FACTORS INFLUENCING ADOPTION OF GREENHOUSE HORTICULTURAL FARMING IN *MIRIGAMIERU EAST DIVISION, IMENTI NORTH DISTRICT*

BY

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DECLARATION

This research project is my original work and has not been presented for a degree award to any other college or university.

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SUPERVISORS' DECLARATION

This research project has been presented for examination with our approval as University supervisors.

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DEDICATION

This work is dedicated to my dear husband Paul Mutuma Ndethiu for his unfailing love and support. To our children Clifford, Brenda, Derrick and Shiru for their understanding and encouragement during the rigorous period of my study.

To my late parents, Mr. Duncan Mugo and Mrs. Virginia Wanjiru, for the virtues of hardwork, patience and success they instilled in me.

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ABBREVIATIONS AND ACRONYMS

AFK	Amiran Farmers Kit
DAEO	Divisional Agricultural Extension Officer
DAO	District Agricultural Officer
FAO	Food and Agriculture Organization
FFS	Farmer Field Schools
GOK	Government of Kenya
Ha	Area of land in hectares
KHDP	Kenya Horticulture Development Programme
KARI	Kenya Agricultural Research Institute
MDGs	Millennium Development Goals
MOA	Ministry of Agriculture
NEMA	National Environment Management Authority
SPSS	Statistical Package for Social Sciences
SRA	Strategy for Revitalizing Agriculture
UK	United Kingdom
US$	Currency in United States of America dollars
USA	United States of America
USaid	United States Agency for International Development

ABSTRACT

As the world population continues to increase, and more agricultural land is being used for urban development, greenhouse farming could lead towards reduction of hunger problems for the whole world. However, there are a number of factors that hinder greenhouse farming in Kenya. The purpose of this study was to investigate factors influencing adoption of greenhouse horticultural farming in Mirigamieru East Division, Imenti North District and to recommend areas for improvement in future. The objectives that form the basis of this study were to; assess how availability of information, availability of resources, cost, extension support and farmers' level of education and training influenced adoption of greenhouse horticultural farming in the area of study. The study adopted correlational research design. A sample size of 187 farmers from a total population of 16,475 households in Mirigamieru East Division was interviewed after stratified and systematic random sampling. The research instruments were questionnaires which consisted of open-ended and close-ended questions. The analysis was descriptive in form of frequencies and percentages. The major analysis method used was linear regression using Statistical Package for Social Scientists.The study found that there was positive relationships between availability of information, availability of resources, cost, extension services, farmers' education level and training and adoption of greenhouse farming in the division to a great extent, though in varying degrees. The study gave recommendations to the policy makers, Ministry of Agriculture and the government and concluded by giving areas for further studies.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Greenhouse farming is said to have started in the 1st Century when cucumber was being cultivated under protected agriculture for Emperor Tiberius. The technology was rarely practiced during the next 1500 years (Prasad and Kumar, 2010). In Netherlands, which is today's largest greenhouse industry in the world, greenhouse farming is thought to have started at the beginning of 16th Century. France and England started greenhouse cultivation around the same time. Development of greenhouse industry in America followed much later in 1764 (Nelson, 1985). In India, greenhouse cultivation is of recent origin and the 1994-95 estimates show that only 100ha of land was under greenhouse farming.

Jensen and Malter, in their 1997-1988 world estimates observed that greenhouse farming has been readily adopted in all the five continents, especially in the Mediterranean region, China and Japan. Kenya has recently borrowed greenhouse farming from Israel, where the country has most of its agriculture under greenhouses due to scarcity of water and land. For a long time, greenhouse farming has been a preserve for Kenya's large scale horticultural and flowering companies. However, Kenya Horticultural Development Programme (KHDP) and Kenya Agricultural Research Institute (KARI) are working to make it possible for farmers, especially the small scale farmers, to adopt greenhouse farming which allows farmers to farm all the year round and to maximize their yields using less farming space and pesticides (www.freshplaza.com).

The development of greenhouse farming technology is leading towards production of food for the whole world and reduction of world hunger problems. As the world population continues to increase, and more agricultural land is being taken up by urban development, intensive food production in greenhouses will play an essential role in eradicating food insecurity (Dairymple, 1973).

(FAO, (2011) report states," Food production must clearly increase significantly to meet the future demands of an increasing and a more affluent world population." We are

living in a world with limited natural resources such as water, land and energy. As a result, cost effective remedies must be employed in order to achieve the FAO's main objective of defeating hunger and improving agriculture, forestry and fisheries. Greenhouse production can meet the consumer need for increasing health, nutrition and demand for high-quality food products.

The emphasis in many developing countries is on increasing food production without considering preservation of basic and natural resources. As a result, large areas of the world face severe soil degradation, water erosion, ground water pollution and natural resource depletion (Humi, 2000). One of the solutions being offered to this problem is that farmers change their current farming to more sustainable agricultural practices, with greenhouse farming being considered among the best technologies. (Karami and Manosoorabadi, 2008) Therefore, a large scale move to greenhouse agriculture would lead to reduction in water, land and labour usage as compared to open-field agriculture. It also provides greater independence from weather conditions (Nanotechnology: Benefits of molecular manufacturing).

One of the key pillars of the Millennium Development Goals (MDGs) is the eradication of extreme poverty and enhancing food security which corresponds with Kenya's Strategy for Revitalizing Agriculture (SRA). Greenhouse farming has been touted as an activity that could aid the country in attaining food sufficiency thereby, playing part in solving the world's persistent food problems, (www.kenyanmagazines.com).

