FACTORS AFFECTING FARMERS' ADOPTION OF AGRICULTURAL TECHNOLOGIES IN IRISH POTATO PRODUCTION IN KABALE DISTRICT, UGANDA

BY

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JANUARY, 2015

DECLARATION

I Kansiime Kyabato Rose, declare that this is my original work and has never been presented for any award in any Institution of higher learning.

Signed ……

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Date……

APPROVAL

This is to certify that this dissertation titled 'Factors affecting farmers' adoption of the agricultural technologies of Irish potato production in Kabale district' has been submitted for examination with our approval as Institute Supervisors.

Signed…….

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Date……..

Signed……

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Date…….

DEDICATION

This work is dedicated to my family members; Mugumya Jerome, Muheki Mukama, Humura Nuwabiine and Jackie Mukaira Mpeirwe for their encouragement throughout the course.

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LIST OFABBREVIATIONS AND ACRONYMS

ASARECA Association for Strengthening Agriculture Research East and Central Africa

CIP International Potato Centre

CHC Canadian Horticultural Council

ECA East and Central Africa

FAO Food Agricultural Organization

FAOSTAT Food Agriculture Organization Statistical Database

IPM Integrated Pest Management

KAZARDI Kachwekano Zonal Agricultural, Research Development Institute

MAAIF Ministry of Agriculture Animal Industry and Fisheries

MDGS Millennium Development Goals

MFP&ED Ministry of Finance, Planning and Economic Development

NAADS National Agriculture Advisory Services

PEAP Poverty Eradication Action Plan

PRAPAC Programme Regional d'Amelio pasration de la Culture de la Pomme de Terre en Afrique Centrale network national research institutes of Uganda, Burundi, Rwanda and Zaire

PRAPACE Programme Regional d'Amelioration de la Culture de la Pomme de Terre en Afrique Centrale network formed after Kenya and Ethiopia joining

UPGC United Potato Growers of Canada

ABSTRACT

The study examined the factors affecting farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District. Objectives of this study were; to assess the effect of economic factors and farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District; to establish how farmers' characteristics affect adoption of improved agricultural technologies in Irish potato production in Kabale District and to establish the extent to which institutional factors affect farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District. The study used a cross sectional survey design with both quantitative and qualitative approaches utilized. A questionnaire was administered to 259 respondents out of a 495 population. Face to face interviews from knowledgeable respondents were conducted and documentary review helped to augment the data obtained from the questionnaire. Data was analyzed using Statistical Program for Social Sciences (SPSS). The empirical findings were presented using descriptive statistics of frequencies and inferential statistics in form of Pearson Product Correlation Coefficients and Multi-linear Regression Analysis in relation to specific objectives. The study findings revealed that economic factors (55.5%), farmers' characteristics (39.7%) and institutional factors (22.2%) have a significant effect on farmers' adoption of improved agricultural technologies in Irish potato in Kabale district. In conclusion economic factors have a significant relationship with adoption of improved agricultural technologies in Irish potato production in Kabale District. This means that, for technologies which were expensive, Irish potato farmers could not adopt them. Again, the study concluded that farmers' characteristics have a significant relationship with adoption of improved agricultural technologies in Irish potato production in Kabale District. This implies that if the farmers' characteristics include gender/age, adoption of improved agricultural technologies in Irish potato production in Kabale District will consequently improve. The study concluded that Institutional factors have a significant relationship with adoption of improved agricultural technologies in Irish potato production in Kabale District. The study recommended that the Ministry of Finance, planning and economic Development and policy makers like Parliamentarians should urgently look at the costs of production with a view to lowering it and enable farmers access funding, District Production and sub county authority undertake mature age education and formation of farmer field school especially in the field of agriculture for Irish potato farmers, in the sub county.

CHAPTER ONE

INTRODUCTION

1.1 Introduction

This study was an investigation into factors affecting farmers' adoption of the agricultural technologies of Irish potato production in Kabale District, Uganda. The factors affecting farmers adoption of agricultural technologies was conceived as the Independent Variable while adoption of agricultural technologies (use of fertilizers, irrigation, aeroponics technology, suitable crop varieties,) as the dependent variable. This chapter presents the background of the study which involved historical, theoretical, conceptual and contextual perspectives. It also includes the statement of the problem, general objectives, specific objectives, research questions, hypotheses, scope of the study, significance, justification, conceptual framework and operational definition of terms and concepts.

1.2 Background to the study

1.2.1 Historical Perspective

The use of improved technologies had remained the major strategy used by governments globally to increase agricultural productivity and promote food and livelihood security (Adesiina et al., 1995). However, the contribution of improved technology to agricultural production was only realized when it was widely used.

Adoption itself resulted from a series of individual decisions to begin using technology. The decision was the result of comparison between the benefits of improved technology against the conventional practice understanding of how the factors affect

this choice was essential for both the generators (researchers) and disseminators (extension agents/educators). Potato production had improved its productivity mostly due to yield increases. Production yields vary between countries and are affected by many factors such as varieties, access to quality inputs, management skills, availability of skilled labor, access to technology, infrastructures to support operations and length of the growing season. (www.canada.gc.ca accessed on October 3, 2013).

The Canadian Potato Industry had a well established bureaucracy consisting of eight provincial organizations that form policy, develop marketing plans and regulate the industry. As well, there are three national organizations, the established Canadian Horticultural Council (CHC) and two emerging organizations that is, United Potato Growers of Canada (UPGC) and the Potato Innovation Network 2020 (PIN 2020). This infrastructure addresses the many political issues faced with marketing potatoes across Canada and with export markets. The United Potato Growers primary initiatives focused on balancing the supply and demand curves, while PIN initiatives focused on creating new value chains. Customers clearly identified different varieties, their recommended use and quality characteristics. Many retailers had already started to identify the variety on the bag. Bags in different colours offer a clear distinction among the different varieties, such as white, red variety, Specialty and Vintage. Packaging that included information about the variety, health attributes, usage or provenance helped consumers to get the best from their purchase.

It was important to promote the variety's distinctive characteristics and suitability for specific purposes. This permitted consumers to choose the varieties best suited for their specific needs. Technology had played a big role in helping to develop the current

strength of the potato industry. It was believed that technology will continue to play an important role as the industry continued to develop a healthy potato as well as other potato products. These products may include using the potato in bio-products, additional ingredient applications, even Plant Made Pharmaceuticals (PMP) (www.canada.gc.ca accessed on October 30, 2013).

Pharmaceutical farming is promising for the potato industry. It began with the development of a potato in which the vaccine for the Hepatitis B virus (HBV) had been placed. This combined with mini-tuner technology that allows the multiplication of the first ever large scale crop from Plant Molecular Farming (PMF). In addition, not only is the success of this research a breakthrough in medical technology, but it also reinforces the importance of medical agriculture as a new worldwide industry and helps solidify the growing ties between agriculture and pharmaceutical companies to form life science companies. (www.canada.gc.ca accessed on October 30, 2013).

In Indonesia, where rice was the major staple food, integrated pest management practices were adopted by farmers to increase rice yields while reducing on production costs (Abara, 1993). In addition, a Potato Peel Bandage (PPB) technology was developed in India. The potato peel made an effective dressing material for burn injuries. The PPB does not stick to burn wounds as it retains moisture in the wound; skin replacement was quicker. European Potato Market May (2007)

As for Malaysia, which is the largest world supplier of oil palm and Kernel oil, farmers adopted the use of recommended fertilizer application rates and other agronomic practices on oil palm that increased yields and income of farmers Stirling(1993).

In South Asia where cotton is the major cash crop and wheat is the major food crop farmers adopted new integrated agricultural technologies such as zero tillage integrated nutrient management, improved hybrid varieties, irrigation management that also led to increased yield and incomes Koertz (2003).

In Africa, agriculture contributes around 25% of gross products, employs 70% of the population and is a livelihood for more than that population. It was therefore the main source of income, employment, food foreign exchange and it also supplies raw materials for domestic industries Manyewa-Mutamba et.al (2009). Agriculture had, therefore, continued to be a fundamental instrument for sustainable development, poverty eradication and enhance food security in developing countries. It was a vital development tool for achieving the Millennium Development Goals (MDG), one of which was to ensure that people suffering from extreme poverty and hunger are reduced by 50% by the year 2015.World Bank (2008).

In Africa, roughly 40% of all root and tuber crops are produced by Nigeria, followed by the Democratic Republic of the Congo, DRC (10%), Ghana (8%), Tanzania (4%), Uganda (5%), Mozambique (3%), Angola (3%) and Côte d'Ivoire (3%) (www.fao.org accessed on November 17, 2013).

The four African countries that dominate potato trade are Egypt, Algeria, South Africa and Morocco and together they produce 65% of the crop and are the leading countries in potato trade on the continent. In 1999 export value of frozen chips in Africa were $ 6.5 million and Egypt and South Africa accounted for 85% of the value (FAOSTAT, 2002).

In Africa, agriculture is a strong option for spurring growth, overcoming poverty and enhancing food security. Agriculture productivity growth is also vital for stimulating growth in other sectors of the economy. However, agricultural productivity in Africa has continued to decline over the last decades and poverty levels have increased (FAOSTAT, 2002).

The biotechnology trust of Zimbabwe in collaboration with a number of other organizations embarked on a number of multi stakeholders and need driven projects in agricultural biotechnology to address selected problems of resources of poor farmers in Buhera and Wedca district of Zimbabwe which aimed at increasing sweet potato production, utilization and marketing (www.sirdc.ac.zw accessed on November 17, 2013).

In Zambia zero tillage was born out of a necessity to combat soil degradation and has been widely adopted by farmers of different scale (Madhin, 2001).

In Nigeria, the study assessed the extent of adoption of sweet potato production technology by farmers in the Southeast agro-ecological zone of Nigeria. The findings showed 79.63% of the farmers were aware of the technology, while 20.37% were not. Majority of the farmers had adopted all the sweet potato production practices except plant spacing. The constraints to increased adoption of the technology were scarcity of land, difficulty in integrating sweet potato production technology into existing production system, low consumer preference associated with sweet potato products, lack of market, unavailability of sweet potato vines, high cost of available sweet potato vines and unavailability of inorganic fertilizer (Koertz,2003).

Agriculture is the backbone of Uganda's economy; 95% of the population farms (both crops and livestock) on small farms for food and cash income, and on fairly large, farms including ranches, of an average size of 1200 ha and crop farms (5 - 20 ha). Agriculture contributes over 40% to the Gross Domestic Product (GDP) and over 90% to the country's foreign exchange earnings. It also contributes over 60% of total Government revenue in addition to employing more than 80% of the total labour force and providing over half of the total income for the bottom three-quarters of the population by Ministry of Finance Planning and Economic Development (MFP&ED, 1996).

Uganda with a production of 573,000MT is ranked third producer of Irish potato after Rwanda and Kenya in the East and Central Africa (ECA) region (FAO, 2000).

According to FAO statistics, the production of potatoes in Uganda (2008) was approximately over 450,000 metric tonnes, produced on approximately over 65,000 ha with an average yield of ha. However, a recent study by the national potato programme estimated production up to 1.2 million metric tonnes per annum, with on farm yields of 14.5 metric tonnes, whereas the most recent household survey produced a production total of 290,000 metric tonnes, with a yield of 4 metric tonnes / ha.(www.finance.go.ug retrieved on November 18,2013)

Traditionally potatoes have been cultivated in the highland areas of Uganda, 1500 – 3000m. The major production zones include (i) the Kigezi highland Districts of Kabale and Kisoro in the south west, which produces the bulk of the crop in Uganda, (ii) Mbale and Kapchorwa Districts on the slopes of Mount Elgon and (iii) Nebbi district, a mid-altitude region in north western Uganda which has more recently started to promote potato production.

In Kisoro district, under the dairy value chain, the FAO worked with Rubuguri Dairy Farmers' Association and transformed into a cooperative of which they were given a processing plant where milk will be put in the milk cooler in their centre to enable it have as much milk supply as possible in the nearby areas . Other machines given out to farmers was to process yoghurt, cheese and ice cream which is sold in other districts and towns which had enabled them to improve on their livelihood.(FAO report 2013).

By 1995, 92% of cowpea farmers in Kumi were using insecticides as their main pest control strategy (IPM CRSP Annual Report, 1996). And as an Integrated Pest Management (IPM) practice, farmers are increasingly planting within the first sign of rains to enable the cowpea crop to escape damaging populations of certain pests by harvesting before peak pest populations. A number of studies revealed that cowpea production could be improved and increased through well-defined IPM systems (Isubikalu et al 1997; Jackai et al., 1985).

Among the most promising technologies developed by IITA are varieties resistant to Striga, 6 aphids (A craccivora Koch), and bruchids (Callosobruchus maculates), improved storage techniques using solar drying, and the use of botanical pesticides in the field and in storage (CGIAR, 2002). Current IPM CRSP practices disseminated to farmers in Uganda for control of cowpea insect pests have included close spacing, and strategic insecticide application. Intercropping with Sorghum is encouraged.

Kabale District boarders with Rukungiri District to the north, Ntungamo District to the northeast, the Republic of Rwanda to the east and south, Kisoro District to the west and Kanungu District to the northwest. It takes approximately 10 hours from Kampala to

Kabale by road. Kabale district lies within an altitude range from 1,400-2,500m and has an annual rainfall between 1,000 -1,500mm, which occurs in two peaks from March –May and September – November. The mean annual maximum temperature is below 22.5^{o}C with an annual minimum above 10.0^{o}C , making Kabale one of the coldest Districts in Uganda (Low, 2000).

Due to the concerted efforts of the National Potato Programme working in collaboration with CIP and PRAPACE, Ugandan farmers including those with in the study area to have access to a range of improved potato varieties, farmers in Kabale district are growing all the varieties, that is, Kiningi, Rwangume, Victoria, Rutuku, Cruza 148 ,Sengema and Nakpot 1,2,and3. However, NAKPOT 1, 2and 3 which are commercially good and disease resistance qualities, are only recently released and have a very limited distribution.

Internationally, Uganda's agricultural technologies of Irish potato production are low and insignificant. Production has been varying in response to market demand between 1995 -2001, the period for which production data is between 1-2 hectares and has reduced from 14m/t -4 metric tonnes / ha (MAAIF, 2005). This high fall in tonnes could have attributed to low levels of technology adoption of Irish potato that is facilitated by inadequate use of agricultural technologies attributed to factors affecting farmer's adoption and adaptation of the new technologies. Given the interest and commitment Government has shown to the agricultural sector, there was little doubt that consideration will be made owned by the government for Irish potato production.

