constant), Economic factors
b. Dependent Variable: Adoption of sustainable farming practices

The regression model in table 4.13 above shows adjusted R^2 value of 0.383 between adoption of sustainable farming practices suggesting that economic factors predicted 38.3% of the variance in adoption of sustainable farming practices. The Beta Value (= 0.355) implies that economic factors have a positive impact on adoption of sustainable farming practices such that favorable economic environment for farmers or any improvement in the same brings about an increase in the adoption of sustainable farming practices by 35.5 times. Therefore, the hypothesis that there is a significant positive effect of economic factors on adoption of sustainable farming practices is

accepted by this study. The implication is that to achieve the expected levels of adoption of sustainable farming practices, the promoters of new farming innovations should devise the strategies that address the economic factors that have constrained the ease with which the farmers in Nwoya District venture into the adoption of sustainable farming practices. In other words achievement of higher levels of adoption of sustainable farming practices will occur among the farmers in the district if the supporting bodies such as NUSAF and NAADs devise strategies to bring about the economic empowerment of the farmers.

4.6 Research Question Three: In What Ways do Social Interactions affect the Adoption of Sustainable Farming Practices?

The third research question was to find out the effect of social interaction on adoption of sustainable farming practices. Social interaction was conceptualized to mean availability of farmersô social networks, interaction with change agents and access to information on sustainable farming practices. In addition, the study aimed at testing the hypothesis: ñSocial interaction has a significant positive effect on adoption of sustainable farming practicesò. The following section presents and interprets the general perception of the respondents about effect of social interaction, the correlation coefficient between social interaction and adoption of sustainable farming practices and the regression analysis of social interaction and adoption of sustainable farming practices.

4.6.1 General perception of respondent staffs on the effect of social interaction on adoption of sustainable farming practices

The respondents were asked their opinion concerning the various attributes of social interaction

including the influence of social networks, interaction with change agents and access to information on sustainable farming practices. The following results were obtained;

Table 4.14: Description of aspects of social interaction

Effect of Social Networks	N	Mean	St.Dev
1. There are many farmer social networks in this area	300	2.18	1.20
2. I am a member to a social network of farmers	300	3.11	1.02
3. I make use of social networks to access new information even when I am not a member	300	3.39	1.11
4. Role models influence my decisions	300	4.33	0.79
5. I always acquire new information from a social network that I used in making decisions	300	2.97	1.13
6. Influential opinion leaders advise me on the viability of new farming innovations	300	3.67	1.15
Interaction with change agents			
7. Change agents always translate my intent into action	300	4.03	0.9
8. Change agents influence my decisions	300	3.61	1.00
Access to information on sustainable farming practices			
9. I use varied sources of information	300	1.73	1.14
10. I get reliable and accurate information	300	3.00	1.03
11. The information I access reduces on uncertainties	300	4.88	0.53
12. Information accessed exposes me to probable risks	300	2.14	1.15
13. There are well established institutions to provide me with reliable and accurate information.	300	2.84	1.05

Key:1.00-2.99=Disagreed, 3.00=Not Sure, 3.01-5.00= Agreed
Source: Primary Data

From Table 4.14, most of the social interaction attributes were favorable with mean values above 3.00 (8 items). Table 4.14 Shows that majority of the respondents disagreed that there were many farmers networks in their area (Mean=2.18, St. Dev=1.20) and further disagreed that

they always acquired new information from a social network which helped them in making decisions in their farming operations (Mean=2.97, St. Dev=1.22). However, the respondents agreed they were members of a social network of farmers (Mean=3.11, St. Dev=1.02) and equally agreed they made use of social networks to access new information even when they were not members. The respondents further agreed that they were influenced by role models in making decisions to adopt some farming practices(Mean=4.33, St. Dev=0.79) while they also agreed that influential opinion leaders advised them on the viability of new farming innovations (Mean=3.67, St.Dev=1.15). Though the respondents disagreed to have been duly influenced by the change agents to adopt the sustainable farming practices, however, there limited utilization of the farmersô social networks in the district either because of being discriminative against some class of farmers or because they were not formally instituted that the farmers became timid to utilize them. The role and influence of the change agents in boosting the adoption of sustainable farming practices would have been even more immense, had the farmers had access to numerous farmersô social network. This had an effect on the ease with which the farmers switched to sustainable farming practices such as crop rotation and minimum tillage.