The Kenyan Government Vision 2030 is the county's new development plan which the government is employing in an effort to improve the quality of life of all citizens. It is the country's long term development plan covering the period 2008 to 2030. The Vision 2030 for Agriculture is to promote an innovative, commercially oriented and modern agriculture (Government of Kenya, 2008). The government has reinforced this by putting in place Economic Stimulus Programme (E.S.P) to boost the country's economic recovery and offer solution to the challenges of food security among others.

Greenhouse farming is a sustainable practice that could help to meet current and long-term needs of the society while maximizing net benefits through conservation of resources to maintain other ecosystem services functions and long-term human

development (Rao and Rogers, 2006). Comparatively, few studies have however, been conducted on greenhouse farming in the world, including Kenya. Most of the studies carried have concentrated on greenhouse gas emissions. Consequently, there is inadequate information on factors that influence adoption greenhouse farming.

A study carried by Hosseini,et al.,(2010) on the perceptions of greenhouse owners about the factors influencing the development of sustainable agriculture in Iran found economic, social, extension, education and policymaking factors to influence adoption of sustainable agricultural practices. Therefore, this calls for research on factors limiting adoption of greenhouse horticultural farming which could help in reducing food insecurity and poverty problems in Kenya and specifically in Mirigamieru East Division, Meru County. Mirigamieru East Division is endowed with natural resources and has potential for high quality crops. However, food insecurity and poverty are a major threat to the community.

1.2 Statement of the problem

All reviewed literature underlines the global outcry on the need to increase agricultural productivity to meet the demands of the world's population. Greenhouse farming has been offered as a possible solution to help eradicate food insecurity problem (Dairymple, 1973). However, majority of farmers in the area of study are not practicing greenhouse horticultural farming. This is evident from the few greenhouses found in the area. According to the report from the office of DAO's, there are about eighteen greenhouses in the division. Most of the available past studies done in other regions of the world including Kenya, have investigated in general the reasons farmers were not adopting new agricultural innovations.

A study conducted by Misiko, (1976) in Bungoma District of Western Province on the incentives and disincentives influencing adoption of agricultural innovations. He found that contact with extension officers, family size, income, endowment of economic resources, and access to agricultural credit, to be positively associated with adoption. Makunzi, (2010) carried a study in Mathira East District, Central Province on factors influencing the use of fertilizer by small scale farmers while Macharia, (2009) investigated challenges facing small scale farmers in implementing soil and water

conservation practices in the coffee zones of Meru South District. While there is scanty literature review on factors influencing greenhouse horticultural farming in Kenya, no study has been conducted in Mirigamieru East Division to find out why farmers have not readily adopted greenhouse farming despite its known advantages. This study therefore, seeks to investigate the factors that are hindering farmers in Mirigamieru East Division from practicing greenhouse horticultural farming.

1.3 Purpose of the study

The purpose of this study is to investigate factors influencing adoption of greenhouse horticultural farming, in Mirigamieru East Division in Imenti North District.

1.4 Objectives of the study

This study was guided by the following objectives:

i. To assess how availability of information influences adoption of greenhouse horticultural farming in Mirigamieru East Division.
ii. To determine how availability of resources influences adoption of greenhouse farming in Mirigamieru East Division.
iii. To establish how cost influences adoption of greenhouse horticultural farming in Mirigamieru East Division.
iv. To investigate how extension support influences adoption of greenhouse horticultural farming in Mirigamieru East Division.
v. To investigate level of education and training influences adoption of greenhouse farming in Mirigamieru East Division.

1.5 Research Questions

The research sought to answer the following questions.

I. How does availability of information influence adoption of greenhouse horticultural farming in Mirigamieru East Division?

II. How does availability of resources influence adoption of greenhouse horticultural farming in Mirigamieru East Division?

III. How does cost influence adoption of greenhouse horticultural farming in Mirigamieru East Division?

IV. How does extension support influence adoption of greenhouse horticultural farming in Mirigamieru East Division?

V. How does the farmers' level of education and training influence adoption of greenhouse horticultural farming in Mirigamieru Division?

1.6 Significance of the study

A number of studies have been conducted in other regions of the world including Kenya to determine why farmers may not adopt agricultural innovations. However few studies have been carried in Kenya, particularly in Meru County to investigate the reasons why greenhouse horticultural farming has not been readily adopted by majority of farmers, hence the need for this study. Where factors influencing adoption of greenhouse farming are not clear cut, then an in depth research becomes a priority. Since not much has been documented on greenhouse horticultural farming, this study sought to add to the body of knowledge available. The study therefore, analyzed the factors influencing adoption of greenhouse horticultural farming in Mirigamieru East Division.

The data collected in the study will bridge the knowledge gap among researches from different regions as well as provoke future studies on greenhouse farming in other parts of the country. The findings may also be useful to the Ministry of Planning and National Development in determining future approaches and policies of eradicating food insecurity, provide the policy makers and development planners to strategies with the aim of achieving Vision 2030.

1.8 Delimitation of the study

The study covered horticultural farmers in Mirigamieru East Division in Imenti North District, Meru County, Mirigamieru. The study focused on the factors hindering farmers in the study area from practicing greenhouse horticultural farming despite its profitability. These factors include information availability, resources availability, cost, extension services and the farmers' level of education and training. The study covered the active

farmers. The soil and climatic conditions are suitable for agriculture and horticulture. The farmers speak the same ethnic language which the researcher understands well. The researcher is also familiar with the area and the culture, which had some advantages when collecting data from the people.

1.9 Limitation of the study

A number of factors posed challenges to the researcher. Personal interviews took a lot of researcher's time because of the low literacy levels in the area of study. Questionnaires faced slow response and unavailability of respondents.

Time and resources, which are typical of one-person research, restricted geographical and numerical scope of the study in Mirigamieru East Division. The vastness of the division posed a challenge in coverage because the selected locations are big and far apart.