The strategic exit workshop which was hosted by FAO held on 25th August 2013 at Protea hotel involved farmer cooperative leaders ,district local government,

Kachwekano Zonal Agricultural Research Development Institute(KAZARDI), officials from Ministry of Agriculture Animal Industry and Fisheries (MAAIF), trade and industry partner development of Irish potato production in Kabale, discussed on the FAOSTAT (2008)report on Irish potato production reduction from 14.5metric tonnes-1.4 metric tonnes per hectare. In their discussions and presentations they found out that, despite the efforts done by different organizations/companies, there was lack of information on the adoption of the disseminated technologies and factors hindering or promoting their adoption, information important for more informed decisions and programmers aiming at improving Irish potatoes production in Kabale district including the study area.

However, from this conference, the researcher wanted to examine the factors affecting farmer' adoption of agricultural technologies in Irish potato production despite efforts made by National Potato Programme working in collaboration with KAZARDI, MAAIF and other organizations, with all the technologies and capacity building provided to the farmers.

1.2.2 Theoretical Perspective

This study was guided by the adaptation theory advanced by Rogers (1983). The theory classified adopters of innovation into various categories .It was based on the idea that certain individuals were inevitably more open for adoption than others. It was also called a multi step flow theory or diffusion of innovation theory.

The adoption or innovation theory had 5 innovations which may influence its adoption decision making process that occurs. When individuals considered adopting a new idea product /practices; characteristics of individuals that made them likely to adopt an

innovation, communication channels used in the adoption process (www.value based mgt.net accessed in November, 2013).

However, this is not the case with all innovations. Moore and Benbasat (1999) split observing into two that is result demonstrability (the ability to demonstrate that positive results have occurred for the user) and visibility (the ability to share those demonstrations with others).

Another important element of diffusion of innovation is communication channel. A communication channel is the means by which messages get from one individual to another. Access to information regarding a new technology is the principal factor affecting adoption decision process (Hooks et al, 1983). An innovation can be communicated through mass media or through interpersonal communication. The complementary roles, while individuals may initially hear about channels, it is the interpersonal communication that is likely to influence adoption decision (Mark and Poltrock, 2001; Lowery and Defleur, 1995). Most individuals evaluate an innovation, not on the basis of scientific research by experts but through the subjective evaluation of near peers who have adopted the innovation. By using Everett Rogers's theory of technology adoption (2003) the study will be guided to find out where the small holder farmers in Kabale District access agricultural information or not, and which communication channels are being used and how effective they are.

Time of adoption is another important element of diffusion of innovations framework. One way that the model refers to time is in the stages through which adopters pass when deciding about adoption of the new technologies or ideas. Depending on when they adopt an innovation, people will be grouped into innovators (those who adopt at the

very earliest times ,early adopters, early majority and laggards (those who never adopt) Chigona and Licker (2008).

By using this theory, therefore the study, was able to capture why farmers' respond to the use of given technology better than others or if there was particular factors affecting the adoption of improved agricultural technology.

1.2.3 Conceptual perspective

According to Feder et al (1985), adoption of technological innovations in agriculture had attracted consideration among development economists. This was because the majority of the people in less developed countries (LDCs) derive their livelihood from agricultural production and new technologies seem to offer an opportunity to increase production and income sustainably. The available literature on the adoption process gives different perspectives.

Kebede et al (1990), farmers' adoption was about their acceptance of an innovation. Adoption was the time lag between technology development and its adoption. Dudhani et al (1987), suggested that two decades was about the time frame that technologies take to develop from the research stage to wide spread implementation.

Rogers (1983) , considered individual farmer adoption as being the degree of use of a new technology in the long run equilibrium when the farmer has full information about the new technology and it is potential. Isubikalu et al (1997) , suggested that it was the sociological stating in the direction of productivity and improvement of agriculture through adoption of innovation or improved methods of production. She pointed out that adoption was positively related to certain factors such as farm size, education level, age, farm information such as radio and extension.

1.2.4 Contextual Perspective

Kabale District, which is currently the base of Irish potato production by small holders, farmers still have large chucks of open land and water bodies that can provide water for irrigation. In the presentation at FAO conference held at Protea Hotel in Uganda on September 2013, it was indicated that one key policy requirement in technology adoption was the socio- economic dynamics.

Kachwekano zonal Agricultural Research Development Institute (KAZARDI) and other Organizations, had been engaged in generation of improved agricultural technologies for Irish potatoes farming for use by farmers in southern highlands of Uganda including farmers in the study area to enhance productivity by provision of disease free seeds using aeroponics technology, agro inputs storage facilities and training on selection of seeds, agronomic practices, research, advisory and others. The research institute had also been working very closely with agricultural extension system and other stakeholders in the area in trying to disseminate these technologies to farmers (FAOSTAT, 2002).

The study therefore examined the effect between factors affecting farmers and adoption of agricultural technologies of Irish potato production in Kabale District.

The District's climate is favorable for planting at anytime. Irrigation had the added advantage of planting anytime and early maturity harvest throughout the year. In Kabale District the researchers thought it necessary to conduct a study on factors affecting farmers' adoption of agricultural technologies to define the parameters that contribute to low levels of technology adoption despite the fact that the district has great potential of adopting a wide variety of agricultural technologies.

In regard to the above comparative advantages, farmers were not adopting the Irish potato technology leading to low incomes of farmers that contributes to decline in achieving Millennium Development Goals (MDGs) of eradicating poverty

1.3 Problem statement

The importance of farmers' adoption of new agricultural technology had long been of interest to agricultural extension workers and economists. Several parameters had been identified as influencing the adoption behavior of farmers on qualitative and quantitative models for the exploration of the subject. The Irish potato is one of the crops that have received increased research attention in Uganda since 1987 after joining the Programme Regional d'Amelioration de la Culture de la Pomme de Terre en Afrique Centrale (PRAPAC) network which has been instrumental in revival and strengthening of Uganda National Potato Research and Development Programme. The programme was established to help and reverse the decline observed in Irish potato productivity. The principle objective of PRAPACE was to generate and disseminate appropriate environmentally, friendly technologies and knowledge which could improve Irish potato productivity. The major technologies included the use of improved varieties, both organic and inorganic fertilizers and related cultural treatments to improve plant vigor, improved soil management, pests and disease management, weed control, post harvest handling and value addition. Although all these technologies were professed as having the potential to overturn the declining food and source of income security in Irish potato agricultural households, the pace of adoption and use of these technologies by farmers in Kabale District had been inadequately small, which results in constant production. The aim of this study, therefore, was to identify the

various factors that influenced the adoption of technologies urbanized by PRAPACE and offer strategies for production. (http://www.cipotato.org (April, 2007)

1.4 Purpose of the study

The purpose of this study was to examine the factors affecting farmers' adoption of agricultural technologies in Irish potato production in Kabale District.

1.5 Objectives of the study

i. To assess the effect of economic factors on farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District.
ii. To establish how farmers' characteristics affect adoption of improved agricultural technologies in Irish potato production in Kabale District.
iii. To establish the extent to which institutional factors affect farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District.

1.6 Research questions

i. How do economic factors affect farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District?
ii. How do farmers' characteristics affect adoption of improved agricultural technologies in Irish potato production in Kabale District?
iii. To what extent do institutional factors affect farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District?

1.7 Hypotheses of the study

i. Economic factors have a significant effect on farmers' adoption of improved agricultural technologies.

ii. Farmers' characteristics have a significant effect on adoption of improved agricultural technologies.

iii. Institutional factors have no effect on farmers' adoption of improved agricultural technologies.

1.8 Conceptual Framework

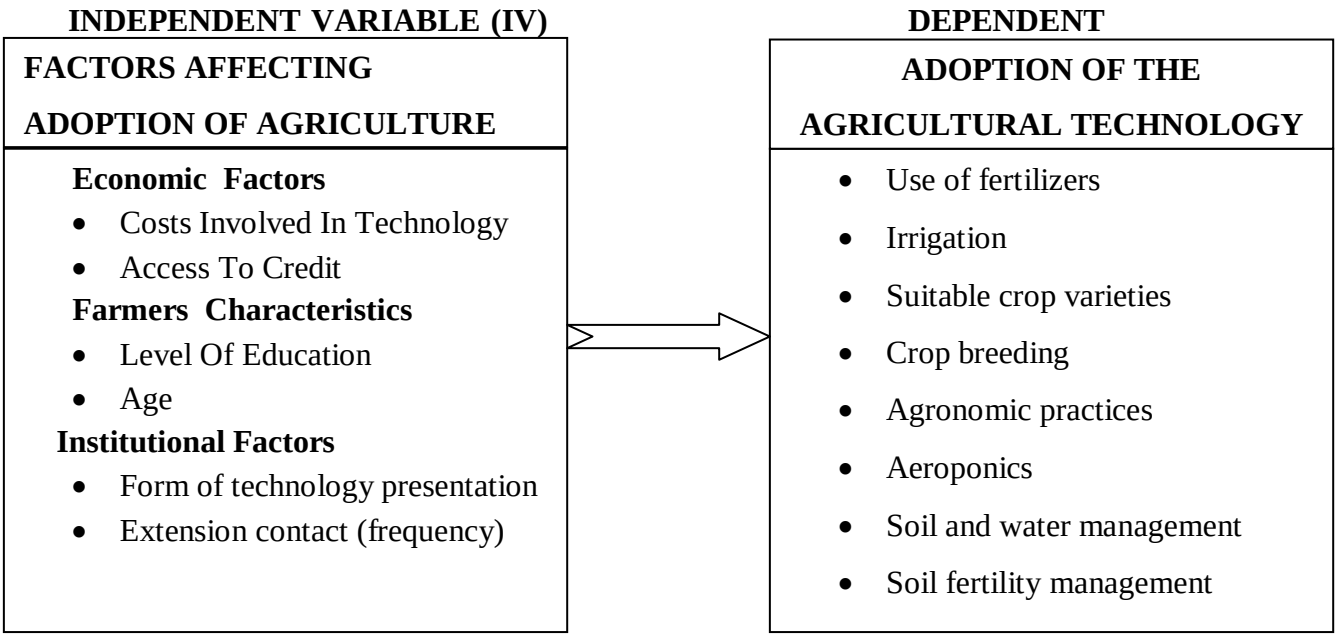

Figure 1: Conceptual Framework

Source: Adopted and modified from Everett Rogers's Diffusion of Innovations (2003)

The framework examines the factors affecting adoption of agricultural technologies in Irish potato production as the independent variable and adoption of the agricultural technologies (Use of fertilizers, irrigation, suitable crop varieties, aeroponics

technology, crop Breeding, agronomic practices, soil and water management, soil fertility management) as the dependent variable.

A technology which is costly is more likely not to be adopted by farmers. Contrary, if credit facilities are not available, farmers may not have enough money to purchase inputs like fertilizers, storage facilities, pesticides and the new varieties of good quality. Farmers' characteristics which include age and level of education may also affect adoption of technology. Also, Institutional factors may which include form of technology presentation and extension contacts affect farmers' adoption of agricultural technologies. The relationship in the framework will be demonstrated in the many to one method.

1.9 Significance of the study

The study findings will be significant to stakeholders like local government contrary other government ministries, departmental agencies non-governmental organizations, and development partners. Particularly, the findings will be significant to the farmers where the research was carried in the following ways:

i. The findings will help MAAIF, NARO, KAZARDI, NAADS and change agents to be aware of the factors affecting farmers' adoption of agricultural technologies in Irish potato production and be able to design strategies that will improve farmers' adoption of improved agricultural technologies.

ii. In addition, this study will provide a basis for gauging how policy changes affect farmers. Policy issues that constrain or enhance the provision of inputs that are required to promote adoption of agriculture technology have a direct effect on how farmers react to them.

iii. The results will provide useful information to enhance the success in the adoption of agriculture technology and indeed any other related program that attempts to introduce technology for adoption in settings that are similar to those in this study area. Results of this study will thus have implications well beyond the confines of the study area.

iv. The study aims at providing the researcher with concrete evidence on how useful information on agricultural technologies affects the rate of increase in agricultural output in relation to farmers' adoption. It will also determine how the increase in agricultural output impacts on poverty levels and environmental degradation

1.10 Justification of the study

The use of improved technologies had remained the major strategy used by developing countries to increase agricultural production and promote food security (FA0, 1999). The Government of Uganda is no exclusion of the fact that over 80% of the population depends on agriculture to receive a living. Irish potato being one of the most important food crops, the reason why Uganda was mandated to join PRAPAC in 1987 which later became PRAPACE after Ethiopia and Kenya joins the regional researcher network. The programme was established to help and reverse the decline observed in Irish potato productivity.

The principal objective of PRAPACE is to generate and disseminate appropriate environmentally friendly technologies and knowledge which can improve Irish potato productivity. However, although a number of technologies have been developed and

disseminated to farmers, Irish potato production has continued to decline as observed by (Ruttan and Thirtle, 1987).

This therefore justifies the study in an attempt to obtain results based on detailed analysis of the factors affecting adoption of these technologies. The study findings will, therefore, come up with suitable recommendations to policy makers, researchers and extension staffs that will help to improve the uptake of the technologies hence reverse the declining Irish potato production trends.

1.11 Scope of the study

1.11.1 Content Scope

The study was restricted to factors that affect farmers' adoption of agricultural technologies on Irish potato production in Kabale District. The factors affecting farmers' adoption of agricultural technologies was conceived as the independent variable with economic factors, institutional factors and farmers' characteristics as its dime

On the other hand, adoption of agricultural technologies was the dependent variable with dimensions such as use of fertilizers, irrigation, aeroponics technology, suitable crop varieties, crop breeding, agronomic practices, soil and water management and soil fertility management

1.11.2 Time Scope

The study was narrowed to the period from 2006 to 2013 when CIP in collaboration with FAO and ASARECA worked together to generate and disseminate appropriate environmentally friendly technologies such as aeroponics, improved varieties, storage

facilities and others, and knowledge which could improve Irish potato productivity (http://www.cipotato.org, 2007). KAZARDI and other organizations have generated and disseminated technologies to farmers that is hoped to lead to improved Irish Potato production and consumption.

1.11.3 Geographical scope

The study was carried out in Kabale District which is one of the traditional Irish potato growing districts in Uganda and this is where Irish potato production has steadily declined over the last eight years.