Study findings from interviews indicated that the social interaction between the farmers and the change agents as well as interaction with fellow farmers through networks influenced the adoption of sustainable farming practices in the district. It suffices to say as per the submission of the key informants that farmers who were in strategic places (for example with good road network) stood to enjoy the benefits of sustainable farming practices as compared to their counterparts in off-site area that were rarely visited by the change agents. The emphasis on the comparative advantage between the farmers within easy reach and those far from the roads was

substantiated further through the following verbatim quotation;

> *"…, among the newly created districts in the northern half of Uganda, Nwoya has always attracted the attention of our partners given its resource endowments and hardworking people. However, whenever we suggest to them that we reach out to some farmers in off-road villages, there is a lot of hesitation… they concentrate only on those they can easily reach out to* (NUSAF official, Nwoya District, 13th January 2014).

In such a situation as shown by the submission of the NUSAF staff, functional farmer groups and farmer networks would be ideal for the farmers in the far off areas from the main road and would serve as distributive conduits for the information and knowledge required to promote the adoption of the sustainable farming practices. Little wonder that the rate of adoption of sustainable farming practices was low because of the absence and or inadequacy of the farmers groups and networks in the district.

The respondents were asked to indicate whether through interacting with the change agents had any impact on their planning and decision making regarding the adoption of farming innovations. The study findings showed that majority of the respondents agreed that the change agents always translated their intent into action (Mean=4.03, St. Dev=0.9) and equally agreed that the change agents influenced their decisions (Mean=3.61, St.dev= 1.00). Change agents were thus a significant factor in inducing the farmers to adopt sustainable farming practices, though through informal conversations with some of the respondent farmers, it was revealed that they were very few in the district and thus their outreach to farmers was determined by the degree with

which a given group of farmers were accessible. The remote parts, despite the numbers of farmers and existence of other cooperant factors such big land size were ñoutsideò the areas of reach by the change agents. This could partly explain why sustainable farming is more practiced in parishes such as Pangora, Ywaya,Latoro, Paromo and Pawatomero.

Regarding the influence of access to information on sustainable farming practices, findings of the study revealed that the respondents agreed that the information they accessed reduced on their uncertainties (Mean=4.88, St. Dev=0.56). However, the respondents disagreed that they used varied sources of information(Mean=1.73, St.Dev=1.14), they further disagreed that the information they accessed further exposed them to probable risks .The respondents further disagreed that there were well established institutions that provided the farmers with reliable and accurate information (Mean=2.84, St. Dev=1.16). The farmers were therefore not sure whether they got reliable and accurate information (Mean= 3.00, St. Dev=1.13). Adoption and use of new technologies is greatly influenced by the quantity and quality of information accessed by the farmers as each technology-cum-farming practice has a number of packages that ought to be internalized by the farmers before adopting. The limited access of the farmers to various information sources as well as the doubts cast over whether the sets of technology they accessed were relevant could be limiting factors for the adoption of sustainable farming practices by the farmers in Nwoya District.

The key informants indicated that the high rate of illiteracy among the farmers contributed to the failure of the farmers to utilize the different sources of information available in the district for extracting more reliable and relevant information necessary to allure the adoption of sustainable farming practices. As was seen from the background characteristics of the respondents, a big

score of farmers were illiterate and this brought about the low uptake of sustainable farming practices in the district.

4.6.2 Correlation between social interaction and adoption of sustainable farming practices

A correlation coefficient was used to establish whether there was a relationship between **social** interaction and adoption of sustainable farming practices. Pearson correlation matrix was used to establish the relationship between the variables of the study because they were numerical. Table 4.15 below provides a summary of social interaction and adoption of sustainable farming practices.

Table 4.15: Correlation table showing the relationship between social interaction and adoption of sustainable farming practices

		Social interaction	Adoption of sustainable farming practices
Social interaction	Pearson Correlation	1	.521(*)
	Sig. (2-tailed)		.01
	N	300	300
Adoption of sustainable farming practices	Pearson Correlation	.01	1
	Sig. (2-tailed)	.521(*)	
	N	300	300

* Correlation is significant at the 0.05 level (2-tailed).

Table 4.15 shows that the correlation coefficient for social interaction and adoption of sustainable farming practices was $r=0.521$, $p=0.01<0.0.5$. These imply that there is a significant positive correlation between social interaction and adoption of sustainable farming practices. Therefore, effective social interaction leads to improvement in adoption of sustainable farming practices.