1.10 Assumption of the study

It was assumed that the sample population drawn was not only willing and ready to participate in the study but was also honest and able to understand questions in the questionnaires and interview schedules, and that they would respond objectively so that information gathered was valid. Above all, it was assumed that the sampled horticultural farmers gave a representative picture of the situation as it is in Mirigamieru East Division, Imenti North district.

1.11 Definition of Significant Terms

Cost- total amount of money required to purchase the required inputs for an agricultural activity

Education level – number of years spent in school.

Extension support – training and advice given to farmers

Greenhouse – a structure which is covered with transparent material in which plants are grown.

Horticulture – cultivation of vegetables, fruits and flowers.

Resources – inputs required for an agricultural activity.

1.12 Organization of the study

The first chapter presents introduction of the study, background, statement of the problem, purpose of the study, objectives of the study, research questions, significance, delimitations, limitations, assumption, and definition of significant terms and organization of the study.

The second chapter consists of literature review which focuses on greenhouse technology, theoretical framework, availability of information, availability of resources, cost of materials, extension support, farmers' education level and training and conceptual framework.

Chapter three presents research methodology which includes research design, target population, sampling procedures, sample size, data collection procedures, reliability, validity data analysis techniques, operationlization tale and a summary of the chapter.

Chapter four deals with analysis, presentation and interpretation of data while chapter five consist of summary of findings, discussions, conclusions, recommendations and suggestions for further study

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter consists of the literature review relevant to the area of study. It starts with a review of how the greenhouse functions and advantages of greenhouse horticultural farming. This will be followed by a detailed review of the factors that influence farmers on the adoption of greenhouse horticultural farming. The chapter concludes with theoretical and conceptual frameworks.

2.2 Greenhouse Technology

The term 'greenhouse' refers to a structure which is heated artificially and is covered with transparent material for the purpose of admitting natural light for plant growth (Prasad and Kumar, 2010). Greenhouses basically collect solar energy from the sun in form of light and electromagnetic wavelengths. This warms up the plants, soil, and other objects in the greenhouse. The transparent covering material traps in the heat and only a little of it may escape. As a result, the temperature inside the greenhouse is much higher than that of air outside. Therefore, the plants have more warmth, grow fast and are healthier. In extremely cold regions, additional artificial heat, especially at night may be provided (Boodley & Newman, 2009).

Prasad and Kumar, (2010) explain that under greenhouse, one can grow crops under controlled environment and throughout the year. Four to five crops can be grown due to the availability of required plant environmental conditions. This helps in increased crop productivity, a superior quality of produce, as well as effective control of pests and diseases in the enclosed area. It also ensures efficient use of the various inputs like water, fertilizers, seeds and plant protection chemicals.

In his work titled 'Manual on Simple Greenhouse Technology' Odame, (2009) outlines the benefits of greenhouse farming as; early maturity of plants due to high temperatures, effective pest and disease control at reduced costs, reduced residual because of less chemical used, high yields, reduced risks and uncertainties, weed control and all year

round production. Light and temperature control makes it possible for greenhouses to turn in arable land into arable land, thereby, improving food production in marginal environments and high altitude countries.

Spain is one of the largest greenhouse complexes in the world. As a result, it is sometimes called a sea of plastics because it covers almost 50,000 acres (200km2). Crops grown in the greenhouses include: flowers, tobacco plants, herbs, vegetables and fruits such as tomatoes, peppers, cucumbers and melons which are in very high demand in the continent (Lemmon, 2000).

In most regions of the world, including Kenya, farmers have had problems accessing information on greenhouse production. Consequently, they have relied primarily on the experience of other farmers or on trial and error approaches to determine optimum conditions for greenhouse farming. Cunningham, A. S, (2000) notes that many farmers are now turning to greenhouse and irrigation farming due to unpredictable weather.. Even those employed other sectors are setting up small greenhouses to grow vegetables for domestic consumption or extra income. Agricultural industry faces many challenges such as loss of top soil and sterilization of land due to over use of pesticides. Greenhouse farming offers the most viable solutions to the industry.