Kabale District borders with Rukungiri District to the north, Ntungamo District to the northeast, the Republic of Rwanda to the east and south, Kisoro District to the west and Kanungu District to the northwest. Muko Sub County was involved in the study since it was one of the main leading Irish potato growing sub counties in the district and where most of the technologies have been provided by FAO, KAZARDI and other organization.

1.12 Operational definitions

Agriculture in this study refers to art and science of growing Irish potato for production and to sustain and maintain quality of life and to promote economic, aesthetic and sound cultural values.

Technology in this study refers to cultivating the crop successfully through application of fertilizers, control of pests, and takes care of Irish potato plants for its healthy and good growing.

Biotechnology is the conventional method of producing pre basic rooted cuttings from the beds of Irish potato seed in order to multiply clean seed in a greenhouse using sterile substrates and a mixture of other components.

Aeroponic technology is a soilless method of producing pre basic Irish potato seed with high yields (up to 10-times higher), more quickly, more sustainably and with greater profits than conventional methods.

Adoption in this study refers to a mental process farmers of Irish potato pass through right from the first time they hear about technology to final utilization of that technology such as use of suitable varieties, agronomic practices.

Technology adoption is the decision to make full use of an innovation or new technology as the best course of action available (Rogers, 1983). In this study, it refers to adoption of agricultural technologies of Irish potato.

Fanya kini", "fanya jju" Digging terraces 10 meters apart and remove soils in the pit

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

In this chapter, related literature was reviewed and involved the systematic identification and analysis of documents containing information related to the research study. The study was factors affecting adoption of agricultural technologies, reference to Irish potato production in Kabale district and it was reviewed objective by objective. This chapter presents the theoretical review which gave highlights and clarification on the problem and provided theoretical basis for the study. It also highlighted the gaps in the existing literature.

2.2 Theoretical Review

A technology, no matter how good it is, will be deferred useless if not adopted. Therefore, it was important to maximize the adoption rate of a technology. One of the important steps towards maximizing a technology rate of adoption is to understand the factors that influence its adoption. Understanding how ideas and technologies diffuse or spread among people or adopted by people had been studied in many fields. To explain the factors that promote or hinder the acceptance of a technology, several models have been proposed, such as the Technology Acceptance Model (Venkatesh & Bala, 2008) and the Lazy User Model (Tetard & Collan, 2009). Perhaps the leading and most influential model is Everett Rogers's Diffusion of Innovations (2003). And it is

Rodger's theory of technology adoption that guided this research

In his research Rogers's model explained why one technology may be preferred to another. Rogers's diffusion of innovations proposes five factors that could shape the rate and likelihood of adoption. Some factors are inherent to the innovation, while others concern the adopters themselves and their usage of the innovation.

Relative Advantage

For a person to choose to use a technology for a specified task, it should provide some form of benefit for the task concerned. The innovation should demonstrate a relative advantage over other options, ideally including the technology currently used for the task. Better technologies will be adopted, plain and simple. However, what defines "better" is rarely a single, simple statistic. Increased performance, cheaper costs, increased social standing, or even a factor may all contribute to the sense of relative advantage.

Compatibility

Another factor is the compatibility of the innovation with the user's life and practices. An adopted technology will be integrated into one's life and therefore must mesh well. This compatibility may be of a technical basis, such as software or hardware compatibility issues with a computer. Any interruption to one's workflow should also be minimal. Additionally, the technology should not cross one's value or belief system. For example, if a person is against the mistreatment of animals, any medication tested on animals would be incompatible

Complexity

When deciding to adopt an innovation, the inherent difficulty of using the technology is a major concern. Complexity refers to the sense of difficulty that the user has in using and understanding an innovation. The learning curve associated with learning how to use a technology is considered. Also considered are traditional human-technology interaction notions of usability and affordability as spoused by Norman (2002) and others

Complexity goes beyond these elements, though. A potential user must also understand why the innovation is appropriate or beneficial. The level of such an understanding need not be to an extreme depth but should at least convince the user of the innovation's value. In a case study of an attempt to promote the boiling of water in a Peruvian village, germ theory was used to motivate the adoption of boiling water. However, the villagers had difficulty in accepting germ theory as the cause of illness. Thus, they overwhelmingly rejected water boiling as they failed to understand the motivation to do so (Rogers, 2003).

Trialability

The fourth factor in promoting the adoptability of an innovation is the opportunity for a potential user to experience using the innovation itself. Such trialability covers opportunities such as test drives, demonstration units, and simulations. The user gets the chance to try the technology without having to fully commit to purchasing or adopting it. Trials can be great sources of information searched for and needed during the Persuasion and Implementation stages. In particular, trials directly limit or prevent forming inaccurate assumptions about the technology.

Observability

The fifth and most critical factor that shapes innovation diffusion is observability. Observability refers to how visible the use of the technology is to those around. For a person to adopt a technology, seeing, hearing about, or otherwise knowing that other individuals are using that technology dramatically encourages adoption. Observing a technology stimulates awareness of the innovation and conversations among one's peers. Rogers (1983), found evidence for the power of observability when he plot the number of adoptions over time. Consistently, these plots revealed a normal Bell curve, while plots of the cumulative number of adoptions over time showed a sigmoid or s-curve.

2.3 Actual Review

2.3.1 Economic factors and farmers' adoption of improved agricultural technology

Agricultural production requires capital, labour, land, entrepreneurship management skills. These are economic factors for agricultural production. Lack of capital could significantly constrain adoption. Ruttan and Thirtle (1987), identified credit as a major factor affecting adoption of few new hybrid rice technologies in Thailand.

Land degradation in Bushenyi district was found to be significantly caused by accessibility to credit (MC Namara et al., 1991). Lack of credit was a major constraint that limited 48% of the small scale farmers in India from applying fertilizers (Bhalla1979).

Credit, timing, distribution and efficiency all affect adoption (Feder et al., 1985). Changes that cost little are adopted more quickly than those requiring large expenditures (Green et al., 1993). The rate of adoption may be dependent on the cost of a technology. Therefore, adoption can be expected to be dependent on cost of a technology and on whether farmers possess the required resources. Technologies that are capital-intensive are only affordable by wealthier farmers MC Namara (1991), and hence the adoption of such technologies is limited to larger farmers who have the wealth (Khanna, 2001).

In addition, changes that are costly adopted more quickly than those requiring large expenditures; hence both extent and rate of adoption may be dependent on the cost of a technology. Economic theory suggests that a reduction in price of a commodity or service can result in more of it being more of demand.

Access to credit through a bank loan or savings in a cooperative society is expected to increase the probability of adoption of a technology (Bonabana, 2002).

However to be eligible for operation of the borrower will be crucial. Farmers operating large farms tend to have greater financial resources and have better chances of receiving credit than those with small farms which have less advantage to access credit facilities, it is also important to consider crop acreage on which technology is practiced. This is because crop acreage is a superior measure to predict the rate and extent of adoption of a technology.

Although, it may be true that the extent and rate of adoption will depend on the cost of technology, many farmers still do it as it pays. In Irish potato production, it is not known whether technologies developed by PRAPACE are costly or not. This will be

revealed by this study. The study will, therefore, be established whether Irish potato farmers are able to access credit from various lending institutions to finance the various Irish potato activities which are necessary for successful Irish potato production.

2.3.2 Farmers Characteristics and farmers' adoption of improved agricultural technology

Different writers have classified farmers' characteristics as demographic factors, while others as social factors. In most classification, farmers' characteristics include age, education and others as to which one affect adoption of agricultural technologies. Farmers experience will not be considered because the study was carried out in a traditional Irish potato growing area district. Therefore it was assumed farmers have the experience.

Formal schooling enhances the farmers' ability to perceive, interpret and respond to new events in the context of risk. Hence education is likely to increase the probability of adoption of improved Irish potato production in the study area. Farming experience was identified as a key of new hybrid rice technologies in Thailand FAO (2008), Karungi et al (1999), found farmers experience are key factors affecting adoption of clonal coffee in Mukono district. Experience was also reported as a significant factor among graduates that influenced their contribution to the development in Masaka district.

Farmers who are educated normally early adopters and apply the associated inputs more effectively (Kabede et al.,1990). However, this will depend on the complexity of the technology, like aeroponic is frequently stated to be a complex technology in Irish potato production (Bonabana, 2002). However, education is thought to reduce the amount of complexity perceived in a technology thereby increasing a technology's

adoption. According to Khanna (2001), one of the hindrances to widespread adoption of IPM as an alternative method to chemical control is that it requires greater ecological understanding of the production system. Effective Irish potato production requires regular field monitoring of pests infestation to identify the critical periods for application of a pesticide or other control measures (Karungi et al, 1999).

Farmers' knowledge of insect life cycles is also crucial when precision is required about the best stage of the life cycle to apply a particular control strategy. In addition, knowledge of the possible dangers from improper use of particular practices may direct farmers to the safest application procedure regarding a given control strategy especially where chemicals are involved.

The ability to read and understand sophisticated information that may be contained in a technological package is an important aspect of adoption. In the case of Irish potato production, the ability to comprehend pesticide application instructions and proper measurement required in certain control agriculture technology adoption of Irish potato production.

Adoption again occurs from increase in knowledge due to farmer field schools, participation in farmer groups (Adesiina et al .1993). However, the applicability of such an idea in Kabale District is not known and remains the concern for this study. It is therefore likely that farmers, who are exposed to improved Irish potato seeds are more likely to increase the farmers' adoption of technologies.

Several variables were hypothesized to influence the adoption depending on the individual farmer and technology involved. For instance, older farmers may have more experience ,resources and authority that allow them more possibility of trying a new

technology. Mugisa –Mutetika et al. , (1983) reported an increase in the proportion of adopters with age in case of improved bean varieties in central Uganda.

Bonabana (2002), found a significant correlation between age and use of summithion pesticides in Uganda among coffee farmers with most adopters being above 50 years. Again, age is found to positively influence adoption of integrated pest management on peanut in Geogia (Mc Namara et al., 1991).

Young farmers in India were found to adopt new technologies related to vegetables more readily than their older counter parts (Remmy, 1987). Garvin (1980) found out that age was significantly related to adoption while Dudhani et al., (1987) found no significant relationship between age and adoption and use of improved technology.

It is believed that with age farmers accumulate more personal capital and thus show a greater likelihood of investing in innovations (Hooks et al.,1983) .However, it may be that young farmers are more knowledgeable about a new practice ,more flexible, willing to bear risk due to their longer planning horizons and hence likely to adopt new technologies. However, the applicability of such an idea in Kabale District is not known and remains the concern for this study.

2.3.3 Institutional Factors and farmers' adoption of improved agricultural technology

The channels used by farmers affect their adoption behavior as well as the adoption rate (Rogers 1983). Bengura (1983), found out that lack of demonstration sites hindered the adoption of agricultural practices. Garvin (1980), showed a high positive correlation between knowledge of innovation and adoption. Khanna (2001), reported that the impact of information on adoption decision varied according to the form of technology

presentation, information, its content, motivation and frequency of use. Dudhani et al (1987), found a significant correlation between adoption and personal extension contact. According to Bonabana (2001), the uptake of new technologies is often influenced by good extension programmes and farmers' provide source of improved varieties and technological advice. Increased exposure to extension agent and participation in farmer groups has been correlated to higher adoption rates (Adesiina et al, 1995).

In the study done by Bonabana (2002), institutional /or informational factors was found to have more significant influence on adoption of integrated pest management technologies. These factors included on -farm trials, farmer field schools training and extension agent's information. This will therefore try to establish in the study the numbers of extension agents in the various Irish potato growing in Muko sub-county in Kabale district and how often are they in contact with farmers. Technology adoption heavily relies on the farmers' acceptability to good quality and appropriate extension service will be revealed by this study.

Feder et.al (1984) reported that personal characteristics of extension workers such as credibility have good relationship with farmers' intelligence, emphatic ability, sincerity, resourcefulness, ability to communicate with farmers, persuasiveness and development orientation.

According to Bengura (1983), the approaches include farmers group approaches, farmer field schools, field days, demonstrations, visit to research institutions, public media, seminars, publications and agricultural shows. The approaches the extension providers use to disseminate research technologies to Irish potato farmers in Kabale are not exhaustive which remains the concern for this study.

2.4 Summary

In the review of relevant literature, it is clear that many factors help to explain the pattern of technology adoption. However, to attempt to include all of them in the study may not be a viable option. The above literature indicates that there are still research gaps that should be addressed in order to explain farmers' adoption technology. This, therefore, required further investigation to clarify As for age, Adesiina and Baidu Forson (1995), reported that age was either not significant or was negatively related to adoption of integrated pest management in peanut in Georgia. This also required further investigation as regards Irish potato production in Kabale District.

Considering the different countries and regions these adoption studies have been carried out and none in Kabale District in Irish potato, this study attempted to provide further investigation and evidence on some of the findings that have been reported to explain farmers' adoption behavior in Irish potato production. This formed a basis of pointing out why Irish potato farmers in Kabale exhibit different characteristics in the adoption of various agricultural technologies.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents the methods and procedures that were used to carry out the study. It gives the background against which data was collected, assessed and analyzed. The methodology is thus presented under the sub–themes ,research study area ,study population, sample size and selection ,sampling technique, data collection and instruments used ,data quality control (validity and reliability), data collection procedures, data analysis and measurement of variables (quantitative) and ethical consideration

3.2 Research design

Research design is the plan for carrying out a research project (Amin 2005). The study adopted both cross sectional descriptive survey and correlation design. Justification for employing of a cross sectional survey designing is that data was collected from various respondents at a given point in time. The cross section design has advantage of being less expensive and takes a little time to conduct (Sekaran, 1994). Quantitative approach was used in computing percentages, mean and measures of variability, where as qualitative approach was used to provide detailed information about the subject of study and so helped the researcher to establish the patterns' trends and relationships among the study variables.

3.3 Study population

Burns & Groove (2001), define population as a group of people who share traits or attributes of interest to the researcher. The study population from which the sample was drawn comprised the staff from production and marketing department who are 10, FAO staff based in Kabale district who were 10, KAZARDI staff of Irish potato department who were 25, Muko sub county staff who were 10 and 44 farmer groups comprising 10 people each supported by National Agricultural Advisory Services (NAADS) in Muko sub county, Kabale District who received and those who did not receive Irish potato seeds. The overall total was 495 elements.

3.4 Sample Size and Selection

According to Sekaran (2003), a sample size is the actual number of subjects chosen as a sample to protect the population characteristics. Amin (2005), advances that in determining the sample size, the sample should be large enough because if it is too small then the results of the study may not be generalized to the population As adopted by Amin (2005) and Sekaran (2003), determining the sample size using the table of Krejcie and Morgan (1970), greatly simplified size decisions by providing a table that is of good decision model. Table 1 gives the sample size of the study based on Krejcie and Morgan as cited in Amin (2005).