4.6.5 Regression analysis testing the research hypothesis: "Social interaction has significant effect on adoption of sustainable farming practices"

A regression analysis was conducted to measure the extent to which social interaction related to the adoption of sustainable farming practices using the adjusted R^2 values, standardized beta values, t values and the significance measured at 0.05 level. The results are tabulated in table 4.16 below;

Table 4.16: Regression results between social interaction and adoption of sustainable farming practices

Predictor	Adjusted R Square	Df	Mean square	F	Sig.
	0.277	1	6.860	28.586	0.000[a]
			Standardized coefficients	t	Sig.
	Adjusted R square	Std error	Beta (*B*)		
Constant		0.157		4.377	0.000
Social interaction	0.277	0.074	0.409	6.003	0.000

a. Predictor: (constant), Social interaction
b. Dependent Variable: Adoption of sustainable farming practices

The regression model in table 4.16 above shows adjusted R^2 value of 0.277 between social interaction and adoption of sustainable farming practices suggesting that social interaction predicted 27.7% of the variance in the levels of adoption of sustainable farming practices in Nwoya District. The Beta Value (= .) implies that economic factors have a positive impact on adoption of sustainable farming practices such that favorable economic environment for farmers or any improvement in the same brings about an increase in the adoption of sustainable farming practices by 40.9 times. Therefore, the hypothesis that social interaction has a significant influence on the adoption of sustainable farming practices in Nwoya district is

accepted. The implication is that to achieve the expected adoption levels of sustainable farming practices, social interaction among the farmers ought to be more than strengthened at all times, farmer networks boosted and farmer literacy programmes introduced in the district such that the information sources available are best utilized by the farmers.

CHAPTER FIVE

SUMMARY, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

The study assessed the socio-economic factors affecting the adoption of sustainable farming practices in Nwoya District. The variables included; farmer characteristics, economic factors and social interaction and their effect on adoption of sustainable farming practices. This chapter therefore presents a summary, discussion, conclusions and recommendations based on the study findings.

5.2. Summary of the findings

The study investigated the socio-economic factors influencing the adoption of sustainable farming practices in Northern Uganda. Nwoya district was selected as a case study. Below, were the findings;

5.2.1. Effect of Farmer Characteristics on the Adoption of Sustainable Farming Practices

The study found out a positive significant effect of farmer characteristics on adoption of sustainable farming practices($r=0.543, p=.0.03<0.05$) which implied that favorable farmer characteristics affected the adoption of sustainable farming practices. Regression results indicated that farmer characteristics predicted a 41.2% variation in adoption of sustainable farming practices in the district. Majority of the respondents agreed that while they try out new innovations in their farming operations, any incidence of perceived risk never deterred them and further agreed that the financial risks never prevented them from uptake of a new farming innovation. The respondents agreed that farmer field demonstrations were important in uptake of information about new farming applications. They also indicated that sometimes, new farming

innovations were difficult to try out because they were not divisible.

5.2.2 Effect of Economic Factors on Adoption of Sustainable Farming Practices

Economic factors such as perceived advantages and accessibility to credit had a positive significant effect on adoption of sustainable farming practices ($r=0.611, p=.0.01<0.05$) which implied that the economic systems and economic environment existent in Nwoya had a great bearing on the choice of the farmers to adopt or otherwise, the sustainable farming practices. Regression results indicated that farmer characteristics predicted a 38.3% variation in adoption of sustainable farming practices in the district. Though the respondents disagreed to most of the variables under economic factors, they were however minding more on the profitability of sustainable farming practices and thus chose to engage in sustainable farming practices because they were more lucrative as compared to conventional farming practices.

5.2.3 Effect of Social Interaction on the Adoption of Sustainable Farming Practices

Social interaction was found to be a significant factor influencing the adoption of sustainable farming practices among farmers in the area. The study findings indicated that social interaction in form of farmer networks, interaction with change agents and model farmers and access to information about sustainable farming practices had a positive significant effect on adoption of sustainable farming practices ($r=0.521, p=.0.01<0.05$) which implied that functional farmer networks and interaction with change agents as well as access to information on sustainable farming practices were important in inducing a farmer to adopt the sustainable farming practices. Regression results indicated that farmer characteristics predicted a 27.7% variation in adoption of sustainable farming practices in the district.

5.3. Discussion of the findings

In this section the researcher presents the discussion of the study findings in relation to the objectives of the study.

