PROSPECTS AND CONSTRAINTS IN FARMERS’ ADOPTION OF AGRICULTURAL TECHNOLOGY:
A case study of Banana growing in Mbarara District, Uganda

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DECLARATION

This thesis is my original work and has not been presented for a degree or any other award in any other University.

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DEDICATION

I dedicate this study to my beloved father Mr. Bamanya A. Mulindwa, my mother Mrs. Maryce Kyomukama, my aunt Mrs. Rutaro Joan, and my siblings Doreen Bamanya, Barbara Bamanya, and Moses Bamanya for essentially supporting me throughout my academic endeavours. I also dedicate this work to the late Dr. Pius Mutie who inspired, supervised and guided me in the course of this study.
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My unreserved appreciation goes to all for their support and love. I further ask for God’s blessings and success in all my future endeavours.

May the almighty God bless you abundantly!
ABSTRACT

This research study sought to establish factors affecting farmers’ adoption of banana improvement technologies in Nyakayojo Sub-county of Mbarara district, Uganda. This was in specific focus on banana improvement agricultural technologies. The general objective of the study was to establish the determinant factors affecting farmers’ adoption of banana improvement technologies.

Using purposive sampling method, Nyakayojo Sub County in Mbarara district was selected as a suitable site for this study. The population considered for this study was drawn from selected sample sites in the Sub County and a sample size was derived using the Roasoft sampling calculator. By using the confidence level of 90%, a margin of error of 10%, and a response distribution of 50%, a calculation from a population of 6021 households came up with 66 households as the sample size for the study to represent the entire population. Data were collected using structured interview schedules, observation, key informant interviews, focused group discussions (FDGs) and questionnaires administered to the respondents. Analytical tool used in the study was Statistical Package for Social Sciences (SPSS).

Results indicated that the farmers’ social characteristics affect adoption of banana improvement technology. Findings from the study also revealed that sources of information affect farmers’ adoption of improved banana farming practices.

Results from the study also showed that a diversity of challenges affected banana farmers in adoption of banana improvement technologies. A number of suggestions were also advanced concerning how the challenges could be addressed in order to positively influence adoption of banana improvement technologies which lead to increased yields, income and change in expenditure patterns of the respondents.

Recommendations based on the findings, among others included the formation of banana producers’ cooperative societies to facilitate positive interactions for information dissemination and improvement in the number and quality of agricultural extension service providers that interact with the banana farmers.
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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

The economy of Uganda is basically agrarian implying that agricultural activities constitute the major activities to which Uganda’s land resources are utilized. African nations especially depend on agriculture for their livelihoods, and most of these are on small farms that are in most cases less than approximately two hectares (Chambers and Conway, 1992). The remarkably low productivity of these farms fuels the cycles of poverty and hunger in Africa. At the same time, their potential productivity provides the basis for a fundamental transformation of African agriculture, one of which is to put Africa firmly on the path of prosperity.

Agriculture is highly considered to be the principal source of employment opportunities and is held to be responsible for contributing large fractions of national income as well as foreign exchange for a variety of the world’s poorest countries. Nations globally and African countries in particular are continuously attempting to increase agricultural productivity, as well as, fostering small holder-led agricultural revolution (Madhin et al., 2002). This can best be attained through innovation and adoption of improved banana growing technologies. Agriculture is at the centre of life and economies as well as a major source of food, foreign exchange, employment, and provision of raw materials for industries. Agricultural development is a fundamental aspect for the economic growth and development of any society or economy. Sustainable economies are, in part, based upon predictable and sustainable food systems which depend solely on agriculture (Mariela, 2005).
According to Mariela (2005), the factors that affect agricultural production are attributed to nature and can only be extended by adoption of improved agricultural technologies (ibid.).

Banana is a significant crop mainly grown in tropical regions. Bananas are widely believed to be the world’s fourth most vital food crop after wheat, rice and maize in terms of gross value of production. They are believed to be one of the most highly exported fruits in terms of value and volume, with an annual level of production that was estimated at approximately 102 million tonnes produced on about 4.8 million hectares in 129 countries globally. With Asia as the leading producer and Africa, in this regard, is believed to account for only approximately 10% of the global production. In 2010 Asia, South and Central America and Africa produced approximately 61%, 26%, and 10%, respectively, of the bananas in the world. The countries leading in banana production in 2010 were India, China, Philippines, Ecuador, Brazil, Indonesia and Tanzania. They produced approximately 32, 10, 9, 8, 7, 6, and 3 million tonnes respectively. In 2010, Eastern, Northern, Western and Southern Africa produced 54%, 14%, 9% and 4%, respectively, of the bananas within Africa. The countries leading in production in Eastern Africa include Tanzania, Kenya, Uganda, Malawi, and Madagascar and they produced approximately 52%, 14%, 11%, and 7%, respectively of the bananas in the region (FAO Statistics, 2010).

Banana is an important food and income security crop for approximately 80 million people in Africa, but yields have been declining. It is obvious that increasing the level of agricultural productivity ultimately leads to economic growth and development. One way of increasing the level of banana agricultural productivity is through adoption of banana improvement technologies (FAO Statistics, 2010).

Banana (Mussa) is highly considered to be the main staple food and banana production is the principal economic activity of most areas in Uganda. The fruit is also nutritious and a rich source
of carbohydrates (22%), fibre (7%), minerals (iron, phosphorus, and calcium). The perennial nature of the crop makes it important especially when the annual food crops are out of production. Surprisingly, there has been reluctance of farmers to adopt improved agricultural practices for banana production.

Uganda is rated highly as a leading banana producer globally; however, the country's banana production is drastically declining. The population of Uganda has nearly doubled and was approximately 33,424,683 in 2010 (Uganda Bureau of Statistics, 2011). This has drastically resulted into increased demand for food, yet fewer bananas, which are the staple food crop, are produced.

Unstable rainfall, pests and diseases, especially the banana wilt disease are the key factors attributed to decline in banana production. The major factor in this regard was linked to poor crop management by the farmers. In Uganda, banana farmers are challenged with a desire to increase production in order to satisfy the growing demand. The adoption of improved banana farming technologies by farmers will not only control banana diseases but will also increase crop yields in the long run.

For the newly planted banana plants, mixing animal remains with black loam soil in a hole of approximately two feet deep, one and half yards wide, is a fundamental crop management aspect. For the fully grown banana plants, cow dung may be buried in holes approximately two yards from the plant. The crop's horizontal roots spread that far to get nutrients. This among others is among the banana growing agricultural techniques that enhance increased crop productivity. Mulching with grass is also an agricultural technology in banana growing aimed at mitigating soil erosion, controlling weeds, and keeping the ground moist. Dry leaves, petioles, and sheaths should
be cut periodically and laid on the ground with grass as mulch. However, mulch should not be extended close to the banana stem base in order to prevent banana weevil attack.

Trapping the weevils is also beneficial in banana farming. This is done by cutting off the banana stem at the base and putting a fresh banana leaf over the exposed cut on the corm, at night banana weevils accumulate under the banana leaf from which are later supposed to be collected and burnt. Regular pruning by removing unnecessary suckers in order to get tremendous bunches is also essential. Providing additional support to plants bearing fruit using wooden forked poles to prevent them from falling under the weight of heavy banana bunches is beneficial. Planting trees near the plantation such as the mutuba to serve as wind breakers is equally important.

Tissue culture technology of banana farming is among the banana improvement agricultural technologies that have been advanced. Traditionally, banana production was commonly by means of propagation of banana suckers. These suckers in most cases contain diseases and soil-borne pests, and by using them, farmers unknowingly distribute and perpetuate banana pests and disease problems. Banana plants produced by tissue culture are produced axenically in the laboratory. This makes the plant materials free of pests and diseases with the exception of fastidious bacteria and viruses.

The only way to end the perennial shortage of food in Africa lies in improving agricultural growth through adoption of improved farm practices and technology. This has also been recognized by Doss (2001) who cited that one of the strategies for improving food productivity is through the introduction of improved farming practices since it is obvious that improved innovative farming practices lead to increased agricultural productivity.
The Government of Uganda through Plan for Modernization of Agriculture (PMA) launched measures to increase efficiency and effectiveness of agricultural extension services. This was implemented through the National Agricultural Research Organization (NARO) and National Agricultural Advisory Services (NAADS), as semi-autonomous bodies with the mandate of developing a demand driven farmer led agricultural service delivery system that was aimed towards targeting poor and vulnerable small scale farmers. These organs were enacted by the government in order to accelerate agricultural modernisation in Uganda and thus introduce profound technological change throughout the sector as a strategy for enhancing incomes of farmers.

NARO is a body that was established in order to provide effective coordination and guidance of agricultural activities. This was concerned with the national agricultural system in Uganda primarily to promote a farmer responsive system with the aim of generating and disseminating profitable, problem-solving and environmentally sound technologies, as well as knowledge and information on a sustainable basis. NARO promotes the generation, adoption and dissemination of appropriate as well as knowledge, demand-driven technologies, and information through an efficient, decentralized, sustainable, effective and well-coordinated agricultural research system. Despite the high intensity, government’s efforts to improve agricultural productivity and modernization of agriculture, few of these agricultural technologies have been adopted especially by the banana farmers. A good example is the tissue culture technology of banana improvement. Therefore, there is need to explore why various approaches to agricultural development and modernization regarding adoption of improved agricultural practices have not been adopted. This study focused on Mbarara district, one of the main banana growing areas in Western Uganda. The present study focused on establishing the factors that influence farmers’ adoption of banana improvement technology.
1.2 Problem statement

Food insecurity is a vital aspect in sub-Saharan Africa despite concerted efforts by donors and scientists to promote technology adoption. Banana production, by providing a vital source of staple food as well as income, is a fundamental necessity in terms of the livelihoods of millions of resource poor, rural farming communities throughout Africa and Asia. Uganda is ranked among the world's largest banana producers and bananas are considered among the most important food and cash crop. But production and productivity has been drastically declining. This trend has been largely attributed to reduced soil fertility, as well as highly destructive pests and diseases (especially parasitic nematodes, banana weevil, sigatoka leaf spots, banana xanthomonas wilt and fusarium wilt) together with socio-economic constraining factors.

Pests, diseases, worn-out soils and social problems mean trouble for the banana industry in Uganda. Plan for the Modernisation of Agriculture (PMA) and National Agricultural Advisory Services (NAADS) have attempted to come up with remedies is helping the industry get back on its feet. In this regard, new plant varieties, application of manure, mulching, biological controls for pests, and disease-free planting material (Tissue culture technology) are some of the technologies that have been advanced to counter the obstacles affecting banana farmers.

Promotion, invention, innovation and adoption through the generation of agricultural technologies to end users play a critical role in boosting agricultural productivity in developing countries (Mapila, 2011). The use of improved agricultural technologies has remained the major strategy used by governments to increase agricultural productivity and promote food and livelihood security and majority of the population earns a living from agriculture mainly in the rural areas (Nguthi, 2008).
Low adoption of modern agricultural production technologies amongst banana farmers in Mbarara district, Western Uganda in particular and Uganda at large has been identified as one of the main reasons attributed to low agricultural productivity in the country. It is evidently clear that Uganda’s ability to fully utilise its agricultural production potential in banana farming solely depends upon the capacity of banana farmers to adopt improved agricultural technologies in their production activities. Agricultural modernisation in the form of adoption of improved agricultural production technologies has been reported to have positive impacts on agricultural productivity growth in the developing world (Ouma et al., 2002).

The availability of modern agricultural production technologies to end users, and the capacities of end users to adopt and utilise these technologies are also critical if agricultural modernisation is to be attained. Unfortunately, the Ugandan agricultural sector, particularly the banana farming industry, is characterized by low levels of technology adoption and this according to Uganda’s Ministry of Agriculture, Animal, Industries and Fisheries (2010) contributes to the low agricultural productivity in the country.

Despite numerous interventions, campaigns and strategies by agricultural development partners few of the technologies advanced have been implemented and adoption among the banana farmers. Different factors affect the adoption of different agricultural innovations and technologies. Unravelling the reasons responsible for low technology adoption among banana farmers requires that the factors which affect their decisions to adopt or not to adopt modern agricultural production technologies be identified.

Banana farmers do not apply all the recommended technology packages that are advanced in order to increase productivity. This study aimed to some of the factors affecting adoption of improved banana growing technology packages and the challenges farmers faced in pursuing such adoption.
This is a serious gap that must be bridged if the problem of low technology adoption among farmers is to be addressed and agricultural productivity improved. Explaining the factors that affect adoption of banana improvement technologies by farmers in Nyakayoojo sub-county can be used for the formulation of a theoretical explanation and policy to facilitate increased adoption rates for up scaling agricultural modernisation.

1.3  **Objectives of the study**

1.3.1  **The general objective**

The general research objective was to explore the social factors affecting banana farmers’ adoption of improved agricultural technologies and the challenges faced in Nyakayoojo sub-county, Mbarara District of Western Uganda.

1.4  **Specific objectives**

i). Explore the socio-economic characteristics affecting farmers in adoption of banana improvement technologies.

ii). Determine whether access to information affects farmers in adoption of banana improvement technology.

iii). Establish challenges faced by farmers in adoption of banana improvement practices and how they can be addressed.
1.5 **Significance of the study**

The farmers, will benefit by exploring factors constraining them from adopting the technology, they shall be equipped with information that will provide advice on how to address the challenges and benefits from improved banana growing agricultural practices or technology. This will eventually enable them to have improved qualities of varieties, adoption of better farming techniques and increased incomes, as well as attainment of food security.

The main beneficiaries from research of this nature are the people involved in agricultural development, to alleviate poverty through the innovation of improved agricultural practices. The key factors and challenges affecting adoption of improved banana farming technology must be addressed and by so doing enhancement of sustainability through agricultural development. As part of Millennium Development Goals, hunger and extreme poverty can be addressed through developing improved agricultural practices. It becomes imperative to understand the challenges facing farmers’ as they adopt the banana improvement farming technologies. It is evident that agricultural growth and increased agricultural productivity are prerequisites to broader-based sustainable economic growth as well as development.

The provision of agricultural technology plays a distinctive role towards agricultural development. Therefore, development actors like extension service providers, NGO’s and other development agencies involved in agricultural development need to understand the constraints and factors affecting access to and utilization of improved banana growing technologies and understand the gaps in order to take remedial strategies. It is also of considerable importance for policy makers to understand whether the existing banana improvement agricultural technology, beside the local
knowledge flows, assures the desired strategy and to make useful policy changes to facilitate meaningful interventions in the study area.

1.6 **Scope and limitations of the study**

The focus of the study was to explore the social factors affecting farmers’ adoption of banana improvement technologies and how to address challenges faced by farmers in adoption of banana improvement farming practices. The study specifically focused on banana growing in Mbarara district of Western Uganda. The study was limited to gathering information which may reveal factors leading to impediment of successful adoption of banana improvement technologies. The research was limited to studying challenges facing farmers in adoption of improved banana growing agricultural technologies, focusing on banana growers in Mbarara district, Western Uganda as a case study.

1.7 **Operational definition of key concepts**

**Access**

Concerns acquiring messages concerned with agricultural production activities from various sources like training, workshops, extension services, and mass media, participating in seminars, research centres or through mentorship.

**Agricultural technology**

Agricultural technology in this study entails application of modalities to enhance the growth, as well as harvesting of animal and vegetable products. It entails measures designed to enhance economical and efficient use of agricultural resources as well as natural resources improved
agricultural productivity. These technologies include mulching, spacing, weeding, tissue culture, staking, pruning, fertilizer application, and trenching.

**Early Adopters**

Have the highest degree of opinion leadership, second fastest category to acquire innovation. These are people who instantly find it easy to imagine, appreciate, and understand the benefits of a new technology.