2.3 Theoretical Framework

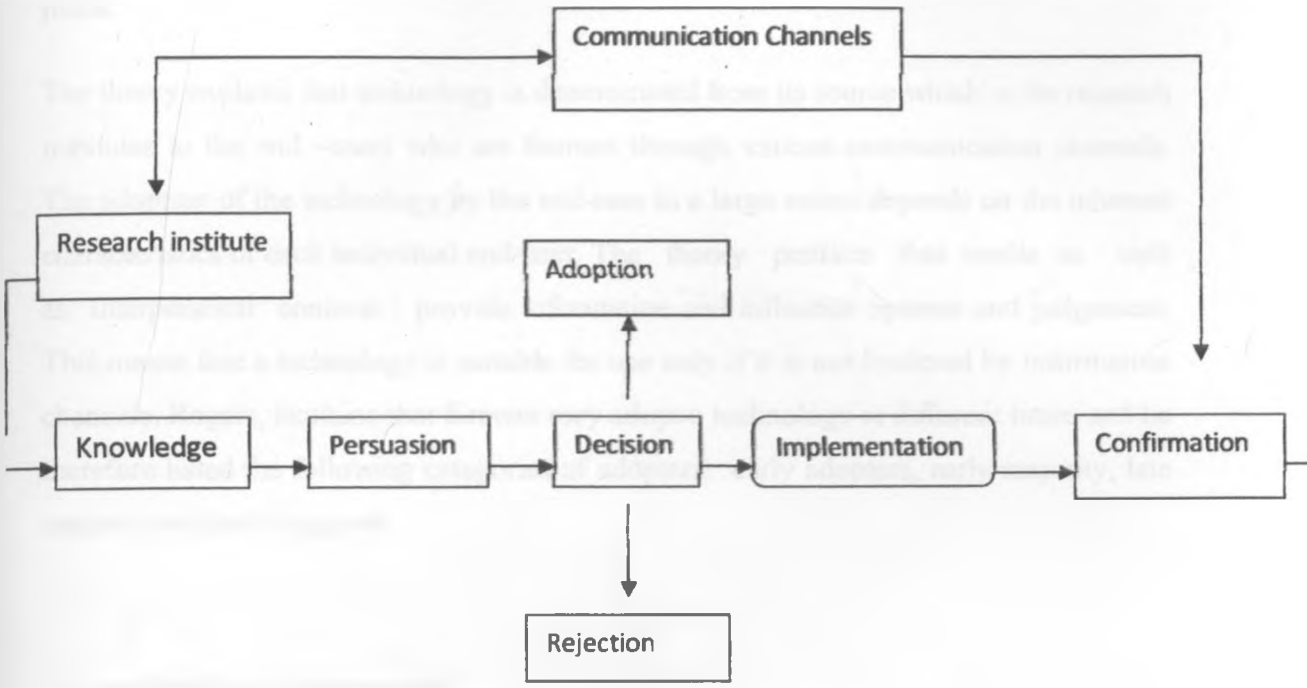

Figure 2.1 - Diffusion of Innovation model by Rogers (1995)

The researcher has based her research on Everrett Rogers's theory of **Diffusion of Innovation (DoI).** Rogers purports that diffusion is a process by which an innovation is communicated through certain media over time to the member of a certain group. The theory seeks to describe the methods, reasons and the rate at which new ideas and technologies spread across individuals or organizations in a certain region (wikipedia.org/wiki/ Diffusion of Innovation). Rogers, (1962) argues that there are four main elements which may influence the spread of a new innovation. These are the innovation itself, communication channels, time and a social system. Rogers explains that decisions are not collective and each member of the social system makes their own innovation decision. He continues to explain that individuals go through 5 stages before adopting a new innovation. These are: **knowledge**, when a person becomes aware of an innovation and has some idea about how it functions, **persuasion**, a stage in which a person forms a favorable or unfavorable attitude towards the innovation **decision**, where

a person engages in activities that may lead to a choice to adopt or reject the innovation ***Implementation,*** *a stage when a person puts the innovation into use and* ***confirmation,*** the final stage where a person evaluates the results of an innovation-decision already made.

The theory explains that technology is disseminated from its source which is the research institutes to the end –users who are farmers through various communication channels. The adoption of the technology by the end-user to a large extent depends on the inherent characteristics of each individual end-user. The theory predicts that media as well as interpersonal contacts provide information and influence opinion and judgement. This means that a technology is suitable for use only if it is not hindered by information channels. Rogers, explains that farmers may adopt a technology at different times and he therefore listed the following categories of adopters: early adopters, early majority, late majority and lastly laggards.

2.4 Availability of Information

Exposure to information reduces subjective uncertainty and therefore, increases the likelihood of adoption of new technologies (Langyintuo & Mekuria, 2005). Hooks, (1993) explains that availability of information is the most important factor for the acceptance of a technology. According to Asiabaka *et. al.*,(2001) for farmers of different agricultural zones to adopt a new agricultural technology, they must be aware of the technology, have valid and up to date information on the technology, the applicability of the technology to their farming systems and receive the technical assistance necessary to adopt the technology. They also argue that if farmers do not adopt a technology it is because they have not understood it well, it is not compatible with their existing farming systems, or just because they are ignorant.

Farmers on their own, may not just adopt an agricultural technology. Among the reasons for this could be ignorance and inability to afford the new technology. There are many factors which may induce farmers into adopting a technology including sources of information, and the farmers attributes (www.ajol.infor/index-php).

Beets (1990) suggest that appropriate technologies are often not available to farmers. Sometimes, they are not available because of the logistic and financial constraints or communication problems. More often than not, technologies that are available may not be suitable or appropriate for the conditions under which the farmers operate. In most case, inappropriate and/or incomplete technologies have been introduced to the farmers without considering the consequences.

Smit and Smithers, (1991) conducted a study in Ontario Canada on adoption of soil conservation practices and found that although farmers in Canada were aware of soil conservation adoption was poor. Forces other than awareness and positive attitude seem to constrain adoption. These were economic pressures, complexity and compatibility of practice and perception. This presents an urgent need to investigate how far aware farmers in other parts of the world, Kenya included are of farming technologies, hence the need for this study.

Odame, (2009) suggests that farmers need to know the different kinds of housing in use to protect the plant from external environment. These include;-Vento type greenhouse, plastic greenhouse, rainshelter, glass greenhouse and tunnel. Simple plastic house or greenhouse or rainshelter has gained prominence among smallholder farmers in horticulture production because of the low costs.

Farmers need to know the ideal materials (plastic or glass) to install which is inexpensive and which would be suitable for use for several years without replacement. Some plastics have several advantages though they cannot completely substitute for glass (Kennard, 1967).He continues to explain that there are various greenhouse designs. These are flat-topped and peaked-roof structures. Before the type of greenhouse is chosen and built, a careful study should be made of the best bench arrangement and crops to be grown in the house. Crops such as roses need a lot of head room and house with at least 7 foot walls.

2.5 Availability of resources

The most challenging limitation to farmers who would like to adopt greenhouse farming is how and where to get the greenhouses. Shrivastava and Singh, (1990) explain that one major constraint to farmers adoption of new farming technologies is lack of facilities and equipment and knowledge about where these can be sourced. Greenhouses can either be imported or bought locally (moneyacademy.co.ke).