5.3.1 Farmer characteristics and adoption of sustainable farming practices

The study findings indicated that farmer characteristics had high positive significant relationship with the adoption of sustainable farming practices (r=.521). Therefore, the more favorable the farmer characteristics are, the greater will be the propensity with which the farmers can adopt the sustainable farming practices. For example, the more the risks that farmers envisaged, the less willing they would be in venturing into the adoption of sustainable farming practices. The findings of the study are amplified by those of Souza Filho (1997) whose study in Brazil found out that where farmers perceived an increase in risk when trying to convert to organic farming, it became a significant barrier to adoption of organic farming. In order to adopt sustainable agriculture practices farmers need to be able to overcome the transition period. Souza Filho (1997) further found that the financial risk of the transition time represented a significant barrier to adoption of organic farming.

The study findings are in agreement with those of Alene, Poonyth and Hassan (2000) that education as one of the constructs under farmer characteristics in this study positively affected the adoption of improved maize varieties in West Shoa, Ethiopia and therefore Education is a major factor influencing the adoption of new agronomic practices.

In this study, the findings indicated that belongingness to a farmersô association was an

influencing factor for the adoption of new farming innovations. Therefore, where farmers are in functional groups or associations, the rate of adoption is better than where there no functional farmer groups of associations. The findings revealed that the propensity of adopting new farming practices was higher for farmers in groups than for individual farmers, unless they are enlightened and progressive. This finding is in consonance with Suri (2005) who demonstrated that aggregate adoption rates may remain low or stagnant despite high average returns to new maize technologies, either because marginal returns to adoption are low, or because the farmers with comparative advantage in adoption have already done so. Suri implied that farmersô organizations provide fora through a farmer can copy and implement the activities copied from fellow farmers.

5.3.2 Economic factors and adoption of sustainable farming practices

The study findings revealed that economic factors greatly affected the adoption of sustainable farming practices. This inference was made basing on the high positive significant relationship established between the study variables(r= .611). The economic power determined by the ease with which the farmers could afford the costs of the technology and/ or inputs as well access to credit and land size affected the uptake of sustainable farming practices in Nwoya district. The difficulty in affording and /or accessing the above hindered the uptake of the sustainable farming practices irrespective of perceived advantages known to the farmers. Caswell et al, (2001) observed that the decision to adopt presents a shift in farmersô investment options. Therefore, adoption can be expected to be dependent on cost of a technology and on whether farmers possess the required resources.

Adopting new technologies is supported by land size owned by the farmers. In this case of sustainable farming practices such as minimum tillage and crop rotation, farm size is even more and more important. Hence farmers with more land will find it easier to adopt the sustainable farming practices as compared to those without. The study findings find testimony in a past study by Fernandez-Cornejo and McBride (2002), who, using data from a US survey at one point in time (1998), found that adoption of HT maize was positively related to farm size. The same study also analysed Bt maize but drew no clear conclusion on the effect of this variable. Based on the same survey data, in 1998 Fernandez-Cornejo et al. (2002), found that larger farms and better educated farmers had responded positively to adoption of HT soybean in the USA.

Credit access and availability was found to be a key factor affecting the adoption of sustainable farming practices in Nwoya district. Credit availability of credit provides an assurance to the farmers that whenever they ventured into a new farming enterprise, the funds to finance the operations would easily got and their payment deferred. In Nwoya, the aspect of credit access and availability was raised as a key factor inhibiting the adoption of sustainable farming practices. The findings of the study rhymed those of Feleke and Zegeye (2006) who reported significant positive effects of access to credit on the adoption of improved maize varieties. While their study used based on logit result for the adoption of improved maize varieties suggests that use of credit will result in more adoption of improved maize varieties with a positive coefficient and was significant at p= 0.05.), the current study in Nwoya found out that farmers having access to credit have higher adoption was seen than those with no access to credit.

5.3.3 Social interaction and adoption of sustainable farming practices

Social interaction was found out to be key in influencing the adoption of sustainable farming practices. A moderate high positive relationship was established between social interaction and adoption of sustainable farming practices (r=.521). The more the interaction a farmer makes with the change agents and the farmer networks, the higher is the propensity with which they venture into new farming innovations, sustainable farming practices inclusive. The farmer networks for example provide for a through which the farmers will interact with model and progressive ones. This provides the basis of benchmarking and provides an avenue for the uptake of sustainable farming practices.