**Farmer**

A farmer is defined as one who owns and manages a farm. For purposes of this study, focus was put on banana growers. In relation to this study a farmer refers to one who grows bananas.

**Fertilizer application**

This involves application of nutrients to the soil in order to promote vigorous plant growth by improving upon the soil’s physical properties, like the water holding capacity.

**Innovators**

Innovators are referred to as people who introduce changes, new ideas, or methods of doing something in different and better modalities than those that existed before and are considered as new by the audience.

**Mixed cropping**

An agricultural practice that involves cultivation of two or more crops on the same piece of land simultaneously.
**Mulching**

This involves covering the cultivated soil with plant materials in order to protect the soil against erosion as a result of heavy rains, preventing weed growth, and conserving soil moisture.

**Non Adopters**

This is a category of individuals who show little interest towards adopting new technologies; mostly they exhibit conservatism of tradition and advanced age.

**Pruning**

This is concerned with the selective cutting and removing the dry parts or sections of a banana plant in order to promote and improve plant growth.

**Spacing**

Spacing in this study was used to refer to the plant management practices intended to help in minimizing mineral competition and ensuring sufficient spacing between plants.

**Staking**

Using poles to support the plant’s root system in order to hold the plant firmly and it is necessary to produce heavy bunches.

**Technologies**

Technologies are tools that pertain to motives. A technology is simply the name given to a category of tool, together with personal knowledge of its properties. Technologies are mental and social
constructs which vary from person to person; they are only relevant to adoption to the extent that they help or hinder motives.

**Technology adoption**

The choice to acquire and use a new innovation or invention regarding agricultural technologies.

**The rate of adoption**

Rate of adoption encompasses the relative speed at which members of a social system adopt an innovation. It is considered in terms of the length of time required by a certain percentage of members of a social group to adopt an innovation.

**Tissue culture**

This involves the process of growing plant cells under sterile conditions in order to regenerate to a whole plant.

**Trenching**

This involves construction of narrow ditches to trap running water and control soil erosion as well as erosion of soil nutrients.
CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter aims at review of relevant literature and it starts with a historical background of agricultural technology since the medieval era, it also focuses on the Ugandan banana sector, technology development, and the social-economic factors influencing farmers’ adoption of technology, access to information, and the challenges faced by banana farmers’ in adoption of banana improvement technologies. In addition to that, this chapter also focused on the relevant literature concerning adoption that has been noted by various scholars as well as the theoretical and conceptual framework.

2.1.1 History of agricultural technology

Globally, agricultural technology concerns the techniques, tools, and machinery used primarily or entirely for the sole purpose of supporting enhanced agricultural productivity. Since the medieval times, there have been a diversity of improvements to agricultural technology that have largely changed the techniques and ways in which certain crops or certain types of crops were cultivated, grown or harvested and preserved. Progressively, there are continuously more and more changes to agricultural technology. Available technology is regularly being transformed and altered in order to make it more precise in its functions and ability to perform more advanced and complex functions. In the past centuries, agricultural production was characterized by enhanced productivity through the replacement of human labour by synthetic fertilizers and pesticides, selective breeding, and mechanization to enhance productivity. The recent history of agricultural technology has been
closely associated with a diverse range of political issues including farm subsidies, bio fuels, genetically modified organisms, and water pollution. In recent years, there was a backlash against the external environmental effects of mechanized agriculture, and increasing support for the organic movement and sustainable agriculture (Kottonau et al., 2000).

Asia is highly believed to be one of the continents in which civilization first developed and where humans learned to live by cultivating plants for subsistence. In fact, more than half of the world’s edible food crops originated in Asia. The Indus Valley is still considered to be one of the areas in which agriculture was discovered. Agricultural beginnings appear in the era of the 6th millennium BCE. The beginnings of agriculture in Eastern Asia are believed to date to Neolithic times (about 7000 to 9000 years ago) with rice cultivation about 4000 BCE. Agricultural origins in the Indus valley occur about the same time. In North China and Manchuria, a civilization was established about 2000 BCE and by the Zhou dynasty, 1000 BCE, there was also evidence of canals and extensive irrigation (Sitawa, 2008).

Globalization has greatly affected innovation in regards to agricultural technology. In the last half of the 20th Century, Ugandan agriculture was reported to have been incorporated with Western innovations responsible for the mechanical, chemical, and biological revolutions that have characterized modern agriculture. This involves the widespread use of fertilizers, pesticides, use of tractors, protected horticulture, and advances in genetic improvement. In regards to banana growing, the most recently innovated technology is the tissue culture technology of banana improvement (PEAP, 2002).


2.1.2 The Ugandan banana sector

The centre of origin of bananas is believed to be South East Asia as well as the Western Pacific region. Banana crops were introduced from Indonesia to Madagascar from where they found their way to the Eastern part of Africa. In Uganda, banana farming dates way back to 13 A.D (Robinson, 1996).

The economy of Uganda is basically agrarian and Uganda is popularly referred to as ‘the country of bananas’. Banana is a leading income generator and staple food for majority of farmers in Uganda at large, and Mbarara District in particular. Almost every household in the study area has at least a significant piece of land that is reserved for banana cultivation. Uganda is highly ranked among the leading world banana producers, and it is the indigenous dietary staple food. Bananas are considered as special in Uganda evidently due to their multipurpose. The banana crop has rich genetic resource diversity. They can be consumed as a diet for breakfast, lunch and dinner; even local beer and juice can be extracted from bananas (Karugaba and Kimaru, 1999). Ugandans attach high social, cultural and economic values to the crop and banana farming in particular. Suitable soils and naturally sufficient rainfall in the areas favour banana farming, especially in the Southern, Central, and South-western regions of the country.

Several species of bananas are grown in Uganda particularly Musa paradisca and Musa sapienta. The escalating population pressure on land resources has led to a diversity of socio-economic transformations. This seems to pose threats to the expansion and agro-biodiversity of bananas while concurrently increasing diversity in management aspects. Pests (weevils and nematodes) and diseases are also among the factors affecting banana farmers as well as drastic climatic changes (ibid.).
Tissue culture is a relevant technology of improved banana production considered to be significant as far as banana farming and pest control is concerned. Using this technology of banana growing, it eliminates the traditional means of planting suckers by propagation. Banana suckers that are propagated in most cases contain diseases and soil-borne pests. By using the propagation method of growing bananas, farmers unknowingly distribute and perpetuate pest and disease problems (Gold et al., 2003).

Banana plants that are produced by tissue culture technology of improved banana production are free from pests and diseases with the exception of fastidious bacteria and viruses due to the fact that they are produced axenically in the laboratory. Tissue culture banana plants are more vigorous, allowing for faster and superior crop yields. In addition to that, the tissue culture banana plants can be produced in huge quantities within short periods of time, allowing for faster and better distribution of existing and new cultivars, including genetically modified banana. Tissue culture banana plantlets are often recommended to be planted in fields or areas that are vulnerable to biotic pest pressures and abiotic constraints (Gold et al., 1999).

Management of banana plantations is dominantly by soil and water conservation trenches, mulching, inter cropping, weed management, and soil fertility maintenance. Diversion channels and soak pits are also essential for soil and water conservation. Management of the plantations mainly requires timely pruning (fibres and leaves), weeding and suckering. Failure of banana farmers to adopt improved banana growing technologies for their plantations evidently leads to situations of decline in production and crop yields.
2.1.3 Technology adoption

The use of improved farming technologies has remained the major strategy that has been used by governments in order to increase agricultural productivity and promote food as well as livelihood security (Nguthi, 2008). Technology adoption is a crucial component for agricultural intensification and development. High incidences of poverty and poor living standards have been some of the substantial development challenges within developing countries, and Uganda in particular. This trend can be reversed effectively with agricultural development through the adoption of improved banana growing agricultural technologies.

Mbarara district has relatively favourable climatic conditions that favour production of various types of crops, though agricultural activities in the area are characterized by smallholder production systems. Therefore, there is a need to realize the full potential through increased agricultural production in the area and hence poverty reduction through the use of improved banana agricultural production technologies.

Adoption of new agricultural practices and technologies has for long been proposed to reduce pressure on natural resources, improve societal welfare through increased household incomes, reducing rural-urban migration, and enhancement of environmental sustainability. Many have proposed for adoption of improved banana growing agricultural technologies in order to attain agricultural intensification effectively and efficiently. This study focused on factors influencing farmers’ adoption of improved agricultural technology, a case study of banana growing in Mbarara district of Western Uganda.
2.2 Social characteristics influencing farmers’ adoption of technology

2.2.0 Introduction

It has been observed that the process of diffusion and adoption of a variety of innovations is influenced by a diversity of variables including the innovation’s values and norms of a social system, characteristics of the agents as well as the adopters of the innovations within the same space and time. Therefore, in this regard, selected socio-economic characteristics were put under consideration to study their influence on farmers in adoption of banana improvement technologies.

2.2.1 The selected socio-economic variables

The continuous progression of socio-economic development leads to technological advancement and creates an urgent need for adoption of improved agricultural technologies. The aspect of agricultural technology has profoundly captured the attention of many agricultural researchers with the aim of combating food security. Agricultural technology, if properly designed and implemented, has the potential of enhancement and improvement upon the level of agricultural productivity (Madukwe et al., 2000).

The central and strategic role of agriculture in Africa makes the sector the key to economic growth, increased incomes, raising the standards of living of households, poverty eradication and increased food security. Indeed all Millennium Development Goals (MDGs) have direct or indirect linkages to agricultural production in one way or another.

The agricultural production system in Uganda, especially for the case of banana farming is basically dominated by traditional farming systems, and thus the application of modern agricultural inputs has been extremely limited, as a result.
Agriculture is evidently the backbone of the Ugandan economy and is believed to employ approximately close to 90% of the entire population. Evidently high population pressure and land fragmentation have escalated drastically over the years in Uganda. In this regard, family farms are continuously sub-divided into smaller plots, and fields are over-cropped. Moreover, high population growth rates are rapidly outstripping food production. Therefore, there is a need to intensify production for improved food security through adoption of improved agricultural production technologies (Uganda Daily Monitor Newspaper, Monday, 31st, October 2011).

Currently, the world population is believed to have hit the seven billion mark. Uganda has an approximate size of approximately 197,058,000 km$^2$ (93,104 miles$^2$) and is believed to contribute about 34 million to the global population figures. In addition to that, Uganda is also believed to have the highest birth rates in the region and the world at large, this number is bound to grow and estimates are that the country’s population is expected to be at a whopping 100 million by 2050. Uganda’s population has grown by almost 10 million since the last census a decade ago and is expected to keep growing at about that rate. Approximately 86% of the population in Uganda reside in the rural areas and rely on agriculture to earn their livelihood. Despite Uganda's fertile soil, favourable weather and growing economy, almost half of the population live in abject poverty and have insufficient access to food (ibid.).

According to Ntege (1997), in his research about adoption of maize varieties in Iganga district of Uganda, he compared non-adopters and adopters. He resolved, in this regard, that farmers’ who adopted the new technology were slightly older, owned larger farms, were more educated, used more hired labour and participated more in group work or associations, had greater access to credit and were predominantly males. He goes further to assert that adopters and non-adopters did not differ in access to credit, household size and farming experience.
Various literatures concerning banana growing agricultural technology adoption concurs that the decision on whether farmers adopt improved technology depended upon factors like household size, level of education, availability of information, access to cash or credit and gender of household head.

Access to credit is a greatly affects adoption of agricultural technology. Access to credit has been advanced to be among the key elements that are prerequisite for improving agricultural production and poverty reduction (Awotide et al., 2012). Access to credit enables and facilitates farm households to be able to effectively and efficiently afford to purchase the needed agricultural inputs. In addition to that, access to credit enhances the farmer’s capacity to effect long-term investments in their farm activities.

Despite the importance of access to credit, the majority of farm households lack access to formal credit and conceptually, access to credit can be influenced by institutional factors and household characteristics (ibid.).

Furthermore, access to funds including credit is expected to increase the probability of adoption. For instance, it has been reported that most small scale farmers in the country are unable to afford basic production technologies such as fertilisers and other agrochemicals resulting in low crop yields due to poverty and limited access to credit (Ministry of Agriculture, Animal, Industry and Fisheries, 2010).

Studies have revealed that gender-based constraints act as a powerful deterrent against adoption of agricultural technologies. This is basically attributed to the typically lower asset base of women and their more limited control which acts as a major deterrent to adoption of agricultural technologies. Gender plays a central role regarding agricultural development in the African context. Women play a key role in food production and make significant contribution to household food security. While women are the main food producers, they lack access to and control over the
means of production such as secure land tenure, information, credit and control of labour. Gender issues regarding agricultural production and technology adoption have been investigated for a long time. Most of such studies show mixed evidence regarding the different roles that males and women play in technology adoption (Doss, 2001).

Access to productive resources, particularly land, plays a significant role in influencing the level of adoption of agricultural technologies. Historically, women's access to land in most African cultures was and is still based on status within the family and involved right of use, not ownership (Ouma et al., 2002). Under customary systems of land tenure property is held in a man's name and passed partrilineally within the group. Women have access to land through their husbands while daughters do not inherit land and divorced women lose their ex-husbands land. In patrilineal systems, which prevail in Uganda, land is mostly owned and controlled by the males with traditional tenure and inheritance based on patrilineal descent (World Bank report, 2012). Although married women have user rights over their husbands’ land, the husbands in most cases have more exclusive rights over the land’s disposal. Continued use of land across seasons and investments on its improvement is therefore dependent on the good will of men. Thus, developing technologies that require secure land tenure will disadvantage those with insecure tenure and in most instances these are women. Furthermore, it is not uncommon to find that interventions aimed at improving productivity on land worked by women may end up by the land being taken over by men when there is a prospective of greater cash-earning opportunities and prestige (UBOS, 2012).

Studies indicated that it was usually men who had primary control over the family’s cash income in many developing countries (Adesina and Zinnah, 1993). A study in Central Province, Kenya reported that whilst women in the area have taken over many of the roles that men used to perform, “men still mostly make the major decisions and control” (Kiriti et al., 2003).
Agwu (2001) observed that adoption of agricultural innovations varied much depending on the characteristics of the farmer. He also suggested that agricultural characteristics of the farmers’ inherently influenced their decisions to adopt agricultural technology. As a result, the farmers’ were more inclined to accept (and participate in) a recommended practice if the practice was profitable, compatible with existing farming systems, divisible, straightforward to use, had relevance for their labour use, farm inputs, marketing, credit values and crop performance.

Farm characteristics are considered to be a significant variable for understanding a farmer’s decision to adopt (Prokopy et al., 2008). If the adoption of improved technologies is perceived by farmers to be profitable prior to making decision, farmers are in most cases likely to adopt the advanced agricultural technologies (Napier et al., 2000; Roberts et al., 2004).

According to Purcell & Anderson (1997), farmers in most cases only take in new technologies when they believe that the proposed changes will benefit them totally. Furthermore, they retaliated that the rate of these adoptions would depend on the individual characteristics of the farmers, characteristics of the technology itself, as well as the social cultural characteristics of individuals (Purcell and Anderson, 1997).

A diversity of studies concluded that age negatively influences technology adoption. Young farmers are educated and willing to innovate and effectively as well as efficiently adopt new technologies that reduce the amount of time spent on farming (Mishra et al., 2002). In this regard, education and farming experience positively influence technology adoption due to the fact that farmers with those attributes are exposed to more ideas and have more experience in decision-making and effectively utilizing the information (Caswell et al., 2001).