Table 1: Sample size of study

Category	**Population**	**Sample size**	**Sampling technique**
Production & Marketing staff	10	10	Purposive
FAO Staff based in Kabale district	10	10	Purposive
KAZARDI staff of Irish potato department	25	24	Simple random
Muko sub county staff,	10	10	Purposive
Farmers	440	205	Simple random
Total	**495**	**259**	

Source: Krejcie and Morgan (1970), as cited by Amin (2005), and Kabale District NAADS document of registered farmer groups (2011-2013)

3.5 Sampling Techniques and Procedures

Sampling refers to the procedure which the researcher uses to gather people, visit places or things for the study. Sampling satisfies the basic law of probability and assures the researcher of an utmost representation of the total population within an accepted margin of error. In this study, both probability and non probability sampling will be used.

The researcher intends to employ purposive sampling for her own judgment or common sense regarding the participants from whom information was collected. Purposive sampling is the type of non-probabilistic sampling, which is characterized by

the use of judgment and deliberate effort to obtain representative samples by including typical areas or groups in the sample Kerlinger (2003).

This technique is more appropriate for qualitative research than quantitative research Amin (2005). This was done in order to get respondents who are directly involved in actual work and are presumed experienced and knowledgeable about the problem under the study. The technique was applied for district production and marketing department, FAO staff and Muko sub county staff

The simple random sampling technique was applied on the direct beneficiaries and non beneficiaries of Irish Potato from Muko Sub County and KAZARDI staff of Irish potato department. Given the number, this gave each member of the population under study an equal chance of being selected and participating in the study.

3.6 Data Collection Methods

Using qualitative and quantitative methods, data was collected from both primary and secondary sources. Sekaran (2003), stated that data should be collected as first-hand information for subsequent analysis to find solutions to the problem. Primary data was collected using questionnaires and interview guides while secondary data was collected through documentary review method.

3.6.1 Questionnaire Method

A questionnaire is one of the methods that were used to collect primary information from the respondents. The method was used because the target population is largely literate and is unlikely to have difficulties responding to questionnaire items Oso and Onen (2008).

Also the method is considered efficient in terms of research time, cost and energy (Sekarana,2003). The questionnaire was used to collect data from leaders of farmer groups who benefited and those who did not benefit basically to make explanations and cross check data from the beneficiaries. It was administered through a self-administered questionnaire with predetermined answer options for respondents to choose appropriate options.

The method however, has weaknesses of failure to return the questionnaire and generation of scanty information which does not clarify the results. This was dealt with by printing extra questionnaires and supplementing the questionnaire views with those from the interview method.

3.6.2 Interview Method

This was administered to the leaders of district production and marketing, Sub County and FAO. The interview method was used because a one to one approach helped to supplement on observation and find extra information, which certainly supplements observation in order to make purposive decisions. The method also gave a chance for probing especially when the respondents had not understood the question. Interview guide was used to administer the interview method and this guide contained mainly open ended questions for the respondent to answer at length (Sekarana, 2003) . The disadvantage of the method was that it took long to complete the selected sample with its related costs. This was solved by creating adequate time for the interviews and employing research assistants to move to the selected homes of the respondents.

3.6.3 Documentary Review Method

Documentary review is the critical examination of public or private recorded information related to the issue under investigation (Sekarana, 2003). The researcher was to access documents like numerous text books, policy documents, reports from district and Sub County like agriculture sector development strategy and investment plan(DSIP), five year plan (2011-2016), agriculture technology and agribusiness advisory services(ATAAS), NAADS annual reports and quarterly reports(2008-2013) and annual procurement plan and budget for the district, sub county and KAZARDI(2008-2013) records concerning the study area to provide qualitative data concerning the typical issue. A documentary review guide was designed to administer the method. Documentary review method was used for comparison purposes and baselines for the current study.

3.7 Data Collection Instruments

3.7.1 Questionnaire

The researcher used self administered questionnaire as shown in appendix i which consisted of open ended and close ended questions designed to obtain data on the respondents' background, adoption of the agriculture technologies and its effects on agricultural technology adoption of Irish potato in the selected farmer groups.

A questionnaire is preferred because of the big numbers of respondents covered. It is also cost effective and good for quantifying responses from a large number of respondents.

3.7.2 Interview Guide

An interview guide shown in appendix ii is a set of questions that the interviewer asks when interviewing. The researcher carried out personal interviews and direct verbal discussion and interaction with key informants in order to collect data. The objective of the interview guide was to bring some preliminary issues to the surface so that the researcher can determine what variables needed further in-depth investigation. The questions were planned in advance and the researcher used an interview guide to guide the interview with a lot of probing. This enabled the researcher to unearth information about farmers adoption of agriculture technologies on Irish potato production that could not be captured using the questionnaires. The instrument administered to the district officials, Sub County authority and FAO staff.

3.7.3 Documentary Review Checklist

Documentary review shown in appendix iii provided an insight on factors affecting farmers' adoption and agricultural technology of Irish potato. This method was used to collect secondary data, which was already available in published/unpublished form. According to Barer (2000), documentary analysis is one way of interpreting textual data since it examines it as a medium of expression that reflects a people's culture. He further observes that texts contain records of events, values, and norms and traces of conflict and argument. Various documents at Muko Sub County and Kabale District production and marketing department like minutes, budgets, reports, plans farmers adoption of agriculture technologies on Irish potato production were reviewed. The data to be collected from documents reviewed was used to supplement the data collected from questionnaires and interviews.

3.8 Validity and Reliability of research instruments

The data collection tools were pre-tested on a smaller number of respondents who were within the study population but outside the sample that participated in the study. This was meant to ensure that the questions were accurate and clear in line with the objectives of the study thus ensuring validity and reliability.

3.8.1 Validity

Validity is the accuracy and meaningfulness of inferences which are based on research results. Mugenda and Mugenda (2003), in order to ensure validity of the instruments. It is the extent to which research instruments measure what they are intended to measure(Oso and Onen,2008).In order to ensure the validity of the instrument, the drafted questionnaires were scrutinized by two experts to evaluate the relevance of each item on the scale: Very relevant (4), Quite relevant(3),somewhat relevant(2) and Not relevant(1).The content validity index was calculated by dividing the number of items rated 3 or 4 by both judges by the total in the questionnaire. The two scores from both experts were 38 and 43 out of 50 items in each questionnaire. The two scores gave an average of 40.5 out of the 50 items in the questionnaires

Content validity index was calculated as indicated below,

$$CVI = \frac{\text{Number of items rated 3 or 4}}{\text{Total number of items in the questionnaire}}$$

$$CVI = {}^{38}/_{50} + {}^{43}/_{50} = {}^{40.5}/_{50} = 0.81$$

The content validity index =0.81

According to Amin (2005), for a research instrument to be valid, the content validity index should 0.7 and above. Therefore, the content validity index of 0.81 qualified the

two experts, necessary adjustments and changes were made to the final questionnaire accordingly.

3.8.2 Reliability

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials (Mugenda and Mugenda, 2003). It is the degree to which an instrument measures the reliability each time it is used under the same conditions with the same objects (Barifaijo , Basheka and Oonyu, 2010).

To ensure reliability of quantitative data, the Cronbach's Alpha Reliability Coefficient for Likert-Type Scales test was performed. In statistics, Cronbach's alpha is a coefficient of reliability. It is commonly used as a measure of the internal consistency or reliability of a psychometric test score for a sample of examinees.

According to Sekaran (2003), some professionals as a rule of thumb, require a reliability of 0.70 or higher (obtained on a substantial sample) before they use an instrument. Upon performing the test, the results should be 0.7 and above to be considered reliable. Below are the values of Cronbach'salpha for each variable and for the entire instrument. The δ range of 0.7 and above indicates reliability of research instruments as asserted by (Amin, 2005).

Table 2 shows a Cronbach's alpha of 0.734for Economic factors with 3 items, 0.739 for Farmers' characteristics 2 items, 0.724 for Institutional factors with 5 items, 0.762 for Farmers' adoption of improved agricultural technologies with 9 items, 0.783 for all the variables under study totaling 19 items.

The tool, therefore, passed the test of reliability for each of the variables and for all the variables since they were all greater than 0.7, given that the level of Cronbach's that is

adequate is any value equal to or greater than 0.7 (Amin, 2005). The instruments were therefore suitable for data collection. A value of 0.783 was generated. Since the generated value is 0.783 is greater than 0.70 Amin (2005), the instrument and the findings got by use of it was found to be reliable.

Table 2 is the alpha Cronbach's coefficients computed using Statistical Program for Social Sciences (SPSS):

Table 2: Reliability Analysis Table

Variable	**Alpha Cronbach's coefficient**	**No. items retained**
Economic factors	0.734	3
Farmers' characteristics	0.739	2
Institutional factors	0.724	5
Farmers' adoption of improved agricultural technologies	0.762	9
Entire data collection tool	0.783	19

Source: Primary Data

3.9 Procedure of Data Collection

The researcher ensured that the research instruments were discussed with the two supervisors before using them in the field. The researcher obtained a letter from Uganda Management Institute (UMI) introducing her to various respondents at the district, Sub Counties and Irish potato farmer households. This enabled the respondents in the field to co-operate willingly without any suspicion. The researcher then made appointments

with key informants at the district, the Sub County and Irish potato respondents confirming dates of data collection.

At the district and Muko Sub County, the researcher collected data using an interview guide and report guide and during the process, she kept on noting down major points. The respondents were assured on anonymity and confidentiality in order to encourage honest responses. As for the Irish potato farmer groups ,the research collected data using research administered questionnaire which was filled and collected immediately to avoid loss or misplacement. The distribution and collection of questionnaires and data collection through interviews was conducted by the researcher herself.

3.10 Data Analysis

As stated earlier, techniques to be used in analyzing the data were both qualitative and quantitative.

3.10.1 Quantitative Technique for Data Analysis

Under quantitative analysis, various techniques were used such as describing the data, presenting, summarizing them. The data was collected through structured questionnaires and was entered into a computer, tabulated and analyzed using the SSPS computer programme.

Pearson's correlation coefficient as recommended by Amin (2005) , was used during data analysis in order to test the strength, degree and direction of the relationship because the researcher used ratio scales. Value of correlation between -1 and +1 reflected a negative or a positive relationship and r = 0 reflect no relationship

Multilinear regression was used to establish the effect of the three independent variables

on the dependent variable.

3.10.2 Qualitative Analysis

Under qualitative analysis, general analytical procedures were applied. The qualitative data was collected through interviews with key informant and unstructured questionnaires. It was placed under different themes and sub-themes which were given codes. The code category was written in the margins and assembled accordingly. These approaches enabled the researcher to easily depict the finding of the study and to interpret them in-depth and an appropriate manner so as to come up with valuable conclusions from the data gathered.

3.11 Measurement of Variables

The operational definition of variables yields data or information that is quantitative which was analyzed quantitatively. The choice of data, statistical procedures to be applied is largely determined by the type of measurement scale used in the operationalization of the variable (Mugenda & Mugenda, 2003). The measurement scales include Nominal, Ordinal, Interval and Ratio scales.

3.12 Ethical Considerations

The researcher obtained an introductory letter from UMI which was presented to all the Group Managers in charge of respondents for permission to conduct the study.

During data collection, the researcher endeavoured to get the consent of all the respondents and also the confidentiality of their responses. The identity of the respondents was kept confidential by intentionally designing anonymous questionnaires.

For checking quality control, there was pre-testing of the research instruments, supervision and working with research assistants and continuous editing of questionnaires before leaving respondents as well as daily evaluation of field research.

CHAPTER FOUR

PRESENTATION, ANALYSIS AND INTEPRETATION OF FINDINGS

4.1 Introduction

This chapter presents the analysis and interpretation of the study findings arising from the data collected from the respondents using questionnaires and interview guides. The first section presents the response rate and demographic characteristics followed by a presentation and analysis of the study findings in relation to specific objectives. The purpose of this study was to examine the factors affecting farmers' adoption of improved agricultural technologies in Irish potato production in Kabale district.

4.2 Response Rate

A total of 259 questionnaires were administered and all of them were fully filled giving an overall response rate of 100.0%, the highest that can be achieved, although the internationally acceptable response rate is any percentage over and above the 50% (Mugenda & Mugenda, 2003). The researcher in addition to the data collected through questionnaires, also collected qualitative data from a number of knowledgeable respondents including leaders of district production and marketing, Sub County and FAO. Out of 30 respondents for the interviews, 18 respondents were interviewed giving a response rate of 60%. These overwhelming response rates mean that the collected data and the findings from it can be relied on according to Mugenda and Mugenda, (1999). The high response rate was because of high level of co-operation and enthusiasm from the respondents, as well as the fact that the study was conducted in a geographically small area of Kabale District.

4.3 Demographic Characteristics of the Respondents

In this section the background characteristics of the respondents are presented. The section presents age groups, gender, education levels, total land size, and the acreage of Irish potatoes of the respondents.

4.3.1Distribution of Respondents by Age Groups (N=259)

Table 3 indicates that the majority of the respondents, 67.2% were aged 50 years and below, while 32.9% were above 50 years. The 20-30 years age group also comprised of a small number, contributing only 5.4%. Those below 50 years were the ones very active in Irish potatoes farming. However, not many people aged 20 – 30 years are actively involved in farming.

Table 3: Showing the distribution of respondents by age groups

Age Group	Frequency	Percent	Cumulative Percent
20 – 30 years	14	5.4	5.4
31 - 40 years	53	20.5	25.9
41 - 50 Years	107	41.3	67.2
51 - 60 years	68	26.3	93.4
Above 60 years	17	6.6	100.0
Total	**259**	**100.0**	

Source: Primary data from field study

4.3.2 Distribution of Respondents by Gender

Table 4 shows that the majority of the respondents were males, 69.1% compared to the females who comprised only 30.9%.This implied that Irish potato is a crop owned by

male as it is both food and cash crop. Since males are the head of the family, they have to ensure there is food and cash crop. Since males are the head of the family, they have to ensure food availability as well as cash income to cater for other family requirements like medical care and education .According to the documentary check list both at the sub-county and district' majority of the farmers who attended training meetings were males which is in line with the findings**.**

Table 4: Demographic description of the sample by gender (N=259)

Gender	**Frequency**	**Percent**
Male	179	69.1
Female	80	30.9
Total	**259**	**100.0**

Source: Primary data from field study

4.3.3 Distribution of Respondents by Highest Level of Education

Table 5 shows that the majority of the residents, 84.2% were of primary and Secondary level of education, with only 10.8% of tertiary level of education and a meager 5.0% of other levels of education. This implied that the majority of the respondents attained formal education and were therefore in position to give relevant and useful information about the study. This Irish potatoes growing is majorly a rural activity being done at a small level, thereby attracting mostly people of low education standards. In Kabale, just like in many parts of Uganda, most people living and earning a living through agricultural activities are not of high education level.