Nowark (1991) and Souza Filho (1997) found out that many sustainable agriculture practices were highly complex. Thus, adopting them imposed a need for increased learning. The intellectual cost of adopting environmental innovations is usually greater than conventional innovations because they require a better understanding of farm systems, cropping systems, or chemicals. Thus farmers may not be attracted to changes that require such intellectual investments (Vanclay and Lawrence 1994). The aspect of change agents who may either be knowledgeable in sustainable farming practices or have an accumulated experience into practicing the same provide a best alternative to dispel the doubt among the farmers. However, such were few in Nwoya thus accounting as to why farmers were hesitant to adopt sustainable farming practices. Nowak (1991) states that one reason for farmers being unable to adopt is their inadequate managerial skills. He explains that the issue is exacerbated by the fact that residue management systems often are designed for average or above average managers, and local assistance networks are also oriented to this group.

As regard the influence of change agents, the success stories used are more appealing and therefore provide practical examples that new farmers emulate while they consider trying out new farming innovations. Therefore, the higher the incidence of interaction, the greater will be the degree with which the farmers adopt sustainable farming practices. Katungi (2007), found out that information generated by early adopters diffuses through sparse social networks contrary to the assumption of free availability in the whole village. Some factors associated with levels of knowledge of innovation included innovation proneness and utilization of mass media influences.

The study findings are also in agreement with Bearenklau (2005), who found out that two drivers that determined whether a farmer will adopt a new technology were: if he thinks itôs profitable and if his peers accept it. The degree to which this type of influence will affect adoption of technologies may depend upon the degree of risk of the technology. Bearenklau (2005) also specified that the neighbor effect may have more importance for smaller, less costly and reversible decisions.

Information accessed by the farmers when comprehensive and relevant to the set of technology or innovation in question demystifies the false beliefs among the farmers and therefore increases on the ease with which the farmers would try out new innovations. However, this perceived role of information greatly suffices only when the farmers are literate to be in position to decode the information concerning the new innovations. According to Caswell et al., (2001), acquisition of information about a new technology demystifies it and makes it more available to farmers. Information reduces the uncertainty about a technologyôs performance hence may change

individualôs assessment from purely subjective to objective over time.

The findings are in line with those of Marsh *et al.* (2000) that prior to trialing, the farmerôs assessment of a technology or practice rely strongly on information from outsiders. At this stage, social and information networks would be important influences on the decision to proceed to trial, but after trailing has commenced, personal experience gained in that way is likely to be the main influence on further decisions

5.4. Conclusions for the study

This section gives the conclusions from the discussion above and was made in line with the objectives of the study. The farmers in this study reported implementing a range of sustainable agriculture practices that reduce drought risk, such as organic soil enhancement methods, the use of more drought tolerant crops and crop rotations, reduced tillage, alternative grazing management and land and water conservation strategies. Although it was reported that some strategies were implemented with drought risk reduction in mind, many of the producers argued that the nature of their system provided long-term adaptation benefits for drought vulnerability reduction. They implement many of these strategies primarily as long-term sustainable practices that allow for adaptation to climate and other fluctuations.

5.4.1 Farmer characteristics and adoption of sustainable farming practices

The study findings indicated that an individual farmerôs personal philosophies undoubtedly are a substantial motivator to adopt sustainable practices. Multiple studies, including this investigation, have shown that farmers who adopt sustainable practices are significantly

influenced by their personal experiences, beliefs, and value systems. It was concluded that farmers who adopt sustainable agricultural practices are those that are willing to change and to try new things are risk lovers, owned land and belonged to farmer groups as compared to their counterparts. Regardless of demographic or personal philosophy, those farmers who adopted sustainable practices were those were willing to try something new.

5.4.2 Economic factors and adoption of sustainable farming practices

Financial considerations such as profitability (cost reduction, benefits on yields, price premiums), government programs, were viewed as central forces motivating the adoption of sustainable practices while weak returns in conventional farming also were cited as a motive for adoption of sustainable farming practices. The study concluded that the economic power of the farmer defined by affordability of the costs of adoption, perceived benefits and access to credit among others were key determinants of sustainable farming practices. This study provides an evidence that the economic power of the farmer increases on their preparedness for uptake of modern farming practices.

5.4.3 Social interaction and adoption of sustainable farming practices

The issue of social support through social interaction was a critical one for the adoption of sustainable agriculture. Change agents and farmers alike, both in this study and in the literature, frequently identify particular individuals who are particularly active and/or strongly promote and support sustainable agriculture. As one key informant put it, change agents are *ñworth their weight in gold.ò* In this study, having a particular person or people who ñbelievedò in sustainable agriculture to support the farmer was a vital factor in that farmerôs successful adoption.