Age is a significant aspect that influences the probability of adoption of new agricultural technologies due to the fact that it is said to be a primary latent characteristic in adoption decisions.
However, there is a diversity of contention regarding the direction of the effect of age on adoption. Studies revealed age to have positively influenced adoption of Integrated Pest Management on peanuts in Georgia (McNamara et al., 1991), sorghum in Burkina Faso (Adesiina and Baidu-Forson, 1995), and chemical control of rice stink bug in Texas (Harper et al., 1990). On the other hand, age has been found to be either negatively correlated with adoption, or not significant in farmers’ adoption decisions in some other studies. In studies on adoption of Integrated Pest Management sweep nets in Texas (Harper et al., 1990), fertilizer in Malawi (Green and Ng’ong’ola, 1993), rice in Guinea (Adesiina and Baidu-Forson, 1995), Hybrid Cocoa in Ghana (Boahene et al., 1999), land conservation practices in Niger (Baidu-Forson, 1999), age was either was negatively or not significantly related to adoption.

Farming experience and education are considered to be measures of human capital that determine the level of adoption. Human capital is expected to have a positive influence in the decision to adopt new technologies. Previous studies (Paxton et al., 2010; Roberts et al., 2004; Velandia et al., 2010; Walton et al., 2010) have revealed that age, farming experience, and income, among others are widely accepted variables that affect adoption decisions.

A number of studies have been conducted in an attempt to establish the effects of education on adoption of agricultural technologies in most cases related it to years of formal schooling attended (Tjornhom, 1995, Feder and Slade, 1984). Basically, education is believed to create a psychologically favourable mental attitude for the effective and efficient acceptance of new technologies (Waller et al., 1998; and Caswell et al., 2001). According to Rogers (1983) and Ehler and Bottrell (2000), technology complexity has a negative effect on adoption and this could only be dealt with efficiently by means of education.
Farmers with larger farms or higher yields were found to be more likely to pay close attention towards adopting farming technologies (Larkin, 2005). In addition, Larkin (2005) also concluded that farmers who had previously adopted farming technologies found it profitable or who believed it created input reduction was important had higher probabilities of adopting other farming technologies (ibid.). Farmers with larger farms and obtaining higher than average yields were more likely to adopt improved agricultural technology (Banerjee et al., 2008).

The Government of Uganda launched measures to increase efficiency and effectiveness of agricultural extension services through the National Agricultural Research Organization (NARO) and NAADS, as semi-autonomous bodies with the mandate of developing a demand driven farmer led agricultural service delivery system aimed towards targeting poor and vulnerable societal members.

The initiative of the Government of Uganda through NAADS concerns giving people the power to determine the extension services they deem as appropriate on their farms. Despite all these efforts, there has been a limitation in the level of adoption of improved agricultural technologies most especially the banana farmers. Since competency is influenced by a diversity of factors among which include, exposure, levels of education, experience and the financial strength of the agricultural farmers as well as societal members (ibid.).

NARO has the mandate of developing and promoting appropriate production and post-harvest crop and livestock technologies to end users in Uganda. NARO has research stations located all over the country and has developed many improved agricultural technologies. It is also essential to note that the adoption rate of these technology initiatives seems to be low, hence, the decreasing level of productivity (Ashby, 1991).

These agricultural institutions, among others, work tirelessly to develop improved agricultural technologies and management practices. As a major challenge for agricultural technology adoption,
however, it is considerable to establish when and how new technologies are used by farmers. In this regard, agricultural scientists have turned to social scientists, in the quest for an improved level of understanding of the mechanisms underlying technology adoption (NARO annual report, 2011). Yet many questions still remain pertinent in as far as the aspect of adoption of improved agricultural technologies is concerned, in regards to banana improvement. At the simplest level, there prevails a diversity of considerable gaps in general knowledge concerning which technologies are being used, by whom, and where. More controversy has also arisen as scholars and policy makers are continuously querying about the roles played by institutions, policy and infrastructure in increasing agricultural productivity through the adoption of improved agricultural technology.

According to Madhin et al., (2002) the importance of technology advancement has become an accepted fact. Yet the answers to the questions of who adopts the new agricultural technologies, how quickly, and at what cost to society still remain elusively pertinent particularly with regards to banana growing.

Hintze et al., (2003) and Smale (1995; 2001) suggested that it is beneficial for all researchers concerned with technology adoption to reconsider the implicit assumptions behind most adoption studies. Especially, the fact that “improved technology” is in most cases considered being better than the existing technologies, as well as the corresponding policy recommendations, that agricultural farmers need to be convinced to use new and better agricultural technologies.

Endeavours directed towards enhancement of agricultural productivity are expected to result into improved agricultural production; therefore, better technologies need to be generated and effectively put into action if this has to be realized (Fischer et al., 2009). This is not necessarily the case as improved agricultural technologies are not effectively adopted. This justifies a need for more research and study about the factors that influence farmers’ adoption of these improved agricultural technologies, especially among banana farmers. This can best be attained through
considering the factors influencing farmers’ adoption of improved agricultural technologies and this was the main emphasis of this study.

Improved crop production, through improved farming practices as a result of adoption of improved technologies forms an integral part in as far as agricultural development is concerned in order to eradicate hunger and poverty at household levels.

Different factors have been held responsible in determining the adoption of different agricultural technologies and innovations. A diversity of empirical adoption literature has been found to focus on farm size as the most significant determinant in adoption of improved agricultural technologies (Shakya and Flinn, 1985; Harper et al., 1990; Green and Ng'ong'ola, 1993; Adesiina and Baidu-Forson, 1995; Nkonya et al., 1997; Fernandez-Cornejo, 1998; Baidu-Forson, 1999; Boahene et al., 1999; Doss and Morris, 2001; and Daku, 2002). This is basically due to the fact that farm size can affect and in turn be affected by the other factors held responsible for influencing adoption agricultural technology. The profound effect of the factor of farm size on adoption of agricultural technology could be negative, neutral or positive. For example, McNamara et al., (1991); Abara and Singh, (1993); Feder et al., (1985); Fernandez-Cornejo, (1996) and Kasenge (1998) revealed farm size to be positively related to adoption. However, Yaron et al., (1992); and Harper et al (1990) found an inherent negative relationship between adoption and farm size. Interestingly, Mugisa-Mutetikka et al., (2000) found the relationship between farm size and adoption of agricultural technology to be a neutral one. With small farms, it has been argued that large fixed costs are a constraint to agricultural technology adoption (Abara and Singh, 1993), especially if the agricultural technology requires a substantial amount of initial set-up cost. In this regard, Feder et al., (1985) noted that only larger farms will adopt agricultural technologies effectively and efficiently. A study conducted by Gabre-Madhin and Haggblade (2001) in Kenya revealed that it
was the large commercial farmers who in most cases adopted new improved farming technologies more effectively and efficiently as opposed to smallholder farmers.

Regarding household food security, banana production is believed to contribute highly to both small scale and large scale producers and plays a key role as source of food as well as cash income for small-land holder producers. However, it is imperative to note that some banana farmers do not apply all the recommended banana improvement technology packages. Identifying the knowledge gaps on adoption of banana improvement technology is critical for professionals engaged in agricultural development, researchers, policy makers and institutions. This study aimed to identify the knowledge gaps in adoption of improved banana growing technology packages. This was conducted in one of banana growing regions of Western Uganda in Mbarara District.

### 2.3 Access to information

University publications and research findings from studies conducted are significant regarding enabling banana producers to obtain farming information. Extension services in turn convey such information about university research and publications and thus enabling the farmers to make informed decision thereby influencing adoption (Lowenberg-DeBoer, 2000).

Producers tend to use multiple sources of information to increase their knowledge about precision agriculture (Nowak, 1992). Therefore, information is expected to be positively related to technology adoption due to the fact that exposure to knowledge concerning the benefits of agricultural technologies leads some farmers to adopt new technology (Rogers, 2003).

Awotide et al., (2012) in their study about technology adoption contended that access to information about improved farming practices and agricultural technologies are essential to
increase the intensity of its adoption. Information is significant in ensuring that the process of adopting innovation is evident to the intended end users (farmers) who determine either success or failure of the adoption of innovation (Awotide et al., 2012).

According to Roberts et al., (2004) the development, testing and promotion of agricultural innovation requires interaction between the agents of innovation and the end users. He further asserted that extension agents have limited channels of communication to backup and follow up what is occurring in the fields where the farmers are situated. Roberts et al., (2004) also asserted that, in cases where agricultural research and innovation disconnect with the end-user farmers, there is always a problem with adoption of innovation. Roberts et al., (2004) further argued that scientists in research centres should endeavour to develop innovations that when ready for release to the farmers, should flow naturally (Roberts et al., 2004).

A study by CIGAR (2004) advanced that a thriving agricultural economy is critical for reducing poverty, ensuring food security and managing natural resources, and to this effect, agricultural extension plays an accelerator role in adoption of improved agricultural technologies.

Similarly, agricultural research centres should receive feedback on the performance of innovations they introduce in the field. This implied that communication channels are immensely critical for successful implementation and adoption of agricultural technology innovations (CIGAR, 2004).

Hasan et al., (2010), in a research paper on social economic factors influencing the level of adoption of innovation, resolved that the level of adoption of innovations depends on the structure of society, the standard of life, and economic contribution of the innovations. Most salient is information flow, which according to Hasan et al., (ibid.) increases the distribution of innovation. Hasan et al., (ibid.) also noted that there is a strong relationship between mass media tools and adopting innovation (Hasan et al., 2010).
If the approaches to agricultural development are to effectively work in Africa, governments need to take new approaches to information dissemination that emanate from a clear understanding of what the farmers’ information needs are.

Although farmers may be experts in their farming activities, intensified adoption for improved production requires information and training on methods and the scientific properties of the inputs and their application (Doss 2001). This information is traditionally provided by government extension services. Technology adoption greatly relies on the farmers’ accessibility to good-quality and appropriate information.

Lack of information, evidently implies that the agricultural farmers are in most cases not aware of the benefits that these technologies provide if adopted. The farmers’ have misconceptions about the benefits and cost of the technologies. In addition to that, the technologies are in most cases not available or not available at the moment when they are required by the agricultural farmers. Hintze et al., (2003) also concluded that, in most instances, the agricultural farmers consider the technologies not to be profitable due to the complexity, including the diversity of decisions that farmers have to make when it comes to allocation of their land and labour resources across agricultural and non-agricultural activities. They also came to a conclusion that institutional factors such as the policy environment also affect farmers in the adoption of improved agricultural technologies. A good case in point is that institutional factors, for instance the policy environment, may affect the availability of inputs as well as markets for credit and inputs, and this in the long run determines the profitability of the technology (Hintze et al., 2003 and Smale 1995; 2001). Information is a critical factor in decision making and farmers, who know, are more tempted to adopt innovation than the ones who do not know.
2.4 Challenges faced by farmers’ in adoption of agricultural technologies

Several studies concerned with determining the factors associated with adoption of agricultural innovations by farmers in developing countries have been conducted. Okike et al., (2000) contended that even if innovations are widely adopted, they may not have all the intended effects or may sometimes have un-intended effects. In this regard, it is vital to note that adoption of innovations in agriculture is a complex multi-level process.

Woolley (2010) contended that studies about farmers’ adoption of new technology highlight the adoption-decision as well as the timing (late or early) primarily in terms of the decision-makers’ perceptions, not forgetting the inherent characteristics, with "innovators" at one extreme and "laggards" at the other. According to Woolley (ibid.), the farmers’ decision-making is manifestly more complex than this implies. Woolley asserts that farmers have multiple objectives among which include adequate cash income, food security, social security, and a secure asset or resource base (Woolley, 2010).

Adoption of improved agricultural innovations may in some instances be a straight forward process (Rogers, 2003). Rogers (ibid.) advanced that adoption requires adaptation, adjustment, field testing and correction before the technologies can be adopted on a wide spread basis. Doris and Morris (2001) in their study of grain development projects in Ghana revealed that the adoption of agricultural technologies is affected by three sets of factors. He categorised these factors to include characteristics of the technology, the characteristics of farming environment, and characteristics of the farmers. They concluded that new technologies stood a better chance of being adopted if compatible with the current or prevalent farming practices (Doris and Morris, 2001).

Mapila (2011) noted in a study on rural livelihoods that current conventional agricultural strategies of production, in most cases, resulted into economic problems, environmental degradation and even social problems. He stressed that the efficacy of sustainable agricultural systems in guaranteeing
social, economic, and environmental sustainability of farming practices is demonstrated. According to Mariel (ibid.), it was also established that, despite the support from change agents, farmers are rarely adopting sustainable practices. Such challenges facing farmers include inadequate information given to farmers about available technology. Government initiatives are failing to encourage adoption due to lack of funding (Mapila, 2011).

On the other hand, the economic factors affecting farmers’ adoption of improved agricultural technologies include their financial situation, change of equipment, and uncertainty. Social factors include perception about inefficiency of new technology, peer pressure, lack of role models, and misleading perception (Madhin et al., 2001).

Agricultural innovations, diffusion and dissemination of new technologies are fundamental aspects in the efforts of developing countries to enhance food security and agricultural modernization in particular (Minten and Barrett, 2008). It is pertinent to note that more research and study is essential in order to understand clearly why improved agricultural technologies are not being effectively adopted, in order to address this issue. This is especially the case of banana farmers who are in most instances reluctant to adopt new farming technologies.

From the foregoing, it is concluded that though a number of studies have been conducted across the world on technology adoption, there is dearth of literature on the specific factors that influence modern agricultural production technologies. This is a serious gap that must be explored if the problem of low technology adoption among farmers is to be addressed and agricultural productivity improved.
2.5 Theoretical Framework

2.5.1 Introduction

Adoption of banana improvement technologies involves a decision process concerning information acquisition by farmers who vary in their risk preferences. Adoption is a process that involves finding and implementing the right tools for the job. It is one of the oldest and the most significant concepts in the diffusion of innovations literature and has been the major focus of a mammoth body of research by many scholars.

A complex web of social, economic, technical, organizational, and individual factors interact to influence upon which technologies are adopted and to alter the effect of a technology after it has been adopted. Understanding why societal members use improved banana growing technology and, perhaps more importantly, why they don’t be at the core of the process is vital. According to Rogers (2003), diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system.

2.5.2 The characteristics of innovation

Rogers (2003) stated that successful adoption of a particular innovation should score higher in terms of its relative advantage over existing practices, compatibility to users’ needs, trialability and observability, and lower in its complexity to be used.

In this regard, it is important to note that the relative advantage of one technology over another is a key determinant, especially in adoption of banana improvement technologies. The issue of relative advantage has been shown to have a positive relationship with adoption of agricultural innovations (Rogers, 2003). Users need to be shown that banana improvement agricultural technology offers considerable benefit compared to traditional offering.
Compatibility of the innovation needs to align with the farmers’ current values and experiences. The more compatible banana improvement technologies are to banana growers and extension workers, the lesser a change of behaviour is required, therefore, allowing for faster adoption of the innovations into the agricultural setting. If banana improvement agricultural technologies require users’ to adjust their existing behaviour or are in contrast to their attitudes the more unlikely they are to adopt them (Zaltman & Lin, 1971). In addition the users’ previous experience of adoption of new farming methods and practices in banana growing, whether this was a positive or negative experience also bears significant influence on the adoption of preceding improved agricultural technologies. A negative previous experience can result in innovation negativism which is where a negative previous experience with one innovation can negatively impact the adoption of another. This could be very likely to be an issue in adoption of banana improvement technologies with which existing users’ experience of banana growing may have an impact on the perception and future adoption of preceding banana improvement technologies.

Trialability is the extent to which an innovation may be tested and experimented before its inclusion. Most banana improvement agricultural technologies have enjoyed extensive diffusion; however, it’s imperative to note that their use has not been as widely adopted. Using the banana improvement technologies is significantly different and its introduction should be deliberate and allow users to slowly get familiar with the new innovations. This is especially true of farmers as they need to feel confident when using the technologies before they use them on their farms.