Amiran Kenya Ltd has designed the Amiran farmers' kit (AFK) to allow the small-scale farmers to afford access to modern agricultural technologies. The AFK is specifically designed to meet a particular farmer's or group need by adopting the kit to suit the climate, terrain and agricultural experience of the farmer. Amiran Farmers kit comes complete with installation, training and an agro-support package which teaches the farmer how to grow. Amiran Kenya Ltd stays with the farmer throughout the season to ensure best results (www.amirankenya.com).

Kenya Horticultural Development Programme (KHDP), which is funded by the United States Agency for International Development (USAid), in partnership with Seminis Seeds are sponsoring farmers in the acquisition of greenhouses, drip irrigation systems, training and in supplying hybrid tomato seeds. The Kenyan farmers who qualify for this consideration are those who own at least 240 square meters of land. They are funded with US$ 1,700 to install greenhouses and drip irrigation systems. The farmers' contribution to the project is only concrete and labours (www.freshplazza.com)

Spio, (2002) has also proved that farmers may not seek credit even when they are interested in adoption of an agricultural technology because they are ignorant of their availability. Other farmers may simply shy away from formal credit for fear of uncertainties and the cost of borrowing, an opinion that Doni, (1997) agrees with. However the micro finance revolution which provides access to credit without formal collateral has been of great financial assistance to millions of people. Formal sources of finance include micro finance institutions, Savings and Credit Societies and established financial institutions. The non-formal sources include from friends, families, money lenders, stockiest and marketing agents.

A study carried out by Doss, (2006) on limitations on challenges and opportunities for improving technology adoption using micro-studies suggests that a farmer who had ever received credit is a better measure of credit access than whether there is a source of credit available to the farmer.

According to Beets, (1990) the land area and the quality of the land that a farm family has at its disposal is critical. It determines the production potential and the economic well being of the family. According to Bavalatti and Sundaraswamy (1990) when the size of owned land increases, farmers rate of adoption of new farming technologies increases. This finding is supported by studies done by Pathak and Mazumdar, (1978) who argue that farmers who have more land have also more economic resource and consequently, greater risk taking ability.

Ingle and Wayazade, (1989) also agree that land holding, annual income and social participation are positively and significantly associated to the extent of adoption of new agricultural technologies. Patil *et. al*, (1989) also agrees with the above findings because they suggest that education, size of land holding, experience in farming and annual income are greatly associated with the adoption of new technologies in farming. In Kenya majority of farms are owned and operated by private individuals or families either in small or large scale (Demographics/Ag101/Agriculture/us.)

The amount of water involved in agriculture is significant. Most of it is provided by rain, rivers and lakes. Globally, 2600cm3 of water is used for irrigation each year (FAO, 2004). Kenya is classified as one of the most water deprived countries in the world. It has only 647cm3 per capita. There is a strong link between poverty and access to clean water (NEMA, 2004) Water as a resource is a big challenge in the district. Water shortages in the rivers are compounded destruction of catchment areas are through land degradation. (Smakhtin 2008) This poses challenge in provision of adequate water for agriculture, industrial and domestic use. Lately, changes in rainfall pattern have led to crop failure and hence a shift to irrigation practices. Water is already under stress at the current population levels and this will intensify as the population increases (MOPND, 2008).

2.6 Cost of materials

The obvious disadvantage of greenhouses is the prohibitive cost which is unaffordable to many Kenyan small-scale farmers whose incomes are low. The cost of buying greenhouses depends on proximity to the materials. This means that imported greenhouses are more expensive than the locally available ones in installation, (www.greenhouseinitiativeskenya.com). Green Tec Company claims that it offers the cheapest and affordable greenhouse in East Africa.

The smallest greenhouse should be 8mx15m. The wooden constructed one costs from ksh 100,000 to put up. This includes the greenhouse structure, drip irrigation system and a 500 litre tank to provide water (www.kenyanmagazines.com). Other sources indicate that the cheapest greenhouse kit comprising a 500 litre tank, irrigation drip lines, plastic sheet, seeds and chemicals are put at ksh 150,000. This covers a plot of land in which 1,000 plants can be grown (www.hortinews.co.ke).

For the metal greenhouses of the same measurement, the cost is around Kshs 180,000. Greenhouses are sold as complete kits including the drip irrigation systems and they last for 10 to 12 years. Some timber constructions may go for as cheap as Khs100,000 (www.organicfarmermagazine.org). Kenya Agricultural Research Institute (KARI) has also designed standard greenhouse of 6m by15m from locally available materials such as wood, net, and polythene which last for four to five years (www.webarazafarmer.com). Farmers can also be taught to construct their own greenhouses which are a lot cheaper albeit more technically demanding. These are also more prone to termites, wind and durability of the polythene which may require to be replaced two to three years.

Meti and Hanchinal, (1995) report that heavy expenditure in the adoption of new farming technologies and lack of finance by the farmers account for non-adoption of the new farming technology. Singh, (1999) concludes by purporting that high cost of the farm implement, equipment and the inputs required by the new technology and lack of money are the main constraints in the adoption of the new technologies in farming.

According to World Development Report, (2008) financial constraints in agriculture remain pervasive. They are costly and inequitably distributed which severely limit small

scale farmers' ability to compete. Financial constraints originate in the lack of asset ownership to serve as collateral. Lack of credit translates into inadequate working capital and farmer inability to purchase productivity- enhancing inputs.

2.7 Extension support

The term 'extension' was first used to describe adult education program in England in the second half of the 19th century. These programs helped to extend the work of the universities beyond the campus and into the neighboring communities. The term was later adopted in the United States of America while the British replaced it with advisory services in the 20th century. (www.usaid.gov/work/agriculture/extension services .htm)

Singh Agrobios, (2008) explains that advice and assistance for farmers to help them, improve their methods of production and marketing is called agricultural extension. Farmers need to be supplied with the recent, useful and practical information related to agriculture. Agricultural development should closely be related with the development of the ability of the farmers understanding and adoption of such technologies. A study by Owens *et al.*, (2010), investigating the impact of farmers' contact with agricultural extension services on farm productivity, established that the ability of farmers to effectively diversify their farming system is influenced by their contact with agricultural extension officers.