Table 5: Demographic description of the sample by Highest Level of Education (N=259)

Education Level		Frequency	Percent	Cumulative Percent
Valid	Primary	159	61.4	61.4
	Secondary	59	22.8	84.2
	Tertiary	28	10.8	95.0
	Others	13	5.0	100.0
	Total	**259**	**100.0**	

Source: Primary data from field study

4.3.4 Distribution of respondents by Total Land Size

Table 6 shows that the majority of the respondents, 74.9%own 2 acres of land or less, with 21.2% owning 3 acres and a meager3.9% owning more than 3 acres. This implied that Irish potato farmers in Kabale were wealthy since the majority had 2 acres of land, given the high population in the area. They were therefore able to grow a variety of crops and raise livestock, thereby diversifying their farming enterprises.

Table 6: Demographic description of the sample by Total Land Size (N=259)

Land Size	Frequency	Percent	Cumulative Percent
Less than an acre	14	5.4	5.4
1 acre	77	29.7	35.1
2 acres	103	39.8	74.9
3 acres	55	21.2	96.1
More than 3 acres	10	3.9	100.0
Total	**259**	**100.0**	

Source: Primary data from field study

4.3.5 Distribution of respondents by Acreage of Irish Potatoes

Table 7 shows that the majority of the respondents, 86.9% use 1 acre or less of land for Irish growing, with 10.8% using 1.5 acres and a merger 2.3% using 2 acres. This implies that majority of the farmers had at least a garden of Irish potato on their land which is enough as a source of food and income to purchase other household requirements. Most farmers of Irish potato are low income earners with high fertility rate and hence distribute the small piece of land among the children

Table 7: Demographic description of the sample by Acreage of Irish Potato (N=259)

Acreage	Frequency	Percent	Cumulative Percent
0.5 acre	158	61.0	61.0
1 acre	67	25.9	86.9
1.5 acres	28	10.8	97.7
2 acres	6	2.3	100.0
Total	**259**	**100.0**	

Source: Primary data from field study

4.4 Empirical Findings

Empirical findings are presented using descriptive statistics of frequencies and inferential statistics of correlation coefficients and multi-linear regression analysis in relation to the specific objectives. The purpose of this study was to examine the factors affecting farmers' adoption of agricultural technologies in Irish potato production in Kabale district. The study purpose was broken down into three specific objectives as follows: To assess the effect of economic factors and farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District; To establish how farmers' characteristics affect to adoption of improved agricultural technologies in Irish potato production in Kabale District; To establish the extent to which Institutional factors affect farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District.

The descriptive statistics of the findings are presented objective by objective, while the inferential statistics of correlations and multi-linear regression analysis shall be presented at once for all the objectives as the hypotheses are tested. All the variables were measured on a five point Likert scale ranging from 1-Strongly Agree (SA), 2 – Agree (A), 3 – Not Sure (NS), 4 – Disagree (D) and 5 - Strongly Disagree (SD).

4.4.1 To assess the effect of economic factors on farmers' adoption of improved agricultural technologies in Irish potato production in Kabale district

In order to understand the attitudes and perceptions of the respondents on economic factors, so as to assess whether they have an effect on farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District, the researcher used a total of three statements or items on the questionnaire, to which the respondents were required to show their level of agreement or disagreement. Below the researcher presents the findings

Table 8: Showing views of respondents on economic factors

Statements measuring Economic Factors	**SA**	**A**	**NS**	**D**	**SD**
The cost of producing Irish potato using recommendable technologies is affordable	(3) 1.2%	(123) 47.5%	(9) 3.5%	(120) 46.3%	(4) 1.5%
I access loan from credit institutions for Irish potato production	(5) 1.9%	(136) 52.5%	(0) 0.0%	(114) 44.0%	(4) 1.5%
I always pay low interest rate for the loan I acquire for Irish potato production	(6) 2.3%	(48) 18.5%	(7) 2.7%	(19 6) 75.7%	(2) 0.8%

Source: Primary data from field study

On the variable economic factors, majority of the respondents expressed satisfaction on one item out of the three items measuring them, with 54.4% agreeing that they access loan from credit institutions for Irish potato production, while 45.5% were in disagreement. It can be concluded that formal credit institutions constituted the greatest source of access to credit for those who accessed. This may be due to the ease with which credit from these sources can be accessed with minimal transaction costs and without collateral. Access to loan from credit institution would help farmers to acquire agricultural technologies on credit thus adoption of improved agriculture technologies in Irish potato production.

The majority of the respondents, 76.5% however, expressed dissatisfaction on whether they always pay low interest rate for the loan they acquire for Irish potato production, only 2.7% were neutral, and 20.8% were in agreement. Credit access by Irish potato farmers was poor. Interest rate being high will discourage farmers from borrowing but instead borrow from relatives and/or friends which affect adoption of improved agriculture technologies of Irish potato production.

However there were mixed reactions on two of the items; with 48.7% agreeing that the cost of producing Irish potato using recommendable technologies is affordable, while only 3.5% were neutral and 47.8% were in disagreement which undoubtedly will hamper technology transfer. These mixed reactions were mainly because income levels vary from household to house hold and also because farmers with bigger pieces of land may afford because their harvest are usually bigger compared to farmers with smaller pieces of land.

4.4.2 To establish how farmers' characteristics affect to adoption of improved agricultural technologies in Irish potato production in Kabale District

In order to understand the attitudes and perceptions of the respondents on farmers' characteristics, so as to establish how they have affect farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District, the researcher used two statements or items on the questionnaire, to which the respondents were required to show their level of agreement or disagreement. Below the researcher presents the finding

Table 9: Showing views of respondents on Farmers Characteristics

Statements measuring Farmers Characteristics	**SA**	**A**	**NS**	**D**	**SD**
Educated farmers' adoption rate of agricultural technologies of Irish potato production is higher than that of the less educated farmers	(9) 3.5%	(186) 71.8%	(3) 1.2%	(61) 23.6%	(0) 0.0%
Young farmers' adoption rate of agricultural technologies of Irish potato production is much higher than that of old farmers	(0) 0.0%	(78) 30.1%	(14) 5.4%	(167) 64.5%	(0) 0.0%

Source: Primary data from field study

On the variable farmers' characteristics, majority of the respondents, 75.3% expressed satisfaction on whether educated farmers' adoption rate of agricultural technologies of Irish potato production is higher than that of the less educated farmers, while 1.2% was neutral and 23.6% were in disagreement. Education level of the household head is an important variable likely to have a positive influence on adoption rate of agriculture

technologies of Irish potato production. Educated farmers' adoption rates of improved agriculture technologies was higher than less educated farmers and hence increase in production of Irish potato.

However the majority of the respondents, 64.5% expressed disagreement on whether young farmers' adoption rate of agricultural technologies of Irish potato production is much higher than that of old farmers, while 5.4% were neutral and 30.1% were agreement. The more years spent on Irish potato farming predisposes farmers to better farming techniques through learning by doing. Increased farming experience may also lead to good farm decision making including the efficient use of inputs. Experience is an important positive determinant of a farmer's level of experience, therefore, postulated to be positively affected education level and farmers' adoption rate of agricultural technologies of Irish potato production. According to the documentary checklist 'farmers who attended NAADS workshops, demonstrations, meetings were mainly old and middle age and few were the young farmers.

4.4.3 To establish the extent to which Institutional factors affect farmers' adoption of improved agricultural technologies in Irish potato production in Kabale district

In order to understand the attitudes and perceptions of the respondents on institutional factors, so as to establish the extent to which they have affected farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District, the researcher used five statements or items on the questionnaire, to which the respondents were required to show their level of agreement or disagreement. Below the researcher presents the findings.

Table 10: Showing views of respondents on institutional factors

Statements measuring Institutional Factors	SA(%)	A(%)	NS(%)	D(%)	SD(%)
I always participate in the demonstration of the technology for Irish potato when the service providers are training	(6) 2.3%	(209) 80.7%	(3) 1.2%	(41) 15.8%	0.0 o.0%
I always understand the language extension workers use during the trainings on technologies of Irish potato production	(12) 4.6%	(208) 80.3%	(7) 2.7%	(29) 11.2%	(3) 1.2%
I always understand the form of trainings on technologies for Irish potato production used by service providers	(12) 4.6%	(208) 80.3%	(4) 1.5%	(35) 13.5%	0.0 0.0%
Service providers visit us frequently to provide advisory services on Irish potato production	(6) 2.3%	(204) 78.8%	(2) 0.8%	(44) 17.0%	(3) 1.2%
I always get in contact with the service providers at the sub county when I get a problem on my Irish potato garden	(9) 3.5%	(168) 64.9%	(5) 1.9%	(77) 29.7%	0.0 0.0%

Source: Primary data from field study

On the variable institutional factors, majority of the respondents expressed satisfaction on all the items measuring it; with 83.0% agreeing that they always participate in the demonstration of the technology for Irish potato when the service providers are training, 84.9% agreeing that they always understand the language extension workers use during the trainings on technologies of Irish potato production, 84.9% agreeing that they always understand the form of trainings on technologies for Irish potato production used by service providers, 81.1% agreeing that service providers visit them frequently to provide advisory services on Irish potato production and 68.4% agreeing

that they always get in contact with the service providers at the sub county when they get a problem on Irish potato garden.

Farmers' participation in the demonstration shows that farmers have already started adopting improved agricultural technologies of Irish potato production. Again farmers understanding the language extension workers use during the trainings indicate that they will acquire necessary skills thus leading them to adoption of improved agricultural technologies of Irish potato.

The form of trainings on technologies for Irish potato production used by service providers which was understood by farmers shows that there was attitude to change thus increase in adoption of new technologies. Regular contacts with the extension workers are expected to facilitate practical use of modern techniques and adoption of improved agronomic practices.

Contact with the service providers at the sub county when they get a problem on Irish potato garden shows that there is attitude to change on adoption of improved agricultural technologies of Irish potato production .This will increase the standards of living.

4.4.4 Findings on farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District (Dependent Variable)

Farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District was measured on the questionnaire using nine statements or items, to which the respondents were required to show their level of agreement or disagreement. Below the researcher presents the findings

Table 11: Showing views of respondents on Farmers' adoption of agricultural technologies in Irish potato production in Kabale District

Statements measuring Adoption of Agricultural Technologies	SA	A	NS	D	SD
I always use farm yard manure when planting Irish potato	(9) 3.5%	(109) 42.1%	(3) 1.2%	(136) 52.5%	(2) 0.8%
I always buy fertilizers from shop that I use when planting Irish potato	(3) 1.2%	(153) 59.1%	(0) 0.0%	(101) 39.0%	(2) 0.8%
I always Irrigate Irish potato garden in the dry season	(3) 1.2%	(7) 2.7%	(0) 0.0%	(235) 90.7%	(14) 5.4%
I use recommendable seeds which are disease free when planting Irish potato	(3) 1.2%	(148) 57.1%	(2) 0.8%	(99) 38.2%	(7) 2.7%
I always practice crop breeding for Irish potato production	(0) 0.0%	(21) 8.15%	(3) 1.2%	(229) 88.4%	(6) 2.3%
I always follow all agronomic practices for Irish potato production	(3) 1.2%	(88) 34.0%	(0) 0.0%	160) 61.8%	(8) 3.1%
I have a structure of aeroponic for Irish potato seeds at home	(0) 0.0%	(12) 4.6%	(0) 0.0%	(238) 91.9%	(9) 3.5%
I practice" fanya kini", "fanya jju" in my Irish potato garden	(2) 0.8%	(57) 22.0%	(3) 1.2%	(195) 75.3%	(2) 0.8%
I always put my land to rest for 2-3 years before planting Irish potato	(0) 0.0%	(63) 24.3%	(3) 1.2%	(183) 70.7%	(10) 3.9%

Source: Primary data from field study

On the variable Adoption of Agricultural Technologies, majority of the respondents expressed satisfaction on only two items out of the nine measuring it; with 60.3% agreeing that they always buy fertilizers from shop that they use when planting Irish potato and 58.3% agreeing that they use recommendable seeds which are disease free

when planting Irish potato. This shows that acquisition of fertilizers from shops increases the production of Irish potato and hence has a major influence on adoption of improved agricultural technology.

However the majority of the respondents expressed disagreement on seven of the items measuring it; with 53.3% disagreeing that they always use farm yard manure when planting Irish potato, 96.1% disagreeing that they always Irrigate Irish potato garden in the dry season, 90.7% disagreeing that they always practice crop breeding for Irish potato production, 64.9% disagreeing that they always follow all agronomic practices for Irish potato production, 95.4% disagreeing that they have a structure of aeroponic for Irish potato seeds at home, 76.1% disagreeing that they practice ”fanya kini”, “fanya jju” in their Irish potato garden and 74.6% disagreeing that they always put their land to rest for 2-3 years before planting Irish potato. This shows that farmers have little information on the use of farm yard manure and thus loss of soil fertility which affects adoption of technologies and because of the landscape of Kabale District it is difficult to fetch water for irrigation or use of piped water.

The disagreement on practice of crop breeding of Irish potato, shows that there is little done on dissemination and strengthening on adoption of improved technology. The disagreement on use of all agronomic practices shows that farmers still have poor or low attitude to change to improved technologies and on structures of aeroponics shows there is lack of initial capital or information had hindered adoption of improved technology.

Poor attitude to change hindered farmers from practicing ‘fanya kini’, fanya jju’ which would otherwise control soil erosion.

These quantitative findings are in collaboration with what a key informant at the sub county said *"The landscape of Kabale district does not allow irrigation to Irish potato gardens in the dry season due to scarcity of water ".*

One of the district production staff also agreed with the above findings when he said *"Lack of initial capital and information had hindered farmers from raising structures of aeroponics and follow all agronomic practices of Irish potato production''.*

The Chairman LCIII also said *"Poor attitude to change had hindered farmers from practicing 'fanya kini', fanya jju' which would otherwise control soil erosion''.*

4.5 Hypothesis Testing

This study had three hypotheses, which the researcher tested by using correlation coefficients and multi-liner regression.