The complexity (ease of use) of banana improvement technologies also impacts on adoption. If the use of banana improvement technologies requires considerable learning, it is less likely that
extension workers and banana farmers will persevere with the improved banana farming technologies. In addition, the perceived complexity of the technologies may lead to increased uncertainty and perceived risk, and these in turn could lead into reluctance to adopt (Fidler & Johnson, 1984). According to Sharples et al., (2007) that to explore the complexity of an innovation, it is necessary to understand the contexts in which the innovations occur.

Observability is whereby the innovations’ use and effects are visible to the end users (banana farmers). The introduction of improved banana growing agricultural technologies must be visible and the effects that it has on banana farming must also be clearly visible. A wide range of research and long term studies are prerequisite to truly represent the true value of adoption of specific banana improvement technologies. Currently most studies focusing on banana improvement technology adoption are short term and limited in focus, therefore, failing to provide concrete and on-going benefit.

It is important to note that for banana improvement technologies to be adopted into the farming context, they need to show relative advantage, compatibility and lack of complexity. In addition users, especially banana farmers need to see improved banana growing agricultural technologies in action and be given a chance to try out these technologies themselves. The innovation itself is important to consider however, as shown in the last two characteristics that the perception of the end users (banana farmers) is also important.

There has been a long and impressive history of research related to the adoption and diffusion of innovations. Many of the most important and earliest studies in this area were conducted by researchers working in the field of rural sociology (Rogers, 2003). In fact, a study that investigated
the diffusion of hybrid-seed corn (Ryan & Gross, 1943) was considered to be the first major, influential diffusion study of the modern era (Rogers, 2003). Other researchers have also investigated the diffusion of innovations in such diverse fields as solar power (Keeler, 1976), farm innovations in India (Sekon, 1968), and weather forecasting (Surry, 1993).

The most widely cited and most influential researcher in the area of adoption and diffusion is Everett Rogers. One of the most significant theories advanced by Rogers is the Innovation-Decision Process Model. As shown in the figure 1, this model contends that the adoption of an innovation is not a single act, but a process which occurs over time. Potential adopters go through five stages when interacting with an innovation. The first stage according to Rogers is “Knowledge” in which potential adopters find out about an innovation and gain basic understanding of what it is all about and how it works. The second stage is “Persuasion” in which potential adopters form a positive or negative impression of the innovation. It is only in the third stage, “Decision”, that innovation is actually adopted or rejected. The fourth stage, “Implementation”, occurs when the innovation is actually used. In the fifth stage, “Confirmation”, the adopter seeks information about innovation and either continues or discontinues use of the innovation. The Confirmation Stage might also describe the adoption of an innovation that may have even been previously rejected.

![Figure 1: Five stages of Rogers' (2003) Innovation decision model](image)
Another important and influential idea discussed by Rogers is the concept of adopter categories. This concept states that, for any given innovation, a certain percentage of the population will readily adopt the innovation, while others will be less likely to adopt. According to Rogers, there is usually a normal distribution of the various adopter categories that forms the shape of a bell curve (as illustrated in figure 2). Innovators, those who readily adopt an innovation are believed to comprise about 2.5% of any relevant population. Early Adopters make up approximately 13.5% of the population. Most people will fall into either the Early Majority (34%) or the Late Majority (34%) categories. Laggards, those who will resist an innovation until the bitter end, comprise about 16% of the population. The concept of adopter categories is significant because it illustrates that all innovations go through a natural, predictable, and sometimes lengthy process before becoming widely adopted and incorporated within a particular population.

Figure 2: The hypothesized distribution of adopter categories within a typical population

The diffusion of innovations curve (innovation adoption curve) of Rogers is useful to remember that trying to quickly and massively convince the mass of new controversial ideas (banana improvement technologies) is not relevant. It makes more sense in these circumstances to start with convincing innovators and early adopters first. Also the categories and percentages can be used as a first draft to estimate the significant target groups for communication purposes.
In this regard, it is important to note that the concept of perceived attributes (Rogers, 1995) has served as the basis for a number of diffusion studies. Perceived attributes refers to the opinions of potential adopters who base their feelings about an innovation on how they perceive that innovation in regard to the five key attributes: Relative Advantage; Compatibility; Complexity; Trialability, and; Observability. In short, this construct states that people are more likely to adopt an innovation if the innovation offers them a better way to doing something, is compatible with their values, beliefs and needs, is not too complex, can be easily tried out before adoption, and has observable benefits. Perceived attributes are important because they show that potential adopters base their opinions of an innovation on a variety of attributes, not just relative advantage. Agricultural technologists, therefore, should try to think about how potential adopters will perceive their innovations in terms of all of the five attributes, and not focus exclusively on the aspect of technical superiority.

2.5.3 The Technology Adoption Decision Process

The technology adoption decision process is a dynamic sequence of actions and interactions through which individuals evaluate a technological innovation and decide upon whether or not to incorporate it into the on-going practice. The dominant assumption held by most technology adoption decision process models is the phase theorem (Witte, 1972), which presumes that the cognitive aspects of adoption are easier to manage if the process is broken into more manageable aspects. The most frequently cited adoption model in the diffusion of innovations literature is the Rogers’ model (Rogers, 2003) whose five stages have served as the dependent variable for a reasonable number of studies (Ettlie, 1980). Several other staged models have addressed adoption decisions in collective settings. Staged models are also common in the consumer psychology
literature, where they have been widely used to describe behavioural change by individuals as well as variances in problem-solving by individuals.

Unfortunately, the empirical validity of these staged models remains in doubt. Only a handful of studies have tested the validity of staged technology adoption decision process models (Rogers, 2003). Several researchers report evidence of an overlap between stages, difficulty in clearly distinguishing between stages, skipped stages, and out-of-order stages (e.g., Beal and Rogers, 1960; Francis and Rogers, 1960). Other studies report truncated search procedures, as well as interruptions and disjointed progress and coincidental confluence of problems, solutions, decision makers, and choice opportunities.

The theoretical basis of Rogers’ model is the tendency of individuals to seek information from different communication channels during different stages of the adoption process. However, this is a weak basis for differentiating stages, since individuals may use the same information channels in each stage (Bach, 1989; Rogers, 2003) and non-stage processes may be responsible for the differences (Weinstein et al., 1998).

Furthermore, this criterion is inherently biased since interview questions about information sources and communication channels tend to be framed in terms of an implicit stage model (Mason, 1962; Poole and Roth, 1989). In some cases, these stages may derive more from the researcher’s logic than empirical observations of events over time (Sabherwal and Robey, 1993). In other cases, stage models may be constructed based on retrospective interviews, which tends to bias the models because informants may selectively recall details that make the decision process seem more sequential and logical than it appeared at the time (Coughenour 1965; Schwenk, 1985). Nutt concludes “the sequence of problem definition, alternative generation, refinement, and selection,
called for by nearly every theorist, seems rooted in rational arguments, not behaviour.” (Nutt, 1984).

In summary, the technology adoption decision process occupies a pivotal role in diffusion of innovations research (Eveland, 1979; Rogers, 2003) but it exhibits significant empirical and theoretical shortcomings. Causal adoption process theory has been stagnant for decades and has seldom been subjected to conceptual development or critical scrutiny (Eveland, 1979; Mohr, 1982; Gatignon and Robertson, 1985; Katz, 1999; Rogers, 2003; Venkatesh, 2006). Thus, there is a shortage of inquiry into the causal processes associated with adoption decisions, and in particular, how events or life experiences change an individual’s beliefs about a technology over time. It should be noted that past adoption models share a common limitation: they fail to clearly specify on the basis of which mental structures the adoption process is operating. What mental changes, exactly, does adoption trigger? There is no extant causal description that details, in a step-by-step manner, how a farmer or consumer of improved banana farming technologies decides to adopt or use particular technologies.

And yet, despite this abundant literature, there is still much about adoption that is poorly understood. In particular, the innovation diffusion literature has largely ignored decision psychology (Gatignon and Robertson, 1991; Kottonau et al., 2000) and has treated the causal aspects of adoption as a black box. To be sure, there has been extensive inquiry into factors that influence adoption rates or outcomes for various innovations (Rogers, 2003; Venkatesh, 2006), but to date the literature has yet to offer a satisfactory step-by-step explanation of how events or life experiences cause consumers to change their beliefs about technologies over time. Furthermore, there has been little qualitative inquiry into what Rogers (2003) calls optional adoption decisions,
which are made by a single individual. This omission is significant. Since most decisions fall into this category, the implication is that extant theory is not well-suited for understanding farmers’ behaviour (Choudrie and Dwivedi, 2005).

2.6 The Conceptual Framework

The agricultural industry worldwide is fast evolving, and it incorporates banana improvement technology adoption. The future of agricultural development depends upon the way improved and advanced banana growing agricultural technologies are adopted and managed in various agricultural sectors. Increased banana growing technology adoption may include improved agricultural practices, mulching, staking, spacing, conventional breeding, weeding, improved crop varieties, pruning, tissue culture and use of inputs like organic fertilizers. Successful adoption of improved banana growing agricultural practices is expected to lead to increased yields, which will lead to improved food security, income for the farmer and empowerment in terms of improved lifestyles and the option to adopt more improved banana farming innovations.

Food security is paramount at household level and country as a whole. The improvement in terms of economic welfare of the farmers’ eventually leads to a better lifestyle and thus breaking the vicious cycle of poverty which seems to be propagated by inadequate food productivity. The benefits will also accrue in the long term towards empowerment of the community.

It is important to note that technology and innovation are synonymous set of ideas associated with a degree of uncertainty and hence lack predictability concerning their outcomes. Adoption of improved banana growing technologies is most likely determinant upon a variety of aspects among which include socio-economic factors (household income, education level of household head, age,
and gender, access to credit, land accessibility and farm size), political and environmental factors, as well as access to information.

**Figure 3: Illustration of conceptual framework for adoption of banana agricultural technologies**

- **Political and environmental factors**
- **Access to information. E.g.** extension workers, press releases, attending workshops
- **Socio-economic and cultural factors. E.g.** farm size, household income, gender, age, land accessibility, access to credit and education level of household head.
- **Technology adoption. E.g.** mulching, tissue culture, disease control, pruning, fertilizer application, weeding, spacing, fertilizer application and trenching
- **Banana improvement agricultural technology and the level of adoption of banana improvement agricultural technologies. E.g.** tissue culture, mulching, pruning, organic fertilizer application, mixed cropping, trenching and staking

It is clear that agricultural technology aims at simplifying work, saving time, capital as well as costs. Adoption, on the other hand, is an outcome of a decision to accept a given innovation. Adoption falls into two categories, which include rate of adoption, and intensity of adoption. The rate of adoption is the relative speed at which farmers adopt innovation.

In this regard, intensity of adoption refers to the level of use of a given technology at any given time. Therefore, accordingly for a technology to impact on the economic system it must blend with the existing normal routine, failure to which there would be some resistance from adopters. While
the adopters’ reasons for resistance may vary according to various factors, which may include, social-economic, institutional or capacity.

The acceptance or rejection of banana improvement technologies depends upon the extent to which the adopters can realize the benefits that they may accrue to if they adopt the new technologies. This entails overcoming the uncertainty associated with the new technologies. The importance of banana improvement technology advancement has become an accepted fact. Yet the answers to questions concerning those who adopt the new banana improvement technologies, at what cost it is to society and how instantly still remain elusive.

For purposes of this study, the dependent variable was the level of adoption of banana improvement agricultural practices among which included mulching, pruning, fertilizer application, spacing, mixed cropping, trenching, conventional breeding, staking to provide support for plants, planting wind breakers, and tissue culture. It was measured against factors that influence the level of adoption of banana improvement technologies which are the independent variables. These include social economic factors of the farmers’ (household income, age of the farmer, level of education, experience in farming, size of land, access to information, access to market, access to credit, government policies, household head); political and environmental factors, as well as access to information. In conceptualizing, the researcher attempted to point out how farmers are influenced in adoption of banana improvement agricultural technologies, focusing on banana farmers. Thus, the knowledge of, agricultural related, technological adoption becomes handy.
CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

This chapter starts with a brief description of the study area followed by a detailed discussion of the research strategy and study design, the methods of data collection and analysis. The chapter concludes with a discussion of ethical considerations and of the problems encountered in data collection.

3.2 Research Design

The research design in this study entailed arrangement of conditions for collecting and analysing data in a manner that sought to combine relevance with the research purpose. It comprised a conceptual structure within which research was conducted. It constituted the blueprint for the collection, measurement and analysis of data (Orodho and Kombo, 2002). This research design provides the description of the modalities that were used in the course of carrying out the research study. It structured the research, to indicate how all of the major components of the study worked in conjunction to address the central research questions. Mixed method design was used for purposes of this study. This involved Focused Group Discussions (FDGs), observation, household interviews, and key informant interviews.

Descriptive analysis was used for statistical analysis in this study. Analysis began by showing the distribution of respondents by each of the pertinent variables, e.g. education level, age, gender, marital status, farm size, number of children and levels of access to credit. The researcher used frequency distributions to organize data into a meaningful pattern for statistical analysis. This was
followed by construction of frequency distribution in order to effectively highlight summarized grouping of data divided into mutually exclusive classes and the number of occurrences in each class. It also showed how the observations cluster around a central value; it also highlighted the difference between study findings depending on the objectives. The analysed data was presented using histogram, bar charts and pie charts.

3.3 Site selection and description

The study was conducted in the Republic of Uganda, Mbarara district Kenya which lies across the equator in Eastern Africa. Purposive sampling was used to select Nyakayojo Sub-county as a study site since it is the largest banana growing area in Mbarara district. This is because the major agricultural activity in the Sub-county is banana growing.

Mbarara district is a land positioned in south-western Uganda. It is bordered by Kiruhura district to the east, Buhweju district to the northwest, Ibanda district to the north, Isingiro district to the southeast, Sheema district to the west and Ntungamo district to the southwest. Mbarara district covers a geographical area of 7,346 km². It is sub-divided as follows, land area 7,217 km², wetland 1,295 km², forested area 187 km², and open water area 74 km².

Mbarara district comprises of one municipality (Mbarara municipality), and nineteen Sub-counties, organized into two counties. These include Rwampara and Kashari counties. Kashari county of Mbarara district is comprised of 9 Sub-counties, which are sub-divided into 47 parishes. Rwampara county of Mbarara District is divided into five Sub-counties, among which include Nyakayojo Sub-county.
3.4 Target population

According to Fraenkel and Wallen, (1993), target population was the larger group to which one is hoping to apply findings. This implies a group of individuals, objects, or items from which samples were obtained for measurements. It refers to a large group from which a sample was derived for the study (Orodho, 2004). Population is the group to whom the researcher generalized the results of the study (Best and Khan, 2004). In this case, the target population was the banana farmers in Nyakayojo Sub-county, Mbarara District of western Uganda, which consists of administrative units within the county. The administrative units of Nyakayojo Sub-county include Bugashe parish, Katojo parish, Kichwamba parish, Nyarubungo II parish, Rukindo parish, and Rwakishakiizi parish. These administrative units sum to 33 villages.