Improving agricultural productivity, profitability and sustainability in the developing world depends on the ability of rural people in those countries to adopt, change and innovate in their use of technologies, management system, organizational arrangements, institution and environmental resources. Expanding the people capacity to innovate depends on their access to knowledge and information services. Rural extension and advisory services meet the immediate needs of farmers and other rural people as they change their production and livelihood system.

Mook,(1971) in his study conducted in Vihiga Division of Western Province, Kenya reported that farmer education, extension visits, and attendance at field demonstrations related very positively with adoption of improved maize innovations, a study that has

been strongly supported by other scholars. According to Singh and Prasad,(1990) demonstrations and meeting with extension persons are the most important sources of information for farmers.

Beets, (1990) suggest agricultural technologies can largely be disseminated through a good agricultural extension services which is sadly lacking in most countries. More effective disseminations need better coordination between different agencies particularly the national ministries of agriculture, development planners and rural development. The National Agricultural Extension Policy framework recognizes that diversification and decentralization of the provision of extension services has been provided mainly by the government and the greater community. Private sector participation should be encouraged (Gok 2002-2008)

Adoption decisions are dependent upon the degree of exposure that farmers may have to a piece of information and the amount of interest that they show. (Asiabaka *et al.*,2001). Hussain *et al.*, (1994) believes that conducting on-farm trials, participation in the field and demonstrations using new technologies exposes farmers to the benefits associated with the use of such technologies. This absolutely has a positive influence on the way such farmers perceive the new technologies and hence its importance in influencing the farmers' adoption behavior.

Dorfman, (1996) while working in USA found that the greater number of hours worked away from the farm by the farmers lowers the probability of adoption of new technologies. This finding suggests that farmers who are maximumly involved through field days and on-farm trials are more likely to be influenced by new technologies. Chambers, (1993) concludes by revealing that people acquire knowledge, skills and attitude from what they experience and are exposed to on the daily basis of their lives. Adesina and Baidu-Forson, (1995) in their Burkina Faso and Guinea studies explain that the number of times the farmer participates in training activities, the more perceptions are influenced towards adoption of new technologies.

Birkhaeuser *et al*.,(1991) have shown that farmer training has a positive effect on the adoption of agriculture technologies. Training farmers in basic agricultural technologies

will increase the adoption rate. Farmers are known to gain a lot from access to improved information which may be provided through extension. Farmers who participate more in extension training have been found to be more adoptive to agricultural innovations. This is because participation broadens the knowledge and gives a participant a chance to learn about the benefits of adopting new technologies in agriculture (www.sab.ac.Ik/Acade-Activity). Pontius *et.al.*,(2000) have given their suggestions that farmers can acquire education through informal and formal organized forums. Asiabaka et al.,(2002) also concurs by suggesting that farmers can acquire knowledge and information through Farmer Field Schools (FFS)which is gaining prominence in Kenya.

2.8Farmers' Level of Education and Training

Education is the key to achieving the Millennium Development Goals (MDGs) and is a powerful driver of the development of individuals and societies. Investing in people education is one of the strongest instruments for reducing poverty and improving health, gender equality, peace and stability (web.worldbank.org).

The production function approach has produced evidence of a link between education and agriculture output. In the developing world's literature, increasing literacy and numeracy may help farmers to acquire and understand information and calculate appropriately inputs quantities in a modernizing or rapidly changing environment. Improved attitudes and beliefs may lead to a greater willingness to accept risk in adoption of innovations, save for investment and generally to embrace productive practices (Appletion &Balihuta 1996: Cotlear 1990).

One of the earliest researches conducted in Kenya by Beyer and Ascroft, (1970) on the adoption of technological innovation practices on small farms found that higher rates of adoption were positively associated with years spent in school and use of hired labour. Education may either increase prior access to external sources of information or enhance the ability to acquire information through experience with new technology. Schooling enables farmers to learn on the job more efficiently (Rosenzweig, 1995).

Nabhomba and Bahiigwa, (2003) have emphasized that the level of education of the household head is very important. The higher the number of years spent in school relates

very positively to the ability of the farmer to appreciate and take up agricultural innovations. *Although education is often the most valuable asset for the rural* people to pursue opportunities in new agricultural innovations, education levels in the rural areas tend to be dismally low worldwide. (World Bank, 2007)

Philip and Marble, (1986) note that educated farmers are able to interact more effectively with credit agencies, because they can understand financial transactions and keep records increasing the livelihood of obtaining credit. Benefit education may not only accrue to the person who has acquired the education but also to other members of that person's household or village. Other less educated farmers may copy the agricultural practice of their more educated *neighbor (Jamison & Lau 1982). General skills acquired in* school reduce technical and allocative inefficiencies in production and attitude acquired in school encourage the adoption of new technologies (Husain & Byerlee, 1995)

Education may help to determine whether a farmer decides to be an early adopter of innovative and the extent to which the new innovation will be used. This is because those with education tend to be more affluent and are in less danger of starvation if a prospective innovation is unsuccessful. Also educated farmers may be more likely to be contracted by agricultural extension workers looking for model farmers to test innovations. *Literate farmers are better able to acquire information* about potential innovation and to make rational evaluations of the risks involved in tying new inputs, crops or methods. (www.csae.ox.uk).