4.5.1Correlation Coefficients

Bivariate correlations (Pearson Correlation Coefficients with two-tailed test of significance) were calculated as a preliminary check of hypotheses and to check multi-collinearity between independent variables. The findings are presented in the table below; Table 12 shows that there is a moderate positive relationship between economic factors and adoption of agricultural technologies, given by Pearson's correlation coefficient of 0.555. The relationship is statistically significant at 95% confidence level (2-tailed) as the p-value is less than 0.025 (=0.000).

Table 12 further shows that there is a weak positive relationship between farmer characteristics and adoption of agricultural technologies, given by Pearson's

correlation coefficient of 0.397. The relationship is statistically significant at 95% confidence level (2-tailed) as the p-value is less than 0.025 (=0.000).

The Table12 further shows that there is a weak positive relationship between institutional factors and adoption of agricultural technologies, given by Pearson's correlation coefficient of 0.224. The relationship is statistically significant at 95% confidence level (2-tailed) as the p-value is less than 0.025 (=0.000).

The table 12 shows that there is no multi-collinearity between the independent variables since none of the correlation coefficients between any two independent variables is greater 0.60, the threshold for multi-collinearity. This shows that each of the independent variables' relationship with the dependent variable is based on its own merit and not the influence of another independent variable.

Table 12: The Inter-Correlations among the Study Variables

Pearson's correlation		Economic Factors	Farmer Characteristics	Institutional Factors	Adoption of Agricultural Technologies
Economic Factors	Pearson Correlation	1	.289*	.320*	.555*
	Sig. (2-tailed)		.000	.000	.000
	N	259	259	259	259
Farmer Characteristics	Pearson Correlation	.289*	1	-.125*	.397*
	Sig. (2-tailed)	.000		.045	.000
	N	259	259	259	259
Institutional Factors	Pearson Correlation	.320*	-.125*	1	.224*
	Sig. (2-tailed)	.000	.045		.000
	N	259	259	259	259
Adoption of Agricultural Technologies	Pearson Correlation	.555*	.397*	.224*	1
	Sig. (2-tailed)	.000	.000	.000	
	N	259	259	259	259

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

Source: Primary data from the field.

4.5.2 Multi-linear regression

The hypotheses were tested using multiple linear regression analysis. The justifications for using multiple linear regression analysis were that this was prediction study with many variables and multiple linear regression analysis provides net effects and

explanatory power in form of Adjusted R square. Level of significance was set at less than or equal to 0.05. Using the Enter method, a statistically significant model emerged. The model summary is presented below.

Table 13: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.618	.382	.375	.33820

Source: Primary data from the field

The model summary in table 13 shows that the coefficient of determination (Adjusted R Square) is 0.375. This implies that this model accounts for 37.5% of the variance in Adoption of Agricultural Technologies in Kabale district. This could be attributed to the fact that Adoption of Agricultural Technologies has far more factors that influence it than what the study has undertaken.

To assess the overall significance of the model, analysis of variance (ANOVA) was done and the results presented in the table below

Table 14: Analysis of Variance (ANOVA)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	18.026	3	6.009	52.534	.000[a]
	Residual	29.166	255	.114		
	Total	47.192	258			

a. Predictors: (Constant), Institutional Factors, Farmer Characteristics and Economic Factors

Source: Primary data from the field

b. Dependent Variable: Adoption of Agricultural Technologies

In determining whether a model is significant, the decision rule is that the calculated p-value (level of significance) must be less than or equal to 0.05. Since the calculated p-value of 0.000 is less than 0.05, the model was found to be statistically significant ($F=52.534, df = 3, p<0.05 (=0.000)$). A statistically significant model means that at least one of the predictor variables (Economic Factors, Farmer Characteristics or Institutional Factors) has a significant influence or effect on the dependent variable (Adoption of Agricultural Technologies).

To determine which of the predictor variables were significant the researcher examined the standardized beta coefficients (which measure the contribution of each variable to the model), the t values and significance values which give rough indication of the impact of each predictor variable. These are presented in the table

Table 15: Regression coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.818	.135		13.504	.000
	Economic Factors	.290	.037	.434	7.824	.000
	Farmer Characteristics	.181	.033	.287	5.413	.000
	Institutional Factors	.073	.032	.121	2.256	.025

a. Dependent Variable: Adoption of Agricultural Technologies

Source: Primary data from the field

The decision rule for multi linear regression is that the t value must not be close to 0 and the p-value must be less than or equal to 0.05.

Table 15 shows that the p-values for the constant, economic factors, farmer characteristics and institutional factors are each less than 0.05 and their t values are not close to zero (0). This shows that economic factors, farmer characteristics and institutional factors have a significant effect on adoption of agricultural technologies in Kabale District.

The findings on economic factors were supported with the interview results from the NAADS/extension staff and chairman farmers for who stated that

'High cost of agricultural inputs (like fertilizers, pesticides, improved varieties and raising of storage structures) and lack of access to credit affect adoption of improved agricultural technologies''.

Again in connection to the above findings key informants at the sub county during the interview stated that

'Credit access by Irish potato farmers was poor because of interest rate being high had discouraged farmers from borrowing but instead borrow from relatives and/or friends which affected adoption of improved agriculture technologies of Irish potato production''.

The findings on farmers' characteristics were supported with the interview results from the key informants from the district who re-affirmed that

'Age and education do not affect adoption of agricultural technologies in Irish potato production. They claimed that Irish potato is a cultural crop in Kabale District and adoption of improved agricultural technologies depends on what other successful farmers have done''.

The findings on institutional factors were supported with the interview results from the chairman farmers' forum and agricultural extension staff who said that

'The ratio of extension staff in the sub county to over twenty thousand farmers was small. This number was too big for one extension worker and therefore greatly affected adoption of improved agricultural technologies''.

4.5.3 Interpreting the findings and making a decision on the hypothesis

Basing on the research findings the researcher made the following and interpretation and decision on each of the hypotheses.

Hypothesis 1 Economic factors have a significant effect on farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District;

The research findings show that there is a statistically significant relationship between economic factors and adoption of improved agricultural technologies ($r=0.555$, p-value<0.025 ($=0.000$)). This implies that improved economic factors translate or lead to improved adoption of agricultural technologies in Irish potato production in Kabale District. Findings from regression analysis further indicate that economic factors have a significant effect on adoption of improved agricultural technologies in Irish potato production in Kabale district ($\beta=0.434$, $t=7.824$ $p<0.05$ ($=0.000$)). The researcher, therefore, accepted hypothesis number 1, which was stated as thus; economic factors have a significant effect with farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District.

Hypothesis 2 Farmers' characteristics have a significant effect on adoption of improved agricultural technologies in Irish potato production in Kabale district;

The research findings show that there is a statistically significant relationship between Farmers' Characteristics and Adoption of Improved Agricultural Technologies ($r=0.397$, p-value<0.025 ($=0.000$)). This implies that improved Farmers' Characteristics translates or leads to of improved agricultural technologies in Irish potato production in Kabale district. Findings from regression analysis further indicate that farmers' characteristics have a significant effect on adoption of improved agricultural

technologies in Irish potato production in Kabale district (β=0.287, t=5.413 p<0.05 (=0.000)). The researcher therefore accepted hypothesis number 2, which was stated as thus; Farmers' characteristics have a significant effect on adoption of improved agricultural technologies in Irish potato production in Kabale district.

Hypothesis 3 Institutional factors have no effect to farmers' adoption of improved agricultural technologies Irish potato production in Kabale District;

The research findings show that there is a statistically significant relationship between institutional factors and adoption of improved agricultural technologies (r=0.224, p-value<0.025 (=0.000)). This implies that improved institutional factors translate or lead to improved adoption of agricultural technologies in Irish potato production in Kabale District. Findings from regression analysis further indicate that Institutional Factors have a significant effect on adoption of improved agricultural technologies in Irish potato production in Kabale District (β=0.121, t=2.256,p<0.05 (=0.025)). The researcher, therefore, rejected hypothesis number 3, which was stated as thus; institutional factors have no effect to farmers' adoption of improved agricultural technologies Irish potato production in Kabale District.

CHAPTER FIVE

SUMMARY, DISCUSSION, CONCLUSIONS ANDRECOMMENDATIONS

5.1 Introduction

This chapter presents the summary, discussions, conclusions and recommendations got from the research findings guided by the research general and specific objectives. The specific objectives were as follows: To assess the effect of economic factors on farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District; To establish how farmers' characteristics affect to adoption of improved agricultural technologies in Irish potato production in Kabale District; To establish the extent to which Institutional factors affect farmers' adoption of improved agricultural technologies in Irish potato production in Kabale district.

5.2 Summary of the findings

The main purpose of the study was to examine the factors affecting farmers' adoption of agricultural technologies in Irish potato production in Kabale district. There were three independent variables, namely; economic factors, farmers characteristics and institutional Factors, while there was only one dependent variable; adoption of agricultural technologies.

5. 2.1To assess the effect of economic factors on farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District

Economic factors were studied by asking the respondents three (3) questions with the responses measured on the Likert scale. The findings got indicate that economic factors have a moderate positive relationship with adoption of agricultural technologies. The p-

value for economic factors was less than 0.025 (=0.000), given r=0.555, the researcher, therefore, accepted the relationship as statistically significant. This implies that improvement in economic factors leads or translates into an improvement in adoption of agricultural technologies. Similarly, a decline in economic factors leads or translates into a decline in adoption of agricultural technologies.

5.2.2 To establish how farmers' characteristics affect on adoption of improved agricultural technologies in Irish potato production in Kabale District

Farmers' characteristics were studied by asking the respondents two (2) questions with the responses measured on the Likert scale. The findings got indicate that Farmers' characteristics have a weak positive relationship with adoption of agricultural technologies. The p-value for farmers' characteristics was less than 0.025 (=0.000), given r=0.397, the researcher therefore accepted the relationship as statistically significant. This implies that improvement in farmers' characteristics leads or translates into an improvement in adoption of agricultural technologies. Similarly, a decline in farmers' characteristics leads or translates into a decline in adoption of agricultural technologies.

5.2.3 To establish the extent to which institutional factors affect farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District

Institutional factors were studied by asking the respondents five questions with the responses measured on the Likert scale. The findings got indicate that Institutional factors have a weak positive relationship with adoption of agricultural technologies. The p-value for Institutional factors was less than 0.025 (=0.000), given r=0.224, the researcher therefore accepted the relationship as statistically significant. This implies

that improvement in Institutional factors leads or translates into a weak improvement in adoption of agricultural technologies. Similarly, a decline in Institutional factors leads or translates into a decline in adoption of agricultural technologies.

5.3 Discussion of the findings

In this section the researcher discusses the findings of the study according to the study objectives.

5.3.1To assess the effect of economic factors on farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District

The findings got indicate that the economic factors have a moderate positive relationship with adoption of improved agricultural technologies in Irish potato production in Kabale District.

In agreement with the above study findings, some scholars such as Lubwama (1999), Bonabana (2002) and Nguthi (2007), indicated that access to credit through a bank loan or savings in cooperative were also reported to increase the probability of adopting technology.

Further explaining the relationship between factors affecting farmers and adoption of improved agriculture technologies in Irish potato production in Kabale District, the research findings were also consistent with the results from Feder, Just and Zilberman (1985) ,who reported that easy access to credit among farmers was one of the main reason why technology was able to diffuse.

The findings were also in agreement with Drechsel et al (2004), who identified capital and credit availability as one of the adoption adherence. They reported that farmers were able to raise sufficient funds to invest in recommended technologies because of

availability of capital access to credit. It is against this background that farmers as decision makers when faced with productive resources may decide to use the technology or not. This means that economic factors greatly affect adoption of improved agriculture technologies of Irish potato production.

5.3.2 To establish how farmers' characteristics affect to adoption of improved agricultural technologies in Irish potato production in Kabale District

The findings indicate that farmers' characteristics have a weak positive relationship with adoption of improved agricultural technologies in Irish potato production in Kabale district.

In agreement with Chavas and Riley (2001), reported that farmers with more formal education tend to adopt agricultural technologies more than those farmers with less formal education.

Vaiene et al (2009), in their study determinants of agricultural technology adoption in Mozambique also reported that educated farmers were in better position to process information and search for appropriate technologies than uneducated farmers.

The findings are in agreement with Kimanye(2001) ,in his study as to why adoption rates of women farmers was low in adoption of improved sorghum varieties in Mbeera District, Kenya.

Results from the study revealed that women did not adopt new sorghum varieties because the taste was not good and processing of the grains was difficult. It was also found that women did not participate in the later stages of technology development and evaluation. It was only men who were in contact with extension service providers and therefore women lacked information about the improved varieties.

The findings are also consistent with the results reported by Kakooza et al (2005), who reveled that in Uganda most agricultural programmes focus on men despite the predominant role played by women in agricultural production. He further pointed out there that there were gender gaps in decision making to purchase and use particular agricultural technologies, like fertilizers, pesticides, storage facilities and others all the rest in hands of men. The gender differences also favored men to attend farm demonstrations, farmers training sessions and extension services.

As for the farmers age, results revealed no significant differences between farmers' age and adoption of improved agricultural technologies in Irish potato production. This tends to suggest that since Irish potato is a cultural crop in Kigezi region age difference has no effect on adoption of improved technologies in Irish potato production.

Farmers in the traditional Irish potato growing areas have a cultural belief that they must grow Irish potato as it is the main source of food for the households and the surplus to be sold to get revenue for purchase of other household requirement. It is against this background that age does not matter in adoption of Irish potato production technologies.

Although Rogers (1983), reported that young farmers were found to be the first adopters of a technology more than their older counterparts. It is also argued that with age, farmers gain more experience and acquaintance with new technologies and hence expected to have higher ability to use new innovations more efficiently.

The findings from the study are in agreement with studies on adoption of land conservation practices in Niger Baidu- Forson (1999), rice in Guinea Adesiina and

Baidu-Ferson (1995), hybrid cocoa in Ghana Boahene et al (1999) that age was either not significant or negatively related to adoption.

On the other hand, Mc Namara, Wetzstein and Donce (1991) found that age positively influenced adoption of integrated practices on peanuts in Guinea. Like it is the case in the study findings, the adoption of improved agriculture technologies in Irish potato production in Kabale District is also being affected by the age limit according to the research indicated either middle or young who are inadequate for the Irish potato production because of lack of experience.