Likewise, a community or a change agent that does not support sustainable practices can be a significant barrier to adoption. It was concluded that social interaction has a significant effect on the adoption of sustainable farming practices. This study underscores the superiority of social interaction among farmers on the adoption of new farming gear.

5.5. Recommendations

The study makes the following recommendations based on the study findings and conclusions above:

5.5.1 Farmer characteristics and adoption of sustainable farming practices

In this study, membership to a farmersô group had a significant effect on the adoption of sustainable farming practices in Nwoya District. To make the contribution of these groups more effective, the study recommends more empowerment of the management of the farmersô organizations through training and recognition of the efforts by the government as a necessity. This will motivate the management of these groups and associations to become potential stewards of new innovations in the area.

The study recommended the need for training farmers on the best practices of the new technologies before the new farming practices are launched. This will mitigate on the frustration that would occur when the farmers have been left to learn about the technology while they are implementing it(them). Believing that farming sustainably is a better method of farming can explain how farmers are willing to engage in the intensive learning and time commitment that comes with adopting sustainable practices, and how they can feel satisfied with these practices even though they encounter significant challenges in adopting them. This conclusion can have

significant impact for organizations wishing to stimulate adoption. Instead of simply promoting individual practices, they should consider exploring educational strategies regarding how sustainable agriculture can be an overall better method of farming.

5.5.2 Economic factors and adoption of sustainable farming practices

Farmers in this research project indicated that grants or gifts can be a better means of financial assistance, especially those awards that provide funds for items that may stimulate trial of a practice (for example, seed, loaning of equipment, etc.). However, it is critical that financial assistance be given with the thought that it is a stimulus for long-term adoption, and that the assistance provides a measure of flexibility for the farmer as his or her practices change and grow. Handouts of money are likely to fail, since they do not account for how the farmer will feasibly implement the practice once financial assistance ends.

The study recommends that district stakeholders should liaise with the government to rationalize the *Bona bagaggawale* funds to the farmers through the SACCOs and Microfinance institutions such that the farmers can this time round be in position to access credit for boosting their farming operations. The district authorities can lobby for consideration of the farmers who have (are)switched(switching) from conventional farming to the adoption of sustainable farming practices as an incentive for inducing many other farmers to adopt the same.

5.5.3 Social interaction and adoption of sustainable farming practices

Respondents suggested that potentially effective methods for advancing sustainable practices adoption are, in importance order, farmer-to-farmer support, one-on-one extension, field days, word of mouth and group meetings. They felt that contact among farmers is very beneficial. This study suggested farmers clubs and groups be formed as a good option for facilitation of communication about farming innovations.

The study recommends that training the change agents to equip them with extra skills and any other requisite knowledge necessary for making them fully fledged to address the farmersô worries with more authority be ventured into. This can not only enable new farmers to adopt the sustainable farming practices but also keeping those already participating in the activities(sustainable farming)n to remain focused and determined .

5.6 Contribution of the study

The study about the socio-economic factors affecting the adoption of sustainable farming practices in Nwoya District has brought to the fore a set of socio-economic variables that have explained why the levels of adoption of sustainable farming practices were considerably low. Given that limited or scanty information was available in print about the situation, this study provides a point of reference that might be not only ideal in the context of Nwoya District as strategies are formulated to overcome the problems of conventional farming but aloes other parts of Uganda where conventional farming practices continue to be a common practice.

The study findings have also provided information to the promoters of adoption of new farming

innovations in Uganda as well as provided the missing ingredients that they should add in their matrix of practices while promoting the new farming gear. For example, mere encouraging of farmers to form farmers groups or networks is an ideal way of encouraging dissemination of information across many farming households. However, it remains deficient if not supported by deployment of resourceful persons to train the farmers into the best managerial and agronomic practices.

5.7 Areas for further Research

This study has shown the extent of adoption of sustainable farming practices in Nwoya District. However, the findings are not exhaustive since they are not representative given that only 300 farmers were involved. To come up with a representative picture, the study should be extended to all other parts of Nwoya and neighboring districts such that comparative inferences can be drawn. The researcher recommends that a study be carried out on the influence of access to finances on the adoption of new farming innovations in Uganda since access to funds provide key factors for the adoption of new changes by farmers.