2.9 Conceptual Framework

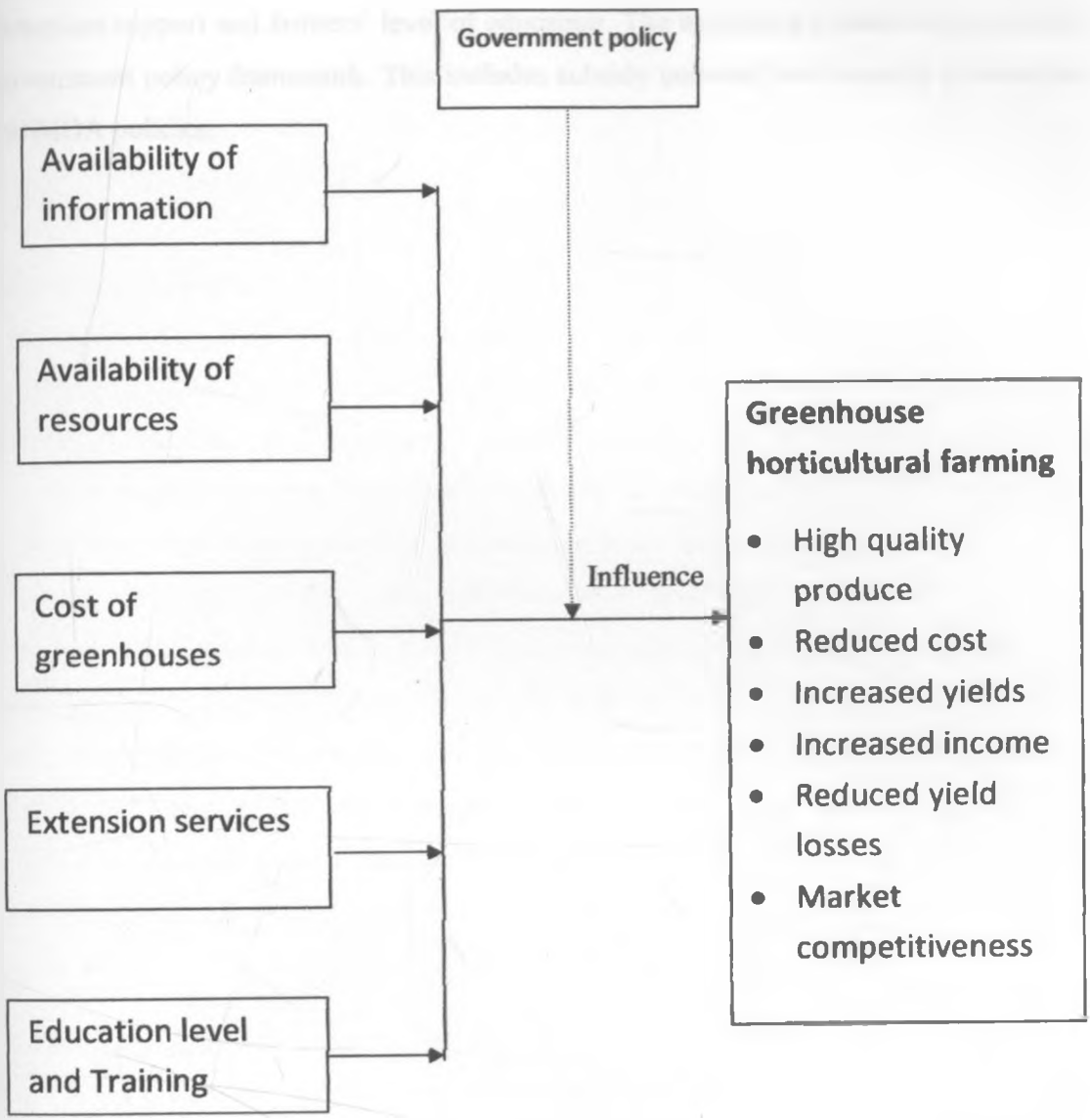

Figure 2:2 Conceptual Framework

A conceptual framework is a graphical representation of the effect of independent variables on the dependent variable. This study has concentrated on one dependent variable which is greenhouse horticultural farming and five independent variables. The independent variables are; information availability, availability of resources, cost, extension support and farmers' level of education. The mediating variable is the existing government policy framework. This includes subsidy policies, food security policies and the MOA policies.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research methodology that was used to collect data and explains how it was analyzed. The chapter contains the research design, target population, sampling techniques, data collection methods, reliability, validity of the data and procedure that will be used analyze data.

3.2 Research Design

The research design for this study was correlation research design. It was used in order to establish and describe the degree of relationships between the independent variables and dependent variables. The researcher sought to establish how the following independent variables: availability of information, availability of resources, cost, extension services, and farmers' level of education relate with greenhouse horticultural farming which is the dependent variable. The design was used because it would determine and report things as they are on the ground. This approach was appropriate to this study because the study involved fact finding and enquired on the relationship between the independent variables and the dependent variable (Nachmias & Nachmias 2008). The independent variables were controlled. Correlational research design will be used in combination with both qualitative and quantitative designs to generate both qualitative and quantitative data from the stated objectives.

3.3 Target Population

The target population in this study consisted of all households in Mirigamieru East Division in Imenti North District since the study is on adoption of greenhouse horticultural farming in the study area. There were a total of 16,475 households in the study area. Since it was not possible to interview all the farmers, the study focused on a few farmers who were selected from the total number of households through systematic sampling. Target population is illustrated in the table below.

Table 3.1 Target population

Locations	House holds	Area in Km2
Mulanthakari	2,546	9.7
Chugu	3884	22.5
Minithu	2440	15.6
Thuura	2760	33.2
Giaki	2185	45.9
Kiburine	1933	39.1
Nkabune	827	5.0
Total	**16475**	**171.0**

Source : County Statistical Officer – Meru

3.4 Sample size and sampling procedure

This section shall discuss the sample size and the sampling procedure.