3.5 Sample Size and Sampling

According to Borg and Gall (1989), a sample size of any study should be based on what a researcher considers being statistical and practicable. For descriptive studies, 10% and above of the accessible population is enough for the entire study Mugenda and Mugenda (1999). The same view is shared by Best and kahn (2005). A sample is a finite part of a statistical population whose properties are studied in order to gain information about the whole (Webster, 1985). It is ideal sample because it is large enough to serve as an adequate representation of the population about the researcher wishes to generalize and small enough to be selected economically in terms of subject availability and expenses in both time and money. The target population in this study was the banana farmers in Mbarara district

A sample size from a total of 6021 households in Nyakayojo Sub-county was selected using the Raosoft sampling calculator.
\[ x = z\left(\frac{c}{100}\right)^2 r(100 - r) \]

\[ n = n \frac{x}{((n - 1)e^2 + x)} \]

\[ e = \sqrt{\left(\frac{n-n}{n(n-1)}\right)} \]

With this formula, the sample size \( n \) and margin of error \( e \) were given by where \( n \) was considered to be the population size, \( r \) as the fraction of responses the researcher was interested in, and \( Z(c/100) \) as the critical value for the confidence level \( c \) (Raosoft, Inc., 2004). By using the above formula with the confidence level of 90\%, a margin of error of 10\%, and a response distribution of 50\%, a calculation from a population of 6021 households came up with 66 households as sample size for the study. In this regard, 11 households were selected as respondents from each of the 6 parishes in the study area. Nyakayojo sub-county was comprised of six (6) parishes which included Bugashe parish, Katojo parish, Kichwamba parish, Nyarubungo II parish, Rukindo parish, and Rwakishakiizi parish. These administrative units summed up to 33 villages.

### 3.6 Methods and tools of data collection

#### 3.6.1 Introduction

Both primary as well as secondary data were collected for purposes of the study. Primary data concerned information collected afresh for the first time and considered original in character. On the other hand, secondary data involved information collected by other individuals and had already been processed through statistical means. In this regard, the researcher manipulated observation method, interview method, focused group discussion and questionnaire methods for data collection.
Since primary data was to be originally collected, it was collected through observation as well as direct communication with the respondents.

### 3.6.2 Household interviews

Interview is among the methods of data collection that was manipulated by the researcher for purposes of this study. This method entailed the presentation of oral-verbal stimuli and reply in terms of oral-verbal responses to obtain information. This method was through personal interviews and face-to-face interactions with the respondents. The researcher asked questions to which respondents responded in relation to the study. The researcher also cross-examined other persons who were presumably assumed to have knowledge about the problem under investigation and the information obtained was recorded.

In this regard, the researcher collected information using structured interviews through personal interviews carried out in a structured way. This involved the use of a set of predetermined questions in a prescribed form and order, as well as the use of highly standardized techniques of recording. Questionnaire is the tool that was used to guide the researcher in the process of conducting household interviews. A questionnaire was administered to respondents who were asked to answer the questions.

### 3.6.3 Observation

Observation as a scientific method of data collection was manipulated by the researcher in order to obtain information by way of direct observation, without asking from the respondents. The information that was obtained in relation to the study relates to exactly what was happening and not
complicated by either the past behaviours or future attitudes as well as intentions. The tool used in this method was checklists in order to provide information about actual aspects to be observed, and observations were thereby noted down.

3.6.4 Focused Group Discussions

This involved the discussion of specific topics and a recording list made out of the discussion. Focused Group Discussions (FDGs) were conducted involving men, women and youth in the study area. A checklist was one of the tools used in this approach in order to obtain the respondents’ awareness about banana improvement agricultural technologies, and those that had been introduced in the study area.

3.6.5 Key Informant interviews

This involved interviewing significant individuals with relevant information about adoption of improved banana growing technologies. The key informants were purposively selected in this regard. These individuals involved local leaders, Agricultural Extension Workers, Local Community Leaders (Local Council Leaders), and prominent farmers in the area, Community Development Workers, Agricultural Development Officers, District Agricultural Advisory Officer, and senior administrators at the Plan for Modernisation of Agriculture.

3.6.6 Desk review

Secondary data was obtained from the data already available from various sources which included both published and unpublished material in relation to the study. This data was also obtained by scrutinizing government publications, as well as other publications and from their subsidiary
organizations. Other sources of secondary data were classified to include books, newspapers, magazines, journals, reports and publications from a diversity of organizations connected with agricultural development. A checklist in this regard is the tool that was manipulated in order to effectively conduct the study. Also reports complied by scholars, Universities, as well as economist publications were considered. It is also important to note that secondary data was also obtained from public records, historical documents and other sources of published information from organizations like NGO’s and other parastatals. Other unpublished data was obtained from sources that among others included the internet, unpublished biographies, as well as autobiographies.

3.7 Validity and Reliability of instruments

According to Orodho and Kombo, (2002) validity is concerned with determination of the extent to which the research truly measures the aspects it intended to measure, or how truthful the research results are; in this case the researcher combined both closed questions and open-ended questions. Reliability concerned the extent to which the results are consistent over time and provide an accurate representation of the population under study. This was aimed at finding out whether it was possible to obtain a similar result using the same methodology. This consistency was tested by the researcher by giving out a few questionnaires to some farmers outside the study area in order to test the uniformity of the responses.

3.8 Data analysis

Data analysed were both qualitative and quantitative. Data cleaning was done in order to determine inaccurate, omitted, inconsistency, outliers and missing data. After editing, the data was coded, analysed and examined critically in order to make inferences.
The study used an exploratory and descriptive design. A mixed-method approach combining quantitative and qualitative methods was used. In this regard quantitative data focused on discrete set of variables to answer the research question while qualitative data was used to study through presenting the large, interconnected complexities of a situation thus making sure all aspects of the study were covered. The quantitative data was obtained with the aid of household surveys.

On the other hand, qualitative data was obtained by the use of focused group discussions, key informant interviews and observation. Data obtained through observation was analysed using a checklist. The researcher then used simple arithmetic and easy-to-draw diagrams reported in the form of descriptive frequency charts and histograms. In this study, the researcher also used one-dimensional data analysis after processing data by editing, coding, classification, tabulation and use of percentages. Graphical representations were used to present information diagrammatically using histogram as well as other polygons including bar graphs and pie charts.

3.9 Ethical issues

A research permit was obtained from the relevant authorities. The researcher went a considerable length to explain to the respondents the exact purpose of the study. It was also vital to explain the information that was expected, the relevance of the research being carried out and assuring them of confidentiality and using the information attained only for the intended purpose.
CHAPTER FOUR

4.0 DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter presents the results and discusses the findings of the study. The findings were presented through use of tables, graphs and pie charts. The aim of this study was to establish constraints and challenges in farmers’ adoption of banana improvement technologies. Banana improvement technologies in this regard involved farmers’ use of mulching, pruning, organic fertilizer application, mixed cropping, trenching, staking, tissue culture and conventional breeding methods.

4.2 Farmers’ socio-characteristics and technology adoption

The first objective of this study sought to establish how social characteristics related to farmers’ adoption of banana improvement technologies. The general aim of this research was to reach an understanding of the factors affecting farmers in adoption of banana improvement technologies. In attempting to gauge how farmers’ socio-economic characteristics affected technology adoption, a number of variables were considered. In this regard, the following variables among which include gender, age, levels of formal education, marital status, number of children, farm size, and access to credit were the socio-economic variables considered in this analysis.
4.2.1 Gender

Findings revealed that gender relations within the banana farming households, in regard to access to factors of production such as labour, land and capital, affected the decisions made regarding adoption of banana improvement technology. The central role of gender concerning agricultural development in African agriculture is now widely recognised.

Key informant data indicated that women easily adopted cheap but labour intensive banana improvement technologies such as pruning, mulching, and weeding, trenching, staking and organic fertilizer application. This was attributed to the fact that women paid close attention to working on their banana plantations, unlike the males who were involved in many other economic activities.

According to majority of the respondents, the main aspect related to high percentage of female participation was due to the fact that females were actively involved in production of basic agricultural foodstuffs both for subsistence and sale but the land solely was owned by males. This is basically because the males were considered as the household heads and major decision makers in running the households due to customary laws.

<table>
<thead>
<tr>
<th>Table 1: Respondents’ gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Data from table 1 indicates that majority of respondents (78%) were female and a minority (22%) were male. This implied that in the study areas, majority of the people involved in banana
production were females although the land was owned by males. This was mainly attributed to prevailing land tenure systems which culturally favour men in inter-generational property transfer and gender roles.

Key informant data further indicated that most of the women who held control over resources in banana production were widows while others had their husbands working away from home. Hence the opportunity to access and control land for banana production for domestic consumption and sale. This attribute was basically due to the inability of most women to own land for farming which predominantly belonged to males. Majority of the women attributed this gender disparity to land tenure insecurity and this in return lowered their investment in banana improvement technologies. The females also advanced that the high level of insecurity in property rights interfered with their desire to adopt banana improvement technologies.

This is in accordance with a previous study conducted by Whitehead (1985) who advanced that traditionally, most women do not own land for farming. In his study, Whitehead (1985) further argued that historically, women's access to land in most African cultures was based on status within the family and involved right of use, not ownership (Whitehead 1985). Aliber and Walker (2006) also advanced that although married women had user rights over their husbands’ land, the husbands in most cases have more exclusive rights over the land’s disposal (Aliber and Walker 2006). Therefore, it was concluded that due to lack of ownership over productive resources by women compelled them not to pay close attention towards adoption of improved agricultural technologies. Indeed it was revealed that gender played a significant role regarding agricultural development in the African context. This is due to the fact that women were found to be playing play a key role in food production and making significant contribution to household food security. This is in line with a study which was conducted by Food and Agricultural Organisation (FAO, 2006). Findings in this study were also found to be in line with an earlier study by Doss (2001) and Ellis (2000) which
revealed that women were found to be the main food producers, but however, lacked access to and control over the means of production such as secure land tenure and control of labour (Doss 2001; Ellis 2000).

4.2.2 Age of respondents

The age distribution of banana farmers in the study area was also considered for purposes of this study. In this regard, age distribution was considered in an attempt to establish how social characteristics affected adoption of banana improvement technologies. Data regarding the age distribution of banana farmers indicated that majority of the banana farmers (66%) were within the ages of 31-40 years, while about 28% were 41 years of age and above, and only a minority (6%) were 20-30 years of age and above.

Table 2: Age distribution

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 - 30 years</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>31- 40 years</td>
<td>44</td>
<td>66</td>
</tr>
<tr>
<td>41 years and above</td>
<td>18</td>
<td>28</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>66</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

n=66

It was further revealed from one of the prominent banana farmers in the study area that the older farmers (41 years and above) were in most cases conservative and resistant to change. It was also obtained from the women’s focused group discussions that age of the farmers was an influencing factor in adoption of banana improvement technologies.
This was collaborated by the men’s focused group discussions where it was revealed that the older farmers in most cases had more farming experience and thus making them not to easily adopt new banana improvement technologies. It was further advanced in the youth focused group discussions that the young farmers were less risk-averse and therefore more willing to effectively and efficiently adopt the technologies advanced for banana improvement.

Data revealed that young, energetic youths within the age of 30 years and below were more readily willing to adopt and use banana improvement technologies. Individuals within this age group in the study area were limited due to lack of access to land for farming and collateral security for access to credit facilities. Few of them could afford to own land due to lack of funds as well as other customary laws concerned with property inheritance.

According to a key informant, the young and energetic were highly involved in banana farming within the study areas. He added that the young were flexible, more likely to be dynamic and willing to take risks associated with farming with hope of improving their income levels.

Findings in this study were found to be in line with previous studies conducted by Paxton et al., (2010); Roberts et al., (2004); Velandia et al., (2010); and Walton et al., (2010) which revealed that age influenced adoption decisions. A study conducted by Soule et al., (2000) also concluded that age negatively influenced technology adoption. A study conducted by Mishra et al., (2002) revealed that young farmers were found to be educated and willing to innovate and effectively as well as efficiently adopt new technologies that reduce the amount of time spent on farming which is in accordance with the findings in this study.
4.2.3 Formal education

Consideration of respondents’ levels of formal education was crucial for the completion of Objective 1 of this study which sought to establish how farmers’ social characteristics affected adoption of banana improvement technologies. According to an Agricultural Extension Worker in the study area, using banana improvement technologies in most cases required a high level of education in order for the technologies to be efficiently and effectively adopted. Results concerning the educational levels of the farmers using banana improvement technologies revealed that majority of the respondents (46%) had attained secondary level of education.

Table 3: Respondents' levels of formal education

<table>
<thead>
<tr>
<th>Level of Formal Education</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>09</td>
<td>14</td>
</tr>
<tr>
<td>Primary</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td>Secondary</td>
<td>31</td>
<td>46</td>
</tr>
<tr>
<td>Tertiary</td>
<td>15</td>
<td>24</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>66</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Similarly, 24% of the farmers using banana improvement technologies were found to have attained tertiary levels of formal education. Findings from the study also revealed that 16% of the banana farmers in the study area had attained primary levels of education. A minority (9%) composition of the respondents in the study area had attained no formal education.

One of the prominent banana farmers in the study area advanced that formal education affects adoption of banana improvement technologies. He added that formal education enhanced the
farmers’ logical capability to obtain, as well as process and understand information that was considered relevant for adoption of banana improvement technologies. He concluded that formal education greatly affected the farmers’ decisions to adopt banana improvement technologies.

According to an earlier study conducted by Waller et al., (1998); and Caswell et al., (2001), education was found to affect technology adoption as well as increased farm productivity levels. In their study, they revealed that education created a psychologically favourable mental attitude for the effective and efficient acceptance of new technologies.

4.2.4 Respondents’ marital status

The study inquired about the respondents’ marital status as part of the effort to establish how farmers’ social characteristics affected adoption of banana improvement technologies. Results concerning marital status of the banana farmers in this study indicated that majority of the farmers (39%) in the study areas were found to be married.

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>13</td>
<td>20</td>
</tr>
<tr>
<td>Married</td>
<td>26</td>
<td>39</td>
</tr>
<tr>
<td>Divorced</td>
<td>17</td>
<td>26</td>
</tr>
<tr>
<td>Widowed</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>66</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

n=66
Table 4 shows that 26% and 20% of the farmers in the study area were found to be divorced and single respectively, while a minority (15%) of the respondents were found to be widowed. Findings in this regard implied that most of the banana farmers in the study area were married.

It was further revealed that marital status affected adoption of banana improvement technologies. In the course of key informant interviews, a local leader in the study area asserted that it was the married societal members who were found to be actively attending workshops and participating in other related community development initiatives concerning agricultural modernisation. He attributed this to the fact that the married individuals in the study areas always responded positively through effective adoption and implementation of technologies advanced for banana improvement.

4.2.5 Whether respondents had children

The study also sought to find out the number of children that banana farmers had in order to establish how farmers’ social characteristics affected adoption of banana improvement technologies. Data from this study in this regard indicated that majority of the respondents (70.3%) had children. This was backed by the fact that majority of the farmers interviewed were 30-40 years of age, thus implying that respondents were mature enough and of child bearing age.
Table 4 shows that a minority of the respondents (29.7%) had no children and this category was basically among the young farmers, less than 30 years of age. According to a prominent banana farmer in one of the key informant interviews, a large number of children, depending on the farm size, ensured adequate human resource in terms of labour for the banana farmers.

A male banana farmer in one of the interviews asserted that children posed as a motivating factor for increasing the levels of agricultural productivity. He also added that, “it was due to the number of children he had (6) that instigated and motivated him to increase agricultural production through adoption of banana improvement technologies in order to obtain increased resources and income for subsistence.” In this regard, he added that that the technologies he had applied for banana improvement included mulching, organic fertilizer application, weeding, spacing, pruning, staking and trenching.

A prominent female farmer and key informant advanced that children were highly considered as a positive factor in terms of human resource and provision of labour. Inadequate labour supply was mentioned in the focused group discussions as one of the major obstacles hindering the adoption of banana improvement technologies.
### 4.2.6 Respondents' Farm Size

The researcher also found it relevant to consider farm size in the course of establishing the extent to which farmers’ social characteristics influence adoption of banana improvement technologies. In this regard, it was revealed, according to findings as presented in figure 5 that majority of the banana farmers (40%) had farm sizes as big as 11-15 acres. This farm size was considered to be enough for the adoption of modern agricultural technologies for improved banana production. Minority of the respondents (12%) had 1-5 acres, implying that the farm size was quite small for the use of modern farming technologies.