This is in total agreement with the study findings which pointed out a moderate positive relationship between the age and adoption of improved agriculture technologies in Irish potato production in Kabale District. This is due to the fact that as per all the information coupled with the study findings portray that the farmers characteristics can affect the farmers adoption rate and this would consequently affect their Irish potato production.

5.3.3 To establish the extent to which Institutional factors affect farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District

The findings got indicate that Institutional factors have a weak positive relationship with adoption of improved agricultural technologies in Irish potato production in Kabale District.

The findings showed that institutional factors play a big role on adoption of improved agricultural technologies in Irish potato production. Institutional factors basically involve passing on information to farmers and it is from this information accessed lead to adoption or rejection of the technology. This can be through the extension agent

visits to the farmers or the farmers' visits to the extension office seeking information or advice.

Agricultural extension is considered as a type of informal adult education that is intended to enhance farmers' knowledge in certain areas and enables them to benefit from available agricultural technologies and improve practices. In this way, the extension services supplements deficiency in the farmers' formal or informal education, lack of knowledge about technology availability, benefits and effective use of the technology.

This, therefore, explain that there a positive relationship between Institutional factors and adoption of improved agricultural technologies in Irish potato production in like it is Kabale District.

The results are in conformity with other research findings, that the uptake of new technology is often influenced by good extension programmes and farmers' contact with extension providers (Bonabana, 2002 and Nguthi, 2007).

Extension agents provide sources of improved varieties, inputs and technical advice. Increased exposure to extension agents and participation in farmer groups was also reported to have high correlation to adoption rates (Adesiina et al., 2000). The findings therefore are in agreement with the diffusion of innovation theory Rogers (1983), who emphasizes access to information as a principal factor affecting adoption of new technology. The implication of these findings is that extension contacts with farmers are important to technology adoption

However, the findings of the research go ahead and point out that institutional factors positively affect adoption of improved agricultural technologies in Irish potato production in Kabale District though the relationship between the two is a weak one.

All this information further clarifies that there is a positive relationship between Institutional factors and adoption of improved agricultural technologies in Irish potato production in Kabale District as it was also discovered in the researcher`s findings which pointed out a weak positive relationship between Institutional factors and adoption of improved agricultural technologies in Irish potato production in Kabale District.

5.4.0 Conclusions

The study made the following conclusions

5.4.1 To assess the effect of economic factors on farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District

In this objective the sub –dimension included, cost of technology and access to credit. The results indicated that economic factors have a significant relationship with adoption of improved agricultural technologies in Irish potato production in Kabale District. This therefore implies that if economic factors are improved, adoption of improved agricultural technologies will consequently improve. From the analysis of results, the evidence revealed that access and credit had an effect on farmers' adoption of recommended agricultural technologies. This therefore means that for technologies which were expensive, Irish potato farmers could not adopt them. The study results also revealed that farmers had no access to credit facilities; therefore they were unable to

purchase and use the technologies that had been recommended by researchers and disseminated by extension agents.

5.4.2 To establish how farmers' characteristics affect to adoption of improved agricultural technologies in Irish potato production in Kabale District

The analysis of the results from farmers' characteristics confirmed that of the two dimensions used in the study. The research therefore concluded that during technology generation, evaluation and dissemination by researchers and extension agents, gender balance was not considered and therefore affected technology adoption.

The study concluded that farmers' characteristics have a significant relationship with adoption of improved agricultural technologies in Irish potato production in Kabale District.

This implies that if the farmers' characteristics include gender/age, adoption of improved agricultural technologies in Irish potato production in Kabale District will consequently improve. There is, therefore, a need to deliberately focus on improvement of farmers' characteristics to ensure faster adoption of improved agricultural technologies in Irish potato production in Kabale District.

5.4.3 To establish the extent to which Institutional factors affect farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District

The results from the study as to the extent to which institutional factors affect farmers' adoption of agricultural technologies indicate that the two dimensions used in the study namely form of technology presentation and extension contact had a significant effect on technology adoption in Irish potato production. The researcher , therefore, concluded that the research extension contact with the farmers was inadequate due to the small

number of extension agents handling very many farmers in the sub county, farmers were not involved in technology generation and evaluation and therefore adoption of recommended technologies was affected.

The study concluded that Institutional factors have a significant relationship with adoption of improved agricultural technologies in Irish potato production in Kabale District.

This therefore, needs to strengthen the capacity of the institution responsible directly or indirectly for Irish potatoes production in Kabale District.

The study made the following recommendations in relation to findings and conclusions

5.5.1 To assess the effect of economic factors on farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District

The study recommends that Ministry of Finance, Planning and Economic Development and policy makers like Parliamentarians should urgently look at the cost of production of Irish potatoes production in Kabale District with a view to lowering it. There is also need to improve on access credit institutions so that the Irish potatoes farmers can get credit facilities. The interest rates payable on loans should also be affordable for the farmers.

The formation of farmer groups would enable them to pool resources with a view of buying inputs in bulk which would otherwise have been expensive. Farmers groups should be encouraged to access agricultural loans from microfinance which have low interest rates.

The study recommends that the Ministry of Finance, Planning and Economic Development in collaboration with Ministry of Agriculture, Animal Industry and

Fisheries should put in place policies to encourage formation of farmer cooperative societies which should import inputs directly from supplies and supply them to farmers at a relatively fair price. This will reduce the high cost and fake inputs in the market being experienced by farmers.

Cooperative societies in collaboration with Uganda Cooperative Alliance should supply inputs to farmers on credit through district cooperative office , so that farmers pay back after selling their produce. It is hoped that the interest rates will be low and all farmers will be able to access credit facilities even without security.

5.5.2 To establish how farmers' characteristics affect to adoption of improved agricultural technologies in Irish potato production in Kabale District

The study recommends that the agricultural researchers, extension agents and farmers should work together irrespective of gender. This means that equal opportunities should be given to both male and female by researcher and extension agents during technology generation and evaluation and during information dissemination.

The study recommends that District Production and Marketing Administration together with Sub County authority to undertake mature age education especially in the field of agriculture for Irish potato farmers, since the more a person is educated the more it becomes easy to adopt to improved agricultural technologies in Irish potato production.

The District Community Development office in charge of gender, culture and community development together with Sub County authority should encourage youthful people to join the agricultural sector since it has been observed that youthful people adopt faster improved agricultural technologies in Irish potato production. Formation of groups would also aid in countering the fact that older people are rigid towards

technical transformation. These farmer groups will therefore aid older farmers to grasp the value of new technology which would otherwise not be the case had they been on their own. Policy makers should focus on strategies that will provide Irish potato farmers with greater access to adequate and timely credit.

5.5.3 To establish the extent to which institutional factors affect farmers' adoption of improved agricultural technologies in Irish potato production in Kabale District

The study recommends that the participatory research should be encouraged by Ministry of Agriculture, Animal Industry and Fisheries together with Kachwekano Zonal Agricultural, Research Development Institute between researchers, extension and farmers. This will encourage farmers to own the technology at the initial stages of generation and willfully appreciate the technology during evaluation. Participatory research will the therefore increase farmers adoption of the technology

The researcher also recommended the formation of farmer field schools in the sub county. In farmer field schools farmers learn the different technologies in a group and in turn farmers train their fellow farmers. This means that many farmers can be trained in big number and in a short period of time who in turn, become equipped to train many other farmers who have not attended the farmer field schools. This will help to increase on the number of extension agents that provide agricultural information to farmers.

The study recommends that extension workers in Kabale District should be visible to the farmers by visiting them more often and demonstrating to them new agricultural technologies. Other service providers to support Irish potatoes production should also be encouraged to get more involved with the farmers. The recommendation should be implemented by the Chief Administrative Officer together with the Resident District

Commissioner, District Production and Marketing Office and Sub County authority. Farmers' adoption is thus expected to be enhanced more through farmers having hands-on experience than would be the case with the more indigenous technologies. This suggests that the introduction of such farmer field schools practices should be preceded by encouraging higher farmer participation in on-farm trial demonstrations as a means of increasing farmers' practical experience with the introduced technologies. Policy makers should explore ways of strengthening mass media to supplement and complement extension besides extensive use of Information and Communication Technology to support Agricultural Extension.

5.6 Area for further research

The study concentrated on economic factors, farmers' characteristics, institutional factors and adoption of improved agricultural technologies in Irish potato production in Kabale district. However other factors like farmers' participation, financial resources availability, material resources availability, Climatic, influence of government policies and local political leadership were not part of this study.

REFERENCES

Abara, I. O. C., and Singh, S. (1993). 'Ethics and Biases in Technology Adoption: The Small - farm Argument:, Technological forecasting and Social Change.43, 289- 300.

Adesiina, A.A., and Baidu-Forson. J. (1995). Farmers' Perceptions and Adoption of New Agricultural Technology: Evidence from Analysis in Burkina Faso and Guinea. West Africa. Journal of Agricultural Economics. 13, 1-9

Adesiina, A., and Zinnah, M. (1993).Technology Characteristics, Farmers' Perception and Adoption Decisions, Agriculture Economics.9, 297-311.

Amin, E.M. (2005).Social Science Research, Conception, Methodology Analysis: Makerere University printery, Uganda

Baidu-Forson, J. (1999). 'Factors Influencing Adoption of Land-Enhancing Technology in the Sahel: Lessons from a Case study in Niger''. Journal of Agricultural Economics.20, 231-239

Barerk, M.J. (2000). 'The Measurement of Productive Efficiency''. Journal of the Royal Statistical Society, 120(3), 253-290.

Barifaijo, M. K., Basheka, B. C, & Oonyu, J. (2010). How to Write a Good Dissertation/Thesis. Kampala, Uganda

Bhalla, S. (1979). Farm and Technical Change in Indian Agriculture: An Agrarian Structure and Productivity in Developing Countries, Edited by Berry, R.et al. Johns Hopkins, University Press

Bengura, A.C. (1983). The Relationship of Farmer Characteristics to the Adoption of Farm Practices in four villages of Western State of Nigeria, Bulletin of

Rural Economics and Sociology. 4, 76 -95

Boahene, K., Snijders .T.A.B., Folmer. H. (November 1999). 'An Integrated Socio-Economic Analysis of Innovation Adoption: The case of Hybrid Cocoa in Ghana'' Journal of Policy Modeling.21 (2), 167-18

Bonabana, J., D. B. Taylor, V., Kasenge, B., Bashaasha and Erbaugh. M.J. (2001). 'Assessing Impacts of IPM CRSP Strategies on Groundnut Diseases in Kumi-Uganda''. Annual Report, IPM CRSP.

Bonabana-Wabbi, J. (2002).'Assessing Factors Affecting Adoption of Integrated Pest Management: in Kumi District, Eastern. Uganda.

Canadian Potato Situation and Trends. (2006-2007).'Opportunities and Challenges''. Retrieved October 30, 2013, fromwww.canad.gc.ca

Chaves, B.and Riley, (2001). 'Determinants of Factors Influencing Integrated Pest Management Adoption in Coffee Berry Borer in Colombian Farms''. Agriculture Ecosystem and Environment, 87PP:159-177

CIMMTY Economics Program, (1993).The Adoption of Technology: A guide for Survey Design, Mexico DF: CIMMYT, The United Republic of Tanzania and the Southern Africa Centre for Cooperation in Agricultural Research : (SACCAR), Mc-Graw Hill Inc.

Drechsel, P., Olaleye, A., Adeoti, A., Thiombiano, L., Barry, B & Vohland, K. (2004). Adoption Driver and Constraints of Resource Conservation Technology in Sub Sahara Africa. Accra, Ghana

Dudhani, C.M., Sethurao, M.K., and Badachikari, S.Y. (1987). 'Impact of Drought

prone area, Programme on the Demonstration farmers: Journal of Rural Development, Agricultural College, Dhawadi.6 (1), 128-138. Accessed in November 2013.

FAO, Food and Agricultural Organization of the United Nations. (April 1996). Nineteenth, Regional Conference for Africa, World Food Summit: Food Security Situation and Issues in the Africa Region, Ouagadougou, Burkina Faso,16-20 (Print)

FAO, (2000).World Agricultural Statistics, Basic Data Unit, Statistics Division. FAO, Rome. Italy

FAOSTAT, The Food and Agricultural Organization of the United Nations Production Databases [Online], retrieved in October ,2013, from URL: http://www.fao.org. January 20, 2002,October 18, 2002,May 2002.

Feder, G., and Slade. R. (1984, August7). The Acquisition of Information and the Adoption of new Technology, American Journal of Agricultural Economics, American Agricultural Economics Association. 66,312-320.

Feder, G., Just, E. R., and. Zilberman. D. (1985).'Adoption of Agricultural Innovations in Developing Countries, A Survey'', Economic development and cultural change. 33,255-298.

Garvin, R.T. (1980). A sociological Investigation into the Efficiency of Adoption and Rejection of Selected Research Recommendations by Tobacco Growers in Zimbabwe Agricultural Journal, 77(6), 285-288

Green, D.A.G., and Ng'ong'Ola. D.H. (January 1993). 'Factors Affecting Fertilizer

Adoption in Less Developed Countries'', an Application of Multivariate Logistic Analysis in Malawi Journal of Agricultural Economics. 44 (1), 99-109.

Isubikalu, P., Erbaugh J.M., and Semana. A.R. (1997). 'Understanding Farmer Knowledge Regarding Cowpea Production and Pest Management: A case study of Kumi, Pallisa and Katakwi districts, in Eastern Uganda. MS thesis, Makerere University

Jackai, L.E.N., Singh, S.R. A.K., Raheja, F., Wiedijk. (1985). Institute of International Tropical Agriculture, (IITA), World Cowpea Research Conference, John Wiley & Sons

Kakooza, J., Kabasimba, E., Semakula, B& Musisi, A (2005). 'Gender Variation in Agricultural Technology: A Cooperative Analysis of Two Ecological zones in Uganda

Karungi, J., E., Adipala. P., Nampala. M.W., Ogenga-Latigo and Kyamanywa. S. (1999), 'Population Dynamics of Selected Cowpea Insect Pests, as Influenced by Different Management Strategies in Eastern, Uganda: African Crop Science Journal, 7(4), 487- 495

Kato, E. (2001).An Analysis of Factors Affecting Adoption of K131 Bean Variety by Women Groups in Luuka County, Iganga District, MS Thesis, Makerere University

Kimenya, L.N. (2001). 'Understanding Low Rates of Technology Adoption by Women Farmers: a Case Study of the Determinants of Adoption of Improved Sorghum

Varieties by Women Farmers in Mbeera district, Kenya. Agricultural Science

And Technology PP: 30-40

Khanna, M. (2001). Sequential Adoption of Site-Specific Technologies and its Implications for Nitrogen Productivity, A double Selectivity Model, American: Journal ofAgricultural Economics, 83(1), 35-51

Kebede, Y. K., Gunjal and Coffin. G. (1990). Adoption of New Technologies in Ethiopian Agriculture, The Case of Tegulet-Bulga District, Shoa Province: Journal of Agricultural Economics, 427-43.