3.4.1 Sampling procedure

This is a systematic process of selecting a number of individuals for a study to adequately represent the larger group from which they are selected (Chamdran, 2003). The sample size was drawn from the seven locations from the division being studied. The researcher sampled 3 locations, which made up 35% of the target population. Mugenda and Mugenda, (1999) recommends that a sample size of 30% is sufficient for a research study.

In this study, the researcher used probability sampling methods. Stratified random sampling and simple random sampling were used to select the locations and respondents to be involved in the study. The locations were stratified according to their altitudinal zones which were identified as Upper, Medium and Lower. Mulathankari was selected as an Upper zone, Munithu as the Medium and Nkabune as the Lower zone.

3.4.2 Sample size

The sample size for the study was based on the total population of the three selected locations. The sample size was determined using the sample determination formula which was developed by Israel, (1992).

It is given as:

$$n = \frac{N}{1+N(e)2}$$

Where

n = the desired sample size

N = population of the study (total number of households)

e = sampling tolerance error margin

According to Mutai, (2000) confidence level was taken to be 95% allowing for 0.05 error tolerance margin.

Thus, the sample size was calculated as follows:

$$n = \frac{5813}{1+5813*0.05*0.05}$$

$$n = \frac{5813}{15.5325}$$

n= 374

According to Mugenda and Mugenda, (2000) with a large sample, the researcher is confident that if another sample is taken of the same size, the finding from the two samples would be similar to a high degree. However, Singleton, (1993) argue that while a sample size of 2000 to 3000 is considered the extreme of upper limit, extreme lower limit is generally 30 cases for statistical analysis. He continues to add that most social research would recommend at least 100. It is on this basis, coupled with financial and time constraints, that the researcher reduced sample size by half to 187 households. This

sample is still going to be representative of the population in giving the desired characteristics since it cuts across all the area of study.

3.5 Data collection methods

To obtain the required data from the field the researcher used the following instruments

3.5.1 Questionnaires

Questionnaires were used because of their simplicity to the respondents who were literate. It also guided the researcher when interviewing farmers who were illiterate.

The questions were both closed and open-ended. The area under investigation using the questionnaire included general information of each farmer, level of education, annual income, number of household members, landholding, crop planted, possible causes of non-adoption, sources accessibility of information, and farmers' attributes that may influence the farmers to adopt greenhouse farming.

The questionnaires were divided into four sections. Each section had a number of closed and open-ended questions depending on the number of indicators to be sought. The closed-ended provided data that would be easily analyzed to describe qualitative information. The open-ended questions were used to generate grouped data to enable further exploration of the indicators in question.

3.5.2. Interview Schedule

This interview schedule was preferred for the farmers who were literate, instead of filing the questionnaire on their own. The questionnaires were very important due to their flexibility in allowing for the interpretation of the meaning of the questions, developing rapport with respondents, and allowing face to face contact between the interviewee and interviewer. The questionnaire was divided into the following sections; general information, socio-economic status of the farmers, source of information, and the general information available to the farmers.

3.6 Reliability of the instruments

According to Mugenda and Mugenda, (1999) reliability is a measure of degree to which a research instrument yields consistence results or data after repeated trials. In this study,

reliability was ensured by preparing the instruments in such a way that they could be split into two. After administration during pilot testing, the responses were scored. The two parts of the instrument were treated as two instruments. The scores of the two parts were then mathematically correlated through the use of the Spearman's Coefficient Correlation. A correlation coefficient which is found to lie between 0.5 and 1.00 means that the instrument is reliable. The research instruments yielded a reliability coefficient of 0.812 hence the instruments were deemed reliable.

3.6 Validity

According to Gakuu and Kidombo, (2010) validity refers to the appropriateness, meaningfulness and usefulness of the inferences a researcher makes. Validity is therefore, about drawing warranted conclusions on a situation based on data obtained from an assessment. An instrument is valid if the research design fully addresses the research questions and objectives the researcher has set.

The entire research instruments were based on the objectives of the study to ensure that they were all relevant. To ensure validity, the researcher used expert judgment of the supervisors in combination with pilot testing the instrument in which questions with problems or which gave unexpected answers were modified to avoid misinterpretation of questions. The final questionnaires were then developed.

.3.8 Data collection procedures

187 questionnaires were thereafter administered to selected respondents, in a six day interview program organized between the researcher and her assistants. They were administered by reading them and filling in responses in the spaces provided in the questionnaires. The filled in questionnaires were later collected for data inputting and analysis.

3.9 Data Analysis Techniques

Questions in the collected questionnaires were first coded which involved transforming data categories into symbols that may be tabulated and counted (Kothari, 2004). The

coded data was then entered into Statistical Package for Social Sciences (SPSS) and computed ready for analysis. Descriptive statistics like percentages, frequencies, mean and mode were generated. The results of the findings are represented in form of tables and are used to make conclusions and recommendation. To analyze the relationships between the variables, Regression Coefficient Correlation and Pearson's Product Moment Coefficient Correlation were used.

3.10 OPERATIONALIZATION OF VARIABLES

	Objectives	Type of variables	Indicators	Measuring of indicators	Data collection tools	Level of Scale	Tools of Analysis	Type of Analysis
1	To assess how availability of information influences adoption of greenhouse horticultural farming in the area of study.	Independent Dependent	• Innovation • Sources • Extension officers • Seminars • workshops	• Rate of adoption • Number of extension officers • Number of seminars and workshops	• Questionnaire • Interviews • Field visit	Nominal Ordinal	Parametric Non-parametric	Descriptive
2	To determine how availability of resources influences adoption of greenhouse horticultural farming in the study area.	Independent Dependent	• Level of