![Figure 5: Farm size](image)

According to findings obtained from one of the key informant interviews with an agricultural extension worker in the study area, farm-size contributed to limiting the adoption of banana improvement technologies. It was also revealed during the FDGs that adoption of banana improvement farming technologies required considerably large farm area for their adoption and that it was the banana farmers with adequate farm land who readily adopted these technologies. It
was also revealed that the prevailing land tenure systems in the study area encouraged land
fragmentation thus hindering the effective adoption of banana improvement technologies.
These results confirm the findings of some earlier studies by Banerjee et al., (2008) and Larkin
(2005) who assured that those farmers with larger farms were more likely to pay close attention
towards adopting improved farming technologies.

4.2.7 Farm size used for banana improvement technology

Regarding farm size devoted to banana improvement, findings from the study revealed that
majority of the farmers were large scale producers due to the abundance of land they set aside for
banana production.

In this regard, it was revealed from findings that majority of the respondents (43%) had about
approximately 6-10 acres of farm land set aside for banana production. It was also revealed that
30% of the banana farmers set aside land ranging from 11-15 acres for banana production using banana improvement technologies. Least of the respondents (27%) had spared 1-5 acres for banana farming.

In the course of the focused group discussions, the banana farmers that had plenty of land in abundance revealed that they were more willing to accept and adopt banana improvement agricultural technologies. According to a female prominent farmer in one of the focused group discussions, she asserted that she had plenty of land. She added that due to this attribute, she was more willing to adopt and even try out any banana improvement technologies that were introduced simply because of the abundant farm land she owned. It was further widely accepted in the Focused Group Discussions by the participants that farm size affected adoption of banana improvement agricultural technologies. Findings in this regard are in accordance with an earlier studies conducted by Larkin (2005) and Banerjee et al., (2008) who revealed that farmers with larger farm sizes were more likely to adopt improved agricultural technology.

### 4.2.8 Access to credit

It was equally important to gather information on whether or not respondents had access to credit in order to establish how the farmers’ social characteristics affect adoption of banana improvement technologies. Access to credit is vital for households engaged in banana farming.

<table>
<thead>
<tr>
<th>Responses</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>57</td>
<td>85</td>
</tr>
<tr>
<td>Yes</td>
<td>09</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>100</td>
</tr>
</tbody>
</table>

n=66
Table 5 shows that majority of the respondents (85%) of the banana farmers in the study area had no access to credit. A minority (15%) of the respondents advanced that they had access to credit facilities. In one of the Focused Group Discussions, a male prominent banana producer in the study area claimed that it was due to his ability to access credit that enabled him to implement banana improvement technologies.

In addition to that, a local leader in one of the key informant interviews explained that adoption of banana improvement agricultural technologies required resources in order to be implemented and this was limited by inaccessibility to credit facilities. According to another participant, these resources included labour, as well as some farm implements and all these required cash. Therefore, with access to credit funds made available to banana farmers, it would facilitate the banana farmers to effectively and efficiently adopt banana improvement agricultural technologies with ease. A banana farmer in one of the focused group discussions, revealed that there was a tendency for farmers to obviously adopt agricultural innovations if they had access to credit which would enable them afford to purchase farm implements and afford to pay for labour as well as other relevant resources required for the adoption of banana improvement technologies.

Findings in this study correspond with the findings of Zeller et al., (1997), who concluded that ability of a household to bear risks was to a greater extent is largely dependent upon the ability to access to credit facilities (Zeller et al., 1997).

Findings obtained from the focused group discussions revealed that access to credit affected banana farmers in adoption of improved agricultural technology. Access to credit was advanced by the participants as among the key elements prerequisite for facilitation adoption of agricultural technology to improve agricultural production and hence poverty reduction.

Majority of the participants in key informant interviews explained that access to credit enabled and facilitated farm households have capacity to acquire and the recommended agricultural inputs.
Despite the importance of access to credit, findings from the household survey revealed that majority of farm households lacked access to formal credit and conceptually, access to credit was solely determined by institutional factors and household characteristics.

4.3 Access to information on technology adoption

The second objective of this study sought to explain how access to information affects adoption of banana improvement farming technology. Therefore, in this section of the study, the researcher attempted to explore sources of information utilised by the banana farmers to acquire information about banana improvement technologies.

**Figure 7: Information sources**

Findings regarding the information sources utilised by banana farmers in the study area revealed that majority of the respondents (71%) obtained information concerning banana improvement technologies from radio and television programs. The information obtained from these sources included discussion groups on radio programs and drama, exhibitions, films, and demonstrations on television programs.
It was also revealed from these findings that 14% of the respondents obtained information concerning banana improvement technologies from publications. These publications ranged from pamphlets, newspapers, pictures, posters, as well as other forms of print media e.g. journals and magazines.

Another 8% of the respondents reported to have obtained information about banana improvement technologies from other sources that included seminars, workshops, friends, neighbours and farmers’ cooperative associations. Similarly, 7% of the respondents reported that they got information concerning banana improvement technologies from agricultural extension agents who provided banana farmers with agricultural advisory services in Nyakayojo Sub-county.

In the course of the focused group discussions, a participant who happened to be a community development worker in the study area explained that awareness and access to information was a factor affecting banana farmers in adopting banana improvement technologies.

Majority of the participants in focused group discussions explained that there was need to make banana farmers aware of the available banana improvement technologies and therefore a need to conduct a wide range of awareness campaigns.

It was also advanced that there was an urgent need to avail banana farmers with up-to-date and valid information concerning the improved farming technology, as well as its applicability to their prevailing farming systems.

A prominent female banana farmer also stressed the need for agricultural extension workers to avail and ensure that banana farmers got technical assistance to disseminate information required to effectively and efficiently adopt the appropriate banana improvement technologies.

It was suggested that exposure to information on banana improvement technology was a vital factor that would influence the adoption behaviour patterns of the banana farmers. Participants
stressed the need for greater exposure to information in order to enhance awareness concerning banana improvement technologies.

An agricultural extension worker also pointed out that there was a diversity of Institutional inefficiencies during the process of development as well as delivery of relevant information including technical assistance from the relevant national agricultural extension systems.

During one of the focused group discussions, a participant explained that he had obtained information about banana improvement technologies from special editions in newspaper publications. Another banana farmer added that he tried to implement the technologies and registered a large measure of success in terms of productivity as compared to using the banana improvement agricultural technologies.

A prominent farmer explained that many banana farmers in the study area acquired information regarding banana improvement technologies form workshops and seminars previously conducted within the study area. She said that, “Many farmers implemented the banana farming technologies suggested by Agricultural Extension Workers and other banana farmers copied from those farmers that had adopted the technologies after realising the benefits that accrue in terms of returns to productivity.”

The District Agricultural Advisory Officer further asserted that inaccessibility of some parts of the study area due to poor infrastructure in terms of road and communication networks hindered effective transport and communication to the affected places in Nyakayoyo Sub-county.

Findings in this regard are in accordance with Awotide et al., (2013) in their study about technology adoption. They contended that access to information about improved farming practices and agricultural technologies was essential to increase the extent of adoption.
4.4.0 Challenges faced by farmers in adopting banana improvement technology

The third objective of this study sought to establish the challenges faced by banana farmers in adoption of banana improvement technologies and how these challenges could be addressed. The banana improvement technologies that were put into consideration for this study include mulching, trenching, weed control, ploughing, tissue culture technology, pruning, spacing, and fertilizer application.

4.4.1 Extent of adoption of technologies by banana farmers

In this regard, extent of adoption was presented depending on the percentage of farmers that had adopted a particular banana improvement technology in Nyakayojo Sub-county.

Figure 8: Chart showing extent of technology adoption
Therefore, the extent of technology adoption for banana farmers in Nyakayojo Sub-county were found to be at 34% for fertilizer application, 13% for mulching, 12% for weed control practices, 10% for ploughing, 9% for trenching, 6% for pruning, and 4% for spacing. Findings from this study also revealed that 7% of the farmers were found to be using all the above technologies and were obtaining high yields as a result.

It is imperative to note that income appears to be a major motivator for banana farmers in adoption of improved farming technologies. It is therefore important for agricultural researchers to link technology development with productivity and marketability of the resultant produce.

Photo 1: A banana plantation where banana improvement technology was adopted
Photo 1 shows a thoroughly tended banana plantation and a trench constructed in the plantation to control the flow of rain water and soil erosion. This photo caption also shows mulching which is a vital banana improvement technology for controlling weeds and preventing soil erosion. It also enables banana farmers to trap soil moisture and thereby keeping the soil fertile and productive.

According to an agricultural extension officer who operates in the study area, most of these technologies were adopted by the banana farmers because they were similar to the traditional methods, simple and straight forward to use. These findings coincide with the findings of Swanson (1996) who contended that farmers in most cases adopt technologies due to the fact that they were material based, straight forward and simple to use.
The owner of the plantation shown in photo 2 explained that mulching facilitated control of weeds, maintaining soil moisture as well as preventing soil erosion in the banana plantation.

Generally, most agricultural technologies which have wide adoption are attributed to the fact that these agricultural practices fit into the farmers’ existing practices. It is also most likely that the technologies attraction the farmers’ admiration and therefore adopting them (Igbokwe, 2000).
4.4.2 Farmers' reasons for adopting banana improvement technology

Seeking for respondents’ opinions concerning why particular types of banana improvement technology were adopted also became another issue of concern for the researcher in regard to this study. Different opinions were advanced by different participants in the study as illustrated in Table 6 below in this regard.

<table>
<thead>
<tr>
<th>Reasons</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need for improved quality and quantity of output</td>
<td>17</td>
<td>26</td>
</tr>
<tr>
<td>Information obtained from workshops and seminars</td>
<td>15</td>
<td>23</td>
</tr>
<tr>
<td>Programmes on the radio station and television</td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>It is easy to use</td>
<td>09</td>
<td>14</td>
</tr>
<tr>
<td>Copying other farmers’ using the technologies</td>
<td>06</td>
<td>9</td>
</tr>
<tr>
<td>It is cheap</td>
<td>05</td>
<td>7</td>
</tr>
<tr>
<td>Information easily be accessed and understood</td>
<td>03</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>66</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

It was revealed according to findings in Table 6 above from majority of the participants (26%) who explained that they adopted banana improvement technologies in order to improve quality and quantity of produce. It was also further revealed from 23% of the respondents that information obtained from attending workshops and seminars concerning agricultural development instigated them to adopt the technologies in order to obtain the benefits that accrue to it.
Listening to radio and watching television programmes’ concerning agricultural modernisation was also advanced by 17% of the respondents for technology adoption in Nyakayojo Sub-county. Programmes that involved lectures and demonstrations inspired banana farmers to adopt the presented banana improvement practices in order to reap the benefits that accrue in terms of improved varieties.

Lack of complexity was one of the significant reasons that banana farmers in Nyakayojo Sub-county advanced to explain why they adopted some banana improvement technologies. It was supported by 14% of the respondents who explained that it was due to the fact that those technologies were easy to use and able to be efficiently adopted by the banana farmers.

It was also advanced by 9% of the respondents that they copied the banana improvement technologies from other banana farmers who were applying and reaping benefits from the technologies.

In addition to that, 7% of the respondents claimed to adopted banana improvement technologies because they were cheap to use regarding the benefits that accrued to adopting and applying the technologies.

Minority of the respondents (4%) explained that they adopted banana improvement technologies because information regarding banana improvement technologies could easily be accessed.
The owner of this banana plantation in photo 3 asserted that by adoption of relevant banana improvement technologies like mulching, it helped reduce the amount of human resource required to maintain banana plantations. He explained that mulching controls growth of weeds in the plantation, maintaining soil moisture and controlling soil erosion. He also added that the decomposed mulch provides fertility to the soil by acting as organic manure and this led to increased benefits as well as improved quality of output.
4.4.3 Challenges affecting farmers in adoption

There are several constraints to adoption of banana improvement technologies faced by banana farmers in Nyakayojo Sub-county of Mbarara district. In this section of the study, an attempt was made to establish the constraints to adoption of banana improvement technologies.

Findings from the study regarding challenges faced by banana farmers in adoption of banana improvement technologies revealed a number of constrains. Majority of the respondents represented by 44.8% explained that adoption of banana improvement technologies required a lot of manpower and skills in order to be adopted and implemented effectively.

Figure 9: Bar Graph Showing Challenges faced in Technology Adoption
A total of 27.1% of the banana farmers interviewed in the study contended that adoption of banana improvement technologies was costly and expensive to maintain and use. It was revealed that farmers assumed the banana improvement technologies as complex, difficult to perceive and required skilled labour to be adopted. This in turn made the banana farmers have complicated beliefs and opinions about that the length of time required to adopt the technology.

Another 13.1% of the participants advanced lack of adequate income was a constraint in adoption of banana improvement technologies. The participants explained that it required financial resources in order for the banana improvement technologies to be adopted and that they lacked access to credit facilities.

It was further revealed from 9.5% of the banana farmers in Nyakayojo Sub-county assumed that adoption of banana improvement technologies required a lot of time to be implemented.

Least of the respondents 5.5% advanced that adoption of banana improvement technologies was limited by unfavourable weather and climatic conditions. The participants explained that Nyakayojo Sub-county is affected but long dry spells to the extent of even going for close to two months without any rains. As if that is not enough, they added that when the rains come, they are in most cases accompanied by strong winds and hail storms which destroy the crops.
Photo 4 shows a plantation whose owner explained that inadequate human resource was a major challenge in adoption of banana improvement technologies. Findings from the study indicated that shortage of human resource in terms of labour affected farmers in adoption of banana improvement technologies.

Data obtained from key informant interviews indicated that government was not allocating adequate funds to the agricultural sector. It was revealed that national budget allocations did not indicate any major contributions towards supporting agricultural research and development.

In this regard, it was also reported that inadequate dissemination of agricultural research findings to the end users due to lack of adequate funds affected adoption of banana improvement technologies.

It was also reported that research concerning agricultural modernisation was predominantly funded and supported by foreign development partners and not much of government resources. Findings also revealed that poverty affected effective and efficient adoption of banana improvement technologies. The majority of the population in Nyakayojo Sub-county was
comprised of youth and majority of them were found to be unemployed. It was observed that poverty affects the farmers’ ability to access agro-inputs as well as other resources required to support banana farmers in technology adoption. It was also reported that inadequate access to markets for agricultural produce affected adoption of banana improvement technologies.

Data obtained from the study also indicated that population growth affected adoption of banana improvement technologies. It was further explained by a key informant that agricultural growth was below population growth in Nyakayojo Sub-county. Increased population growth was attributed to food insecurity that was considered to be a major constraining factor affecting development in the study area. This was also attributed to increased pressure on resources like land, thereby influencing policy reforms like land fragmentation that was considered to affect agricultural development.

Climatic changes were also advanced among the factors affecting banana farmers in adoption of banana improvement technologies. This was majorly attributed to escalation in global warming which was to blame for long spells of drought and heavy rains that caused intensive destruction of plantations. This in the long run results into loss of soil fertility and land degradation. In this regard, it was also reported that soils were continuously being depleted of nutrients and affected measures directed towards sustaining and increasing crop yields.

It was also reported that absence of effective mechanisms to facilitate provision as well as supporting dissemination of technologies/innovations to the end users affected adoption of banana improvement technologies. This was basically attributed to inadequate dissemination of research outcomes concerning banana improvement technologies.
Photo 5 shows a banana plantation in Nyakayojo Sub-county where adoption of banana improvement agricultural technologies was not implemented. The owner of the above plantation explained that inadequate information about banana improvement technologies was the major factor for not using any. As a result, he said that it became almost impossible to control weeds in the plantation leading poor quality yields/produce.