Koertz. (2003). Identification of Technologies Products and Strategies with High Resources Efficiency, Potential Results of a Cooperative Selection Process, Centre for Research, Malawi.

Hooks, G. M., Napier. T. L. and Carter. M.V. (1983). 'Correlates of Adoption Behaviours,

International Maize and Wheat Improvement Centre (CIMMYT)'', A Guide for Survey Design.

International Potato centre. (2006).WorldPotatoAtlas. http://gilb.cip.cgiar.org/ confluence/pages/doexportpage.action. Accessed on 17th November 2013

InternationalPotatoCentre. (April, 2007).WorldPotatoAtlas.Retrievedfrom http://www.cipotato.org/potato/pests_diseases/late_blight.Accessedin 17thNovember 2013

International Potato Centre. (October 2008).ISSN 0256-8748, printed Peru by Commercial Grafice Sucre .Retrieved from (http://www.cipotato.org/publications /pdf/004365.pdf Accessed in 18th November 213

Luc, J. (1999).' Factors Influencing Adoption of Land Enhancing Technology in the Sahel'', lessons from a Case Study in Niger, Agricultural Economics 20(3), 23-23

Lubwama, F.B. (1999).Social-Economic and Gender Issues Affecting the Adoption of Conservation Tillage Practices, Kampala-Uganda.

Madhin, E.Z. (2001) .'Farmers Perception and Adoption of Soil Management Technologies in Western, Kenya: African Crop Science Journal 7(4), 549-558

Manyewa-Mutamba., & Nyagaha, L. (2009). Africa, Small Holder Agriculture Transforms lives of Poor, Cotton-Wheat production System, in South Asia. A success story

McNamara, K. T., Wetzstein, .M.E., and Douce, G.K. (1991). 'Factors Affecting Peanut Producer , Adoption of Integrated Pest Management'', Review of Agricultural Economics. 13,129- 139.

Ministry of Agriculture Animal Industry and Fisheries (2005). Economic Review of Agriculture, Prepared by the Central Planning and Monitoring Unit, Kampala.

Ministry of Agriculture Animal Industry and Fisheries. (2005). National Policy on Potato Industry Kampala, Government printer.

Mugenda, O.M., and Mugenda, A.G. (2003).Research Methods, Quantitative and Qualitative Approach. Nairobi. Kenya. African centre for technology studies

Mugisa-Mutetikka, M., Opio, A.F., Ugen, M.A., Tukamuhabwa. P., Kayiwa, B.S., Niringiye,C. `et al''. (2000).Logistic Regression Analysis of Adoption of New Bean Varieties in, Uganda. Unpublished

Nguthi. N. (2007). 'Adoption of Agricultural Innovation by Smallholder Farmers in the Content of HIV/AIDS: The Case of Tissue Cultured Banana in Kenya, Nairobi-Kenya

Onen, D., and Oso .C. (2005). A general Guide to Writing Research Proposal and Report, Options Press and Publishers

Pesson, L. (1967).Factors Associated with the Adoption of Agricultural Practices, Rural Sociology.23 (4), 35-88

Punch, A. (2000). Well-being at work, 'A cross-National Analysis of the Levels and Determinants Of Job Satisfaction: Journal of Socio-Economic, 29(6), 517-539.

Remmy, J. (1987).Technical Innovation and Social Relationships, The Case of Vegetable Producers in Roussilon, Economic Rurale.177, 19-23

Rogers, M.E. (1983). Diffusion of Innovations, 3rdEdition, The Free press, New York

Ruttan, V.W., and Thirtle, G.C. (1987). The Role of Demand and Supply in the Generation and Diffusion of Technical Change, University of Manchester, and University of Minnesota.

Sekarana, B.A. (2003). Research Methods for the Behavioral Sciences, (3rd Ed) Wadsworthcengagelearning, USA.

Stirling, (1993). Post Harvest Handling of Pineapple in Malaysia, In proc, Australasian Post Harvest Conference of Queens Land Gatton Colleges, Brisbane, pp 225-228

Tetard, J., and Collan. (2009).'The Analysis of Farmers' Behavior About Selecting Agricultural Technology'', American Journal of Agricultural Economics, Vol. 87 No. 4, pp. 1009-19.

Top 5 facts sources: Potato World Commodity Online report. Retrieved from http://www.potato2008.org/).,India potato price seen falling, supplies to rise 20%" FAO.

Uganda, Republic of, Background to the Budget 1998/99 (Budgeting for Poverty Eradication),Ministry of Finance, Planning and Economic Development, Kampala.1998a.

Republic of Uganda, Establishment of National Agricultural Research Organization. (2012). International Service for National Agricultural Research (ISNAR)

Republic of Uganda, Report on Uganda National Household Survey (1995-96) (Third Monitoring Survey) Vol. 1, Main results of the Crop-Survey Module.

Republic of Uganda, Statistical Abstract. (1996). Ministry of Finance, Planning and Economic Development. Entebbe

United Nations. (2006).Food and Agriculture Organization. The State of Food and Agriculture. Rome.

United States Bureau of the Census. International Data Base. (Online) Retrieved from URL:http://www.census.gov accessed December 29, 2013.

Vaiene, R.N., Armdt, C., Masters, W.A. (2009) .Determinants of Agricultural Technology Adoption in Mozambique

Venkatesh, P., andBala, J.D. (2008).Integrating Technology Traits and Producer Heterogeneity,'Amixed-Multinominal Model of Genetically Modified Corn Adoption:American Journal of Agricultural Economics, Vol. 91 No. 2, pp. 444-61.

World Bank Participation Sourcebook, (Online) .Retrieved from

www.worldbank.org/wbi/sourcebook. Accessed November, 2013

World Bank. (2008). Uganda Agriculture Country Study, The World Bank Washington,D.C.

APPENDIX 1: SELF ADMINISTERED QUESTIONNAIRE

This questionnaire is for Irish potato farmers of Muko Sub County who benefited from NAADS programme and those who did not benefit and KAZARDI staff working in Irish potato aeroponic.

Dear respondent,

Iam Kansiime Kyabato Rose a master's participant of Uganda Management Institute carrying out an academic research on the factors affecting farmers' adoption of agricultural technologies in Irish Potato production in Kabale District. I do therefore request you to answer the questionnaire below and do promise that everything raised by you as far as this research is concerned will be kept confidential and used strictly for academic purposes.

SECTION A: IDENTIFICATION OF RESPONDENT

Date of self administered questionnaire…….

Village……

Parish……

Sub County……

SECTION B: BIODATA

Instructions: Please tick where appropriate

1. What is your age range? 20-30years ☐ 31-40 years ☐ 41-50years ☐ 51-60years ☐ above 60years ☐

2. Gender

Male ☐ Female ☐

3. Your highest level of education

Primary ☐ Secondary ☐ Tertiary ☐ Others specify ☐

5. Your total land size:

Less than acre ☐ 1acre ☐ 2 acres ☐ 3 acres ☐ more than 3 acres ☐

6. Your acreage of Irish potato:

0.5 acre ☐ 1acre ☐ 1.5 acre ☐ 2 acre ☐ More than 2 acres ☐

SECTION C: (Tick the most appropriate in the questions below, where 1 is strongly Agree, 2 Agree, 3 Not sure, 4 Disagree, 5 Strongly Disagree)

S/N	Section A: Economic Factors	SA	A	NS	D	SD
7	The cost of producing Irish potato using recommendable technologies is affordable					
8	I access loan from credit institutions for Irish potato production					
9	I always pay low interest rate for the loan I acquire for Irish potato production					
	Section B: Farmers Characteristics					
10	Educated farmers' adoption rate of agricultural technologies of Irish potato production is higher than that of the less educated farmers					
11	Young farmers' adoption rate of agricultural technologies of Irish potato production is much higher than that of old farmers					

	Section C: Institutional Factors					
12	I always participate in the demonstration of the technology for Irish potato when the service providers are training					
13	I always understand the language extension workers use during the trainings on technologies of Irish potato production					
14	I always understand the form of trainings on technologies for Irish potato production used by service providers					
15	Service providers visit us frequently to provide advisory services on Irish potato production					
16	I always get in contact with the service providers at the sub county when I get a problem on my Irish potato garden					
	Section D : Adoption of The Agricultural Technologies					
17	I always use farm yard manure when planting Irish potato					
18	I always buy fertilizers from shop that I use when planting Irish potato					
19	I always Irrigate Irish potato garden in the dry					

	season					
20	I use recommendable seeds which are disease free when planting Irish potato					
21	I always practice crop breeding for Irish potato production					
22	I always follow all agronomic practices for Irish potato production					
23	I have a structure of aeroponic for Irish potato seeds at home					
24	I practice" fanya kini", "fanya jju" in my Irish potato garden					
25	I always put my land to rest for 2-3 years before planting Irish potato					

THANK YOU

APPENDIX II: INTERVIEW GUIDE

Interview guide for in –depth interview of the Muko sub county staff, District production officer (DPO), District agricultural officer (DAO), District NAADS Coordinator (DNC), KAZARDI staff in charge of Irish potato and aeroponics technology

Topic of interview: Factors affecting farmers' adoption of agricultural technologies in Irish potato production in Kabale district

Brief description of the research project:

1.Date of interview ……

Interviewer……

Interviewee……

2. Demographic information

(i) Age……

(ii) Marital status……

(iii) Gender……

(iv) Education level……

(v) Occupation……

3.Farmers adoption and use of agricultural technologies

(a) What type of Irish potato varieties do farmers in your area grow and why?

(b) Are farmers in your area know how to use install and use aeroponics technology in Greenbanks?

(c) If yes who teaches them and where do they get funds for installation

(d) If No why?

(e) Which recommended management practices do they follow?

(f) How do Irish potato farmers in your area maintain fertility in their land?

(g) How do farmers participate in technology generation and evaluation?

(h) What is your advice to researcher on Irish potato production?

(i) Which technology have farmers found easy to adopt and why?

(j) How can researchers improve on the technologies they developed so that they can easily be adopted by small holder Irish potato farmer?

4. Economic factors and farmers' adoption and use of agricultural technologies in Irish potato production.

In your opinion can small holder Irish potato farmer afford to buy and use these Technologies?

i. How do most farmers in your area finance their Irish potato farming enterprises?
ii. Are they able to access credit from the lending institutions?
iii. Are there agricultural credit banks /lending institutions in your area to give credit to Irish potato farmers?
iv. How easy is it for the small holder farmers to get credit facilities from banks?
v. What are the interest rates?
vi. What is the repayment period if farmers use the recommended technologies in their Irish potato production, do you think they are able to make profits?

5. Farmers' characteristics and farmers' adoption and use of agricultural technologies in Irish potato production. Give your comment on how the under listed farmer characteristics affect adoption of agricultural technologies in Irish potato production in your area?

(a) Age

(b) Level of education

6. Institutional factors and farmers' adoption and use of agricultural technologies in Irish Potato production

(i) Do you have agricultural /NAADS extension staff in your district/sub county?

(ii) How often do they visit Irish potato farmers?

(iii) How are they facilitated?

(iv) Apart from extension /NAADS staffs how do farmers in your area access agricultural information?

(v) In what form do agricultural /NAADS staffs present technologies so far?

7. What other issues do you suggest to be attended for improvement of Irish potato production in your area?

THANKYOU

APPENDIX III: DOCUMENTARY REVIEW CHECKLIST

Title of the document	Particulars :Themes/Topics of review	Comments
Agriculture sector development strategy and investment plan(DSIP)	Priority areas on the technologies of Irish potato production	
Five year district/sub county plan (2011-2016)	Production and marketing sector objectives Strategies for improving production and productivity	
Agriculture technology and agribusiness advisory services(ATAAS)	Frame work for improving adoption of agricultural technologies of Irish potato production Improving linkages between research and development	
NAADS annual reports and Quarterly reports (2008-2013)	-NAADS project performance on Irish potato production -Progress in adoption of potato production technologies -Evaluation and monitoring reports on Irish potato production -Number and type of technologies for Irish potato development to farmers	
Annual procurement plan and budget for the district/ sub county/KARZARDI(2008-2013)	-Technical specifications for Irish potato technologies -Budget allocation for Irish potato technologies -Quarterly and annual releases for Irish potato technologies	

APPENDIX IV: DETERMINING SAMPLE SIZE

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	256	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	314	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	378
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	100000	384

Source R.V. Krejcie and D.W. Morgan (1970) (Amin, 2005), Determining sample size for research activities, educational and psychological measurements, p.608, sage publications

APPENDIX V: INTRODUCTION LETTER

UGANDA MANAGEMENT INSTITUTE

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Website: http://www.umi.ac.ug

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Our Ref:
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24 July 2014

TO WHOM IT MAY CONCERN

MASTERS IN MANAGEMENT STUDIES DEGREE RESEARCH

Ms. Rose Kansiime Kyabato is a student of the Masters in Management Studies of Uganda Management Institute 30th Intake 2013/2014, **Reg. Number 13/MMSPPM/30/091.**

The purpose of this letter is to formally request you to allow this participant to access any information in your custody/organization, which is relevant to her research.

Her research Topic is: **"Factors Affecting Farmers' Adoption of Agricultural Technologies in Irish Potato Production in Kabale District, Uganda."**

Yours Sincerely,

Stella Kyohairwe (PhD)
AG. HEAD, DEPARTMENT OF POLITICAL AND ADMINISTRATIVE SCIENCE

APPENDIX VI: FIELD RESEARCH

UGANDA MANAGEMENT INSTITUTE

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24 July 2014

MS. ROSE KANSIIME KYABATO
13/MMSPPM/30/091

Dear Ms. Kansiime,

FIELD RESEARCH

Following a successful defense of your proposal before a panel of Masters Defense Committee and the inclusion of suggested comments, I wish to recommend you to proceed for fieldwork.

Please note that the previous chapters 1, 2 and 3 will need to be continuously improved and updated as you progress in your research work.

Wishing you the best in the field.

Yours sincerely,

Stella Kyohairwe (PhD)
AG. HEAD, DEPARTMENT OF POLITICAL AND ADMINISTRATIVE SCIENCE