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APPENDICES

APPENDIX A: Questionnaire for farmers

Introduction

Dear respondent,

My name is Anthony Agaba a student of Uganda Management Institute and I am pursing a Masterôs degree in Project Planning and Management. As part of the requirements for the award of this degree, am undertaking a study to establish ***socio-economic factors that affect the adoption of sustainable farming practices in Northern Uganda: A case of Nwoya District***. This research is purely for academic purposes; however, the findings will help policy planners and makers to formulate sound strategies that can bring about the successful uptake of sustainable farming practices for the betterment of farmers in this district.

SECTION A: BACKGROUND INFORMATION

In this section please circle the category that best describes you.

1.Gender

Male ☐

Female ☐

2. Age of the respondent

Below 20 years ☐ 20-30 years ☐

31-40 years ☐ Above 40 years ☐

3. Education level

No formal education ☐ Primary education ☐

Secondary education ☐ Tertiary education ☐

Others, please specifyé é é é é é é é é é é é é é é é é .

4. For how long have you been engaged in farming? [Experience]

Less than 1 year ☐ 5-10 years ☐

1- 5 years ☐ 10 years and above ☐

5. Source of income

Selling farm produce ☐ Non-farm sources ☐ Both farm and non-farm sources ☐

SECTION B: INDEPENDENT VARIABLE (SOCIO-ECONOMIC FACTORS)
FARMER CHARACTERISTICS

In this section please tick in the box corresponding to your response according to a scale of 1= strongly disagree, 2=disagree, 3=neutral, 4=agree, 5= strongly agree

(i)	**Risk aversion**	1	2	3	4	5
1	Perceived risks never deter me from trying out any innovations in my farming activities					
2	I always venture into a new farming activity irrespective of the likely increase in costs					
3	Financial risks never prevent me from uptake of a new farming investment					
4	New farming innovations are less risky to the environment					
(ii)	**Effect of education and training**	1	2	3	4	5
5	I have always received training on how to make wise decisions regarding my farming activities					
7	I easily decode information about new farming packages					
8	Training by extension workers increases my willingness to try out new farming practices					
9	Training has increased on my managerial skills					
10	Demonstrations on farmer field schools make me to drop the doubts on a new farming innovation.					
(iii)	**Effect of age of the farmer**	1	2	3	4	5
11	My experience with a farming activity affects my decision to try out a new farming innovation					
12	I take time to perceive a new innovation before I switch to it					
13	I am less receptive to new innovations and prefer continuity with the traditional farming practices					
(iv)	**Membership in a farmers' organization**					
14	I belong to a farmersô group for knowledge sharing					
15	Members in our farmersô organizations impart skills in me on aspects like marketing and better agronomic practices					
16	I always copy and implement what farmers in my group do					
(v)	**Land Ownership**					
18	Land property rights affect my decision to adopt a new farming innovation					
19	Land tenure system in this area is not favorable for implementation of some innovative farming practices					
(vi)	**Perceived Complexity**					
20	New farming innovations are usually compatible with traditional farming activities					
21	Sometimes, new faming innovations are difficult for me to try out					
22	Usually, new farming practices are not divisible as compared to traditional ones					

23	Farm characteristics at times affect my willingness to try out new farming innovations					

ECONOMIC FACTORS

In this section, please tick in the box corresponding to your response according to a scale of 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree.

(i)	**Cost of inputs/technology**	1	2	3	4	5
25	I have resources to support trial of new farming innovations					
26	The cost of switching from a traditional farming technique to a new innovative technique is low					
27	I normally get subsidies from central/local government to support my decision to adopt a new farming innovation					
(ii)	**Farm size**	1	2	3	3	5
27	The size of my farm determines my decision to take up an innovation					
28	Small sized farms are better for trying out new farming practices					
(iii)	**Perceived advantages**					
29	I am willing to take a farming activity as long as I am convinced that its worth/profitable					
30	I always compare between an old practice and a new one before making a decision					
(iv)	**Availability and access to credit**					
31	Financial institutions easily give out credit to me					
32	I use more of credit to buy farm inputs than my savings					
33	Interest rates on credit are favorable for me					
34	I need more credit because new farming innovations are more costly than traditional ones					
(v)	**Infrastructure**					
35	Availability of well surfaced feeder roads have influenced my intake of new farming practices in this area					

SOCIAL INTERACTION FACTORS

In this section, please tick in the box corresponding to your response according to a scale of 1= strongly disagree, 2=disagree, 3=neutral, 4=agree, 5= strongly agree