Findings from the focused group discussions revealed that large volumes of bananas had to be transported for long distances, and stored for a considerable period of time after harvesting. Perishability of bananas during postharvest handling was in this regard advanced as a major
constraint affecting adoption of improved agricultural technologies. Results from findings of the study also indicated that heavy losses occurred due to poor storage and poor infrastructure. Furthermore, the trucks and bicycles used as means for transporting bananas produce are open, unrefrigerated and therefore unsuitable. This therefore affected the quality of the harvested banana products and hence the price.

4.5 Solutions to challenges in technology adoption

It was of great importance in regard to the study to make consideration of the actions advanced by farmers as possible solutions to address constraints affecting them in adoption of banana improvement technologies.

Table 7 shows that majority of the respondents (31%) suggested that there was urgent need for the banana farmers to seek consultancy from senior advisors in order to clearly understand the proposed technologies. It was also revealed from findings in this study that most of the technologies and information generated through research, about banana improvement technologies, was not getting down to the intended end users.

A total of 16% of the respondents advanced that there was urgent need to form farmers’ groups and associations in order to facilitate dissemination of information related with banana improvement technology.

Another 13% of the banana farmers explained that there was need for the Government of Uganda and other development partners to support research and development regarding banana improvement agricultural technologies. Findings further revealed that research in the agricultural sector was predominantly donor funded.
Table 7: Actions recommended for overcoming challenges

<table>
<thead>
<tr>
<th>Actions suggested by the Farmers</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attending Workshops and Seminars</td>
<td>05</td>
<td>8</td>
</tr>
<tr>
<td>Implementing Disease Control measures</td>
<td>07</td>
<td>10</td>
</tr>
<tr>
<td>Implementing Advancements by Extension Workers</td>
<td>08</td>
<td>12</td>
</tr>
<tr>
<td>Formation of Farmers’ Groups and associations</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td>Seeking Consultancy from Senior Advisory</td>
<td>21</td>
<td>31</td>
</tr>
<tr>
<td>Supporting Research and Development</td>
<td>09</td>
<td>13</td>
</tr>
<tr>
<td>Implement recommendations by government programs for agricultural modernization</td>
<td>05</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>66</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

It was also revealed from 12% of respondents who emphasised that banana farmers should endeavour to implement the technology advanced by agricultural extension workers. Also 10% of the respondents suggested that there was an urgent need to implement disease control measures. Similarly, 10% of the respondents recommended that banana farmers should follow government programs designed for agricultural modernization. Minority of the respondents (8%) suggested that there was need for farmers to attend workshops and seminars organized to disseminate information concerning banana improvement technologies.

A prominent farmer and an elder in the study area suggested encouragement of banana farmers to attend agricultural development workshops and seminars as one of the ways to overcome constraints facing farmers in adoption of banana improvement technologies. He added that in most cases the seminars and workshops that were organized to train banana farmers about
banana improvement technologies registered low turn up in terms of attendance. He also pointed out that most of the banana improvement technologies implemented on his banana plantation were obtained from regular attendance of agricultural workshops and seminars conducted in the study area by Agricultural Extension Officers.

In the focused group discussions, majority of the participants suggested that there was need for banana farmers to implement recommendations provided by agricultural extension workers. They also emphasised need for banana farmers to form or join existing farmers’ cooperative groups and associations.

It was also suggested that there was need for increased marketing of the produce obtained from banana farming. Postharvest losses were among the major factors hindering banana farmers from adopting agricultural technologies. In this regard, it was also revealed that the banana farmers believed that improved agricultural technology if adopted, would provide high yields spontaneously resulting in large volumes which the farmers and traders did not have the capacity to handle.

With increased availability of market for the agricultural produce, post harvest losses would become minimal and thus encouraging the banana farmers to increase output and productivity and thus adopt the advanced agricultural technologies.

Another female banana farmer suggested that it was recommendable for banana farmers to put emphasis on implementing the disease control measures advanced by agricultural extension officers. She added that banana bacterial wilt disease was held responsible for mass devastation of banana plantations in the study area and therefore need to contain it.
4.5.1 What needs to be done by Government to aid farmers

It was also equally important consider actions that were advanced by banana farmers as the possible measures to be undertaken by the government in order to address challenges affecting them in use and adoption of banana improvement technologies. Data in this regard was collected and tabulated as shown in table 8.

It was revealed from majority of the respondents (41%), who advanced that the major action required to be undertaken in order to address the challenges facing banana farmers in adoption of banana improvement technologies was through the provision of reliable markets for the farmers’ produce.

It was further revealed that 23% of the respondents suggested a need for Government to sensitize the banana farmers about banana improvement technologies. Findings revealed that most of the knowledge and information concerning banana improvement technologies generated through research was not getting to the intended end users, who are the banana farmers in this regard. Community outreach programs need to be designed to sensitize the banana farmers and motivating them about adopting improved agricultural technologies. Community outreach programs may include rural radio and video shows. These outreach programs should provide information and easy-to-learn ways of training the banana farmers about improved agricultural technologies. The videos can also be translated local languages and effectively used by trainers to train and convey important extension messages to the banana farmers.
Table 8: Actions suggested by farmers to be undertaken by Government

<table>
<thead>
<tr>
<th>Actions suggested</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving control of Banana wilt</td>
<td>05</td>
<td>7</td>
</tr>
<tr>
<td>Supporting disease control measures</td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>Providing reliable markets for produce</td>
<td>27</td>
<td>41</td>
</tr>
<tr>
<td>Sensitizing the farmers</td>
<td>15</td>
<td>23</td>
</tr>
<tr>
<td>Funding Research on Diseases</td>
<td>05</td>
<td>7</td>
</tr>
<tr>
<td>Increasing Funding of Agricultural Sector</td>
<td>03</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>66</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

N=66

In addition to that, it was also revealed from 17% of the respondents who advanced that Government should support disease control measures in order to overcome the challenges affecting banana farmers in adoption of banana improvement technologies.

There is need for government to set up demonstrations farms in order to improve scaling up of the improved agricultural technologies and to increase their impact. On-farm trials and demonstrations create important avenues to present as well as showcase the effectiveness of the banana improvement technologies to farmers. Outstanding technologies identified from on-station and on-farm trials can be further evaluated in demonstration trials. The demonstrations carried out will act as an effective tool to showcase the effectiveness of improved production technologies and to convince the banana farmers to adopt them.

Another 7% of the respondents contended the need for Government to provide farmers with knowledge and information regarding techniques to facilitate in control of the banana wilt and other plant diseases.
Training courses should be provided to extension workers in order to equip them with skills for effective dissemination of information regarding improved agricultural technologies. The effectiveness of agricultural extension agents in encouraging agricultural technology uptake is limited by inadequate training and knowledge on the actual farm operations and problems. Thus, it is important to note that training is a very important component of affecting adoption of banana improvement technologies. Several training of trainers’ courses and monitoring tours should be organised for the agricultural extension workers in an effort to promote effective technology exchange and transfer.

A community development worker in the study area emphasised need for increased sensitisation of the banana farmers in order to create awareness regarding the benefits of adopting banana improvement technologies. She also highlighted that the agricultural sector was underfunded, especially in research and development. In addition to that, she urged the need for Government to encourage development partners to avail adequate funds for agricultural development. She added that there was an urgent need to support research about diseases affecting the plantations of banana farmers, especially the banana bacterial wilt. A disease that majority of the respondents claimed was responsible for destruction of banana plantations and thus causing losses to the farmers.

It was also suggested in the focused group discussions that provision of good and adequate infrastructure was essential for marketing as well as critical for bulk and perishable products like bananas. A good rural feeder network was advanced particularly essential for effective production, transportation and marketing of the harvested banana produce. There is urgent need for construction of rural access feeder roads and funding minor road programs. Most roads in the
study area were in a pathetic condition and impassable during rain seasons. This clearly indicates the need for an improved road networks.

Poor roads increase transport costs and this has a bearing on final net margins. There is a need for increased funding for rural feeder roads.

**Photo 6: Photo showing the effects of banana bacterial wilt**

Similarly, 7% of the respondents suggested the need for government to increase funding for research about diseases affecting banana crops.

Least of the respondents represented by 5% advanced that the major action to be taken by the government is supporting disease control measures advanced by agricultural extension workers.
4.5.2 What needs to be undertaken by community members to address challenges

It was also vital to seek respondents’ views concerning the actions needed to be undertaken by society in order to address challenges faced by farmers in adopting banana improvement technologies. Respondents’ views were tabulated as shown in table 9:

<table>
<thead>
<tr>
<th>Actions to be undertaken by Society</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attending Agricultural Workshops and Seminars</td>
<td>09</td>
<td>14</td>
</tr>
<tr>
<td>Participation in Government Programmes</td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>Listening to some Media Agricultural Related Programs</td>
<td>22</td>
<td>33</td>
</tr>
<tr>
<td>Implementing Technological Advances</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Applying control measures of Banana diseases</td>
<td>07</td>
<td>11</td>
</tr>
<tr>
<td>Support Government Initiatives for Agricultural Modernisation</td>
<td>04</td>
<td>6</td>
</tr>
<tr>
<td>Actively Participate in farmers’ cooperatives and credit associations</td>
<td>03</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>66</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 9 shows that the major action required to be undertaken by community members to address challenges faced in using and adopting banana improvement technologies was listening to media concerned with agricultural development programs as advanced by majority (33%) of the participants. This is basically concerned with the need for paying close attention to radio and television programmes designed to disseminate knowledge and information about agricultural technology.
A total of 17% of the respondents advanced need for active participation in Government programmes concerning agricultural modernisation as prerequisite in order to overcome challenges faced by farmers in adoption of banana improvement technologies.

Another 15% of the participants suggested need for the societal members, and banana farmers in particular, to implement the technological advances proposed by agricultural extension workers. In addition to that, 14% of the respondents suggested that societal members should endeavour to attend workshops and seminars organized to disseminate information concerning agricultural modernization.

It was further revealed from findings that 11% of the respondents advanced need for community members to apply disease control measures in order to contain the spread of plant diseases affecting banana farmers.

The study also revealed that 6% of the respondents emphasised that Government initiatives towards agricultural modernization required to be supported by the community members. They explained that this would enable farmers to overcome challenges faced by banana farmers in adoption of banana improvement technologies.

Finally, minority (4%) of the respondents suggested that community members required actively participating, as well as getting involved in farmers’ cooperatives and credit associations.

Tremendous efforts should directed towards addressing the problems of small-scale banana farmers by making credit available to them as this may improve and escalate adoption of improved agricultural technologies. A well managed cooperative credit union can give agricultural development a strong background and thus accelerating adoption of banana improvement technologies.
A prominent banana farmer in the study area stressed the need for societal members not to be conservative. He explained that in most cases the banana farmers were resistant to changes, especially regarding banana improvement technologies that required increased labour and involved with high costs of production in order to be effectively implemented. He therefore advised that it was equally important for the banana farmers to embrace government initiatives for agricultural development.

A District Agricultural Officer in Nyakayojo Sub-county urged the need for banana farmers to actively participate and get involved in government programmes concerning agricultural development. He explained that it was also of great importance for the banana farmers’ endeavours to implement technologies suggested by agricultural extension workers. He added that in most cases, banana farmers attend agricultural seminars/workshops and listen to radio programmes about agricultural development, but fail to put the technologies into action. It is also important to note that he emphasised need for agricultural extension workers to put into consideration identification of the priorities, needs and preferences of the farmers before introducing technologies.
CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction
This chapter includes a summary of main findings, conclusion, recommendations and areas for further research. The general objective of the study was to explore the social factors affecting banana farmers’ in adoption of banana improvement technologies and the challenges faced. This study was summarized in this chapter by principally focusing on the major findings of the research.

5.1 Summary of findings

5.1.1 Social characteristics affecting farmers in adoption
In this regard, the first objective of the study sought to identify socio-economic characteristics affecting the banana farmers within Nyakayoyo sub-county in relation to adoption of banana improvement technologies. The farmers’ socio-economic characteristics that were considered in this regard included gender, age, levels of formal education, marital status, number of children in the household, farm size, and access to credit. Majority of the participants represented by 78% of the banana farmers in the study area were female. The age distribution of the banana farmers indicated that 46% of the farmers were within the range of 31-40 years of age. It was also revealed that 35% of the respondents were involved in farming as a fulltime occupation. In addition to that, findings also revealed that 39% of the banana farmers were married.
It was further confirmed that majority of the participants, represented by 46%, had attained a secondary level of education. Minority of the participants represented by 10% had attained degree awards in education.

Majority of the respondents (70%) had children; most of the respondents interviewed were above 35-40 years of age and mature enough to have children. Least of the respondents (30%) did not have children and were found to be among young farmers of 30 years of age and below. Having children implied availability of labour to be used instead of hiring labour, which reduced costs of labour for using improved farming technologies. However, also having no children meant increased cost of hiring manpower in most cases.

Concerning marital status of participants in the study area, findings revealed that majority of the respondents represented by 39% were married while only a few respondents (15%) were found to be widowed. It was further revealed that 35% of the farmers had no spouses, being single or widowed.

Findings also further revealed that the banana farmers had difficulty in access and management of farm labour. Findings from the type of households visited and interviewed showed that most of the households visited were Male-headed households, (32%), while least of the households were child-headed, (10%). The socio-economic characteristics that were prevalent in the households within the study area had a wide range of implications for agricultural productivity regarding the adoption of banana improvement agricultural technologies. Adoption of banana improvement greatly requires a diversity of resources ranging from financial, physical, as well as other human resources.

5.1.2 Information on adoption of banana improvement technologies

A composition of the respondents (71%) was found to have obtained information concerning sensitization regarding banana improvement technology from radio stations. This was attributed
to the fact that majority of the respondents in the study area admitted to easily accessing information from radio stations. Other sources of information like newspapers and televisions were considered to be expensive to majority of the participants. Minority of the respondents represented by 7.5% reported to have obtained information concerning banana improvement technologies from television programmes about agricultural development.

Findings further revealed that 26% of the respondents adopted banana improvement technologies in order to increase the quality and quantity of output. Least of the respondents represented by 4%, explained that they adopted banana improvement technologies because information concerning banana improvement technologies could easily be accessed. This implied that access to information significantly influenced the levels of adoption of banana improvement technology.

It was also revealed from participants who reported to have failed to adopt relevant banana improvement technologies due to information inefficiencies regarding benefits, effectiveness and existence of relevant banana improvement technologies. These were represented by 47% of the participants regarding the study conducted in Nyakayojo Sub-county. It was further revealed that 8% of the respondents failed to apply some banana improvement methods like tissue culture technology due to lack of adequate information. This in practice implied that inadequate information about relevant banana improvement technologies affected adoption in being adopted and applied. Minority of the respondents represented by 7% explained that they failed to adopt banana improvement technologies because of their complexity and difficulty to use. Inadequate dissemination of knowledge and information generated through research concerning agricultural development was advanced among the factors affecting and constraining adoption of banana improvement technologies.
5.1.3 Overcoming challenges faced in adoption

It was revealed from majority of the participants (44.8%) that banana improvement technologies require a lot of manpower to be adopted and used effectively. Minority of the participants (5.5%) explained that adoption of banana improvement technologies was limited by unfavourable weather and climatic conditions. It was also further revealed that majority of the respondents (31%) needed to seek consultancy from extension workers in order to effectively overcome constraints to use and adoption of banana improvement technology.

Minority of the respondents (10%) also explained that banana farmers need to endeavour to follow and implement government programmes directed towards banana improvement. In addition to that, it was also revealed that majority of the respondents (41%) contended that sensitizing farmers about the use and application of banana improvement technologies was required to be undertaken by government.

Formulation of land reform policies designed to favour agricultural development was also advanced as a solution to foster and enhance farmers’ adoption of banana improvement technologies.

There is need for government to increase funding as well as support for research and development concerning agricultural development. Agricultural research institutions need to be recognised and given due support as well as increased budget allocations and funding for agricultural modernisation. There is also urgent need to ensure that knowledge and technologies generated through research get to the intended end-users and facilitate up-scaling of banana improvement technologies. It is also important to design effective mechanisms for support and strengthening agricultural institutions in order to effectively make agriculture the catalyst for economic growth.
5.2 Conclusions

5.2.1 Farmers’ social characteristics influencing adoption

It was concluded that the banana farmers’ social characteristics affected adoption of banana improvement technologies. Banana farmers had the capacity to easily understand the banana improvement technologies advanced after sensitization. This is according to the findings which indicated that majority of the respondents (46%) had attained a secondary level of education.

It was also concluded by the findings of this study that farmers’ social characteristics affecting adoption of banana improvement technologies largely depended on the household head and the possession of children in a family. Female-headed and child-headed households in most cases registered low adoption of banana improvement technologies. Findings also revealed that majority of the households (55%) had children, this provided assurance of the availability of human resources in terms of labour. According to Figure 1, it was indicated that majority of the respondents (70%) had children implying that these families had enough manpower for labour to effectively as well as efficiently adopt and use banana improvement technologies.

On the other hand, high numbers of children in most cases resulted into land fragmentation, whereby land was divided among the family members and this limited land for banana production, in the long run.

5.2.2 Whether access to information affected banana farmers’ in adoption.

It was concluded that access to information affected adoption of banana improvement technologies. This was in accordance with findings concerned with the second objective of this study which indicated that respondents adopted banana improvement technologies due to availability and access to information. This coincides with findings obtained from 6.7% of the
participants who accepted to have adopted banana improvement technologies due to accessibility of information. It was also revealed that most of the information concerning knowledge and technologies generated through research about banana improvement were not flowing down to the intended end users (banana farmers). Therefore, access to information in technology adoption, affected adoption of banana improvement technologies in Nyakayojo Sub-county.

5.2.3 Overcoming challenges faced in adoption

It was established from the findings of this study that a diversity of challenges limited use and adoption of banana improvement technologies leading to poor yields and thus low incomes for the banana farmers. There is an urgent need to strengthen, provide support to agricultural research institutions and provide them with due support in order to facilitate them to implement as well as integrate the generated farming technologies into the prevailing farming systems. Increased funding is required for the agricultural sector and pooling technical resources in order to make farming the catalyst for economic growth and development.

There is also need for Government to scale up investments in agriculture and as well increase budgetary allocations for agricultural development, especially the sector of agricultural research in order to foster agricultural transformation.

In addition to that, government as well as development partners need to encourage farmers integrate and implement the technologies and knowledge that is generated concerning banana improvement.

Policy reforms should also be designed in order to contain the policy areas that create a diversity of bottlenecks in the course of up scaling banana improvement technologies, a good example is land tenure policies.
5.3 **Recommendations**

5.3.1 **To banana farmers**

i). Emphasis should be directed towards endeavouring to attend workshops and seminars for sensitization regarding the benefits of adopting banana improvement technologies. Through attendance of workshops and seminars, information about agricultural modernisation can be disseminated to banana farmers efficiently. Findings from this study revealed that attending workshops and seminars was suggested by majority of the respondents as a way of effectively addressing constraints faced by farmers in adoption of banana improvement technologies. There is need for farmers to implement disease control measures in order to realize quality and quantity output. Findings from this study revealed that the banana plantations were greatly affected by pests and diseases. Banana wilt is a disease that has drastically affected banana farming in the study area and there was no known cure for the disease as yet.

ii). Banana farmers need to form farmers’ groups and Corporative associations. Findings revealed that through the formation of these farmers’ groups and associations, it would empower the farmers economically and enable them to have access to credit.

iii). There is an urgent need for seeking consultancy and advisory services to provide banana farmers with guidance regarding benefits of implementation, usage and adoption of banana improvement technologies. Some of the technologies were considered to be complex and required thorough guidance in order to enable effective adoption. A good example is banana tissue culture technology.

iv). The banana farmers need to change their attitudes towards farming and look at farming in a different perspective, as an engine for fostering economic growth and development.
5.3.2 To Government

i). Government needs to support research and development initiatives regarding control of diseases affecting banana plantations, especially bacterial banana wilt. According to results from the findings, banana wilt is a disease that has drastically caused mass destruction of produce. It is highly contagious, little is known about the origin and cause of the disease, as well as its treatment. With the prevalence of such diseases, most banana farmers were reluctant to adopt technologies due to uncertainty and fear of losses caused by diseases.

ii). There is need for the Government to provide reliable markets for the farmers’ agricultural produce. Banana produce is fragile, once it matures, it is harvested, and when there is no ready market for the produce, it is likely to ripen and get rotten. Thereby causing losses to the banana farmers. The banana farmers in Nyakayojo Sub-county explained that there was limited market for the produce and sometimes unfavourable prices were offered. Once the banana farmers are provided with a reliable market base for their produce, it will empower them economically and enable the farmers to access the resources required for facilitating adoption of technologies. Prices for agricultural produce are in most cases are not stable and fluctuate, there is need for government intervention regarding measures and policies to ensure price stabilisation.

iii). The Government should increase funding and budgetary allocations for the agricultural sector. Government should increase financing infrastructural development in order to provide mechanisms for agricultural modernisation. There is an urgent need for infrastructural development, for example the construction of roads and communication networks to effectively and efficiently link farmers to markets.
5.3.3 To Development Partners

There is an urgent need for development partners to increase funding for sectors connected with facilitating agricultural growth and development. Research institutions need to be facilitated to generate knowledge as well as technologies and to integrate the generated technologies to the end users (banana farmers). Supporting research concerning diseases affecting banana producers is also a significant aspect that requires attention if agricultural development is to be adequately enhanced. The banana bacterial wilt is a plant disease which is held responsible for massive destruction of banana plantations in Uganda.

The agricultural sector is underfunded and it is important for development partners to avail adequate resources to facilitate agricultural extension agents in fostering positive interactions regarding dissemination of information. There is also need to increase the number and quality of extension agents that come in contact with the banana farmers.

5.4 Areas for further study.

There is need to conduct research about the cause, prevention as well as measures to contain and eradicate plant diseases affecting banana farming, especially banana bacterial wilt.

In addition to that, there is also need to find out why Governments (especially third world countries) allocate inadequate budget funds for the agricultural sector and yet agriculture is the major engine for significant economic growth and development.
5.5 Challenges encountered in conducting the study

- It was costly in terms of financial resources.
- Poor infrastructure in terms of roads and communication networks resulting into difficulty in accessing some locations in the study area.
- Long distances had to be covered in order to interact with respondents.
REFERENCES


Newspapers, magazines and electronic sources


http://digitalcommons.usu.edu/etd/187


APPENDICIES

Appendix 1: Questionnaires

PROSPECTS AND CONSTRAINTS IN FARMERS’ ADOPTION OF AGRICULTURAL TECHNOLOGY: A case study of Banana growing in Mbarara District, Uganda

QUESTIONNAIRE FOR HOUSEHOLD

Preamble

My name is Bahati Marley. I am a student at University of Nairobi, Kenya pursuing Master of Arts Degree in Sociology. I am currently conducting a research study on the ‘Factors influencing farmers’ adoption of improved agricultural technology: A case study of banana growing in Mbarara district-Uganda’. The purpose of my study is to come up with comprehensive findings on issues concerning adoption of banana improvement agricultural technologies. The information provided in this study will be kept strictly anonymous and confidential and will be used solely for research on finding solutions to common problems. What is required is just your opinion on practices used in farming. Your cooperation will be therefore highly appreciated.

Name of respondent: ...............................................................

Contact of respondent: ............................................................

123
## Household information

**Instructions:** Tick the appropriate option

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age</th>
<th>Occupation</th>
<th>Level of education</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Female</td>
<td>1. Farmer</td>
<td>1. None</td>
<td></td>
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<td></td>
<td>3. Trader (specify)</td>
<td>3. Secondary</td>
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<td></td>
<td>4. Unemployed</td>
<td>4. College</td>
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<td></td>
<td>5. Others</td>
<td>5. University</td>
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<tr>
<th>Marital status</th>
<th>Type of household</th>
<th>Time stayed in Nyakayoyo</th>
<th>Sources of information</th>
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<tbody>
<tr>
<td>1. Single</td>
<td>1. Female-headed</td>
<td>1. Less than 5 years</td>
<td>1. Radio</td>
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<tr>
<td>2. Married</td>
<td>2. Male-headed</td>
<td>2. 5-10 years</td>
<td>2. Newspapers</td>
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<td>4. Widowed</td>
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<td>4. 16-20 years</td>
<td>4. Others</td>
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<td></td>
<td></td>
<td>5. Over 20 years</td>
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1). Do you have children? If yes, how many?
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2). What is your highest level of formal education?
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3). What is your farm size? (In acres)
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4). What size of your farm (in acres) did you use to banana improvement technology?
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5). What banana improvement technologies do you know of? Do you use any?
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6). What made you select the kind of banana improvement technology you use? Why did you choose it?
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7). Are there any other banana improvement technologies you would like to use?
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8). What challenges do you face when using banana improvement technologies?

9). What factors made you use the kind of banana improvement technology or technologies you are currently using, or used before?
10). What factors made you not to choose any kind of banana improvement agricultural technology?

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11). Do you regret your choice of adopting this kind of banana improvement technology?

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12). Would you advice other farmers to use the same technology or other forms of technology? Please indicate why or why not.

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13). What advantages did you get from adopting that banana improvement technology?
14). What disadvantages did you get from adopting this technology?

15). What is your average annual income obtained from farming as a result of adoption of banana improvement technologies?
16). Do you have any other sources of income apart from farming?

(a). If yes, please indicate the sources and the average annual income obtained from each

17). Did your income have anything to do with your choice of adopting or not adopting any banana improvement technologies?

18). Please tell me if you are an early adopter of banana improvement technologies

(a). If you are: Were there any benefits of adopting this technology? Please list them.
19). Are there other farmers in the area who have adopted banana improvement agricultural technology and could say offer some competition?

(a). If yes: Do you still enjoy the benefits of adopting the technology?

20). What challenges do you face (or did you face) in adoption of banana improvement agricultural technology?
21). What do you think the banana farmers can do to help address these problems?

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22). What suggestions do you think the government can do to help address these challenges?

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23). What suggestions do you think the society should do to help address these challenges?

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Thank you for your time and cooperation
Appendix II: Key Informant Guide

PROSPECTS AND CONSTRAINTS IN FARMERS’ ADOPTION OF AGRICULTURAL TECHNOLOGY: A case study of Banana growing in Mbarara District, Uganda

KEY INFORMANT GUIDE

Preamble

My name is Bahati Marley. I am a student at University of Nairobi, Kenya pursuing Master of Arts Degree in Sociology. I am currently conducting a research study on the ‘Factors influencing farmers’ adoption of improved agricultural technology: A case study of banana growing in Mbarara district-Uganda’. The purpose of my study is to come up with comprehensive findings on issues concerning adoption of banana improvement agricultural technologies.

The information provided in this study will be kept strictly anonymous and confidential and will be used solely for research on finding solutions to common problems. What is required is just your opinion on practices used in farming.

In this interview schedule there is no wrong or correct answer. What is required is just your opinion on practices you use in farming. Your cooperation will be therefore highly appreciated.

GENERAL INFORMATION

Date ............................

Name of the respondent ...........................................

Contact of respondent: ............................................

Title of respondent ................................................
1). What banana improvement agricultural technologies do you know of? Do you use any?

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2). What made the kind of banana improvement technology you are aware of have to be adopted by banana farmers in the area?

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3). Are there any other banana improvement technologies you are aware of that would be most likely to be used by and easily adopted by banana farmers?

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4). What factors do you think make farmers to use the kind of banana improvement technology or technologies they are currently using, or used before?

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5). What factors made farmers to choose any specific kinds of banana improvement agricultural technology?

6). Do you think household levels of some farmers affect them in their desire to adopt banana improvement agricultural technologies?
7). Do you think the education levels of household heads are among the factors that influences banana farmers in the adoption of banana improvement agricultural technologies? If so, how and why?

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8). Do you think farm size influences the level of adoption of banana improvement agricultural technologies? If so, how and why?

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9). Do you think the gender of the household head influences the level of adoption of banana improvement agricultural technologies?
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10). To what extent is information about banana improvement agricultural technology is accessed by the farmers?
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11). What factors influence banana farmers’ access to information about banana improvement agricultural technologies?

12). Would you advice other banana farmers in the area to use the same technologies that have been adopted by banana farmers in the area or other forms of technology? Please indicate why or why not.

13). What are some of the advantages got from adopting banana improvement technologies?
14). What disadvantages emanate from not adopting banana improvement agricultural technologies?

Please tell me if you are an early adopter of banana improvement technologies

(a). If you are: Were there any benefits of adopting this technology? Please list them.

15). Do you think banana farmers enjoy the benefits of adopting the relevant banana improvement technologies?
16). What challenges do you think are faced by banana farmers (or did you face) in adoption of banana improvement technologies?

17). What do you think the farmers can do to help address these problems?
18). What do you think the government can do to help address these challenges?

19). What do you think the society should do to address these challenges?

Thank you for your time and cooperation 😊
Appendix III: Focused Group Discussion Guide

PROSPECTS AND CONSTRAINTS IN FARMERS’ ADOPTION OF
AGRICULTURAL TECHNOLOGY: A case study of Banana growing in Mbarara
District, Uganda

Focused Group Discussion Guide

Preamble

My name is Bahati Marley. I am a student at University of Nairobi, Kenya pursuing Master of Arts Degree in Sociology. I am currently conducting a research study on the ‘Factors influencing farmers’ adoption of improved agricultural technology: A case study of banana growing in Mbarara district-Uganda’. The purpose of my study is to come up with comprehensive findings on issues concerning adoption of banana improvement agricultural technologies. The information provided in this study will be kept strictly anonymous and confidential and will be used solely for research on finding solutions to common problems. What is required is just your opinion on practices used in farming. Your cooperation will be therefore highly appreciated.

1. What banana improvement agricultural technologies are you aware of?

2. What banana improvement agricultural technologies have been introduced to banana farmers in the area, and by whom?

3. What factors influence banana farmers in adoption of banana improvement agricultural technologies?
4. Comment on the farmers’ social characteristics and particularly whether they influence the level of adoption of banana improvement technologies?

5. To what extent does access to information influence the level of adoption of banana improvement agricultural technologies?

6. What are the challenges facing banana farmers in adoption of banana improvement agricultural technologies?

7. How can these challenges be addressed and overcome?

Thank you for your time and cooperation 😊
Appendix IV: Field Observation Guide

PROSPECTS AND CONSTRAINTS IN FARMERS’ ADOPTION OF AGRICULTURAL TECHNOLOGY: A case study of Banana growing in Mbarara District, Uganda

Field Observation Guide

Preamble

My name is Bahati Marley. I am a student at University of Nairobi, Kenya pursuing Master of Arts Degree in Sociology. I am currently conducting a research study on the Factors influencing farmers’ adoption of improved agricultural technology: A case study of banana growing in Mbarara district-Uganda’. The purpose of my study is to come up with comprehensive findings on issues concerning adoption of banana improvement agricultural technologies.

The information provided in this study will be kept strictly anonymous and confidential and will be used solely for research on finding solutions to common problems.

1. Banana farming agricultural practices used for soil fertility conservation
   - Mulching
   - Pruning
   - Organic fertilizer application
   - Trenching
   - Weeding
   - Others
2. The level of use of banana tissue culture technology
3. Management of pest control practices
4. Gender in relation to banana farming and management
5. Land use and other farming practices that are a threat to banana farming
6. Challenges in the management of banana plantations.

Thank you for your time and cooperation 😊