(i)	**Effect of Social Networks**	1	2	3	3	5
36	There are many farmer social networks in this area					
37	I am a member to a social network of farmers					
38	I make use of social networks to access new information even when I am not a member					
39	Role models influence my decisions					
40	I always acquire new information from a social network that I used in making decisions					
41	Influential opinion leaders advise me on the viability of new farming innovations					
(ii)	**Interaction with change agents**	1	2	3	3	5

42	Change agents always translate my intent into action					
43	Change agents influence my decisions					
(iii)	**Access to information on sustainable farming practices**					
44	I use varied sources of information					
45	I get reliable and accurate information					
46	The information I access reduces on uncertainties					
47	Information accessed exposes me to probable risks					
48	There are well established institutions to provide me with reliable and accurate information.					

SECTION C: DEPENDENT VARIABLE (FACTOR)
ADOPTION OF SUSTAINABLE FARMING PRACTICES

In this section please tick in the box corresponding to your response according to a scale 1=strongly disagree, 2= disagree, 3=neutral, 4=agree, 5= strongly agree.

(i)	**Practice of Crop Rotation**	1	2	3	3	5
	Crop rotation protects soil from nutrient loss					
	I practice crop rotation to reduce soil compaction					
	I practice crop rotation to lessen the need for pest control using inorganic chemicals					
	I adopted crop rotation in orders to reduce the spread of soil-borne disease					
(ii)	**Use of cover crops**	1	2	3	3	5
	I use cover crops to improve soil properties yield on my farm					
	Cover crops decrease weed populations in my gardens					
	I plant cover crops to reduce water runoff and soil erosion					
	Cover-crop mulching offers me opportunities by increasing soil fertility and improving weed management					
	I grow cover crops to conserve nitrogen in the soil					
(iii)	**Use of minimum tillage practices**	1	2	3	3	5
	I minimally till my plot to avoid wind and water erosion					
	I use minimum tillage to conserve soil moisture					
	With Minimum tillage practice, less organic matter is lost					
	Minimum tillage increases on soil organic matter (SOM)					

Thank You for Your Responses!

APPENDIX B: INTERVIEW GUIDE FOR KEY INFORMANTS

Introduction

Dear respondent,

My name is Anthony Agaba a student of Uganda Management Institute and I am pursing a Masterôs degree in Project Planning and Management. As part of the requirements for the award of this degree, am undertaking a study to establish ***socio-economic factors that affect the adoption of sustainable farming practices in Northern Uganda: A case of Nwoya District***. This research is purely for academic purposes. All information shall be treated with maximum confidentiality. Please spare some time and give your most appropriate and honest response.

1 Briefly tell me about yourself, including your highest qualification, number of years you have worked for NAADS/Sub county

2 Do farmers in this area practice sustainable farming?

3 Which sustainable farming practices have been adopted by the farmers in this area?

4 What is your assessment of the rate of adoption of the identified sustainable farming practices?

5 How have farmer characteristics like age, risk aversion, education level, perceived complexity, land ownership and membership in a farmerôs group influenced the adoption of the sustainable farming practices? Explain the influence of each aspect listed.

6 How do economic factors like cost of inputs, access to credit, farm size and perceived advantages affect the adoption of sustainable farming practices in this area?

7 As a policy implementer on behalf of MAAIF, what roles do you play as a change agent as regards the promotion of sustainable farming practices among farmers?

8 How do you ensure that farmers develop a large network?

9 What sources of information on sustainable farming practices are available for farmers in this area? What about the effectiveness of these sources?

10 Within the NAADS/Sub County context, please tell me about challenges and issues facing you as a service provider in meeting the needs of sustainable farming practicing farmers you serve today and in the next five years.

Thank You for Your Responses!

APPENDIX C: FOCUS GROUP DISCUSSION GUIDE

1. Sustainable farming practices adopted
2. Experience in operating the sustainable business practices
3. Viability of sustainable farming practices
4. Farmer characteristics influencing adoption of sustainable farming practices
5. Economic factors affecting adoption of sustainable farming practices
6. Social interaction factors affecting adoption of sustainable farming practices

Thank you for your participation

APPENDIX F: Krejcie and Morgan (1970) Table of Sample size determination

Population size	Sample size	Population size	Sample size	Population size	Sample size
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	280	100000	384

Source: Morgan and Krejcie (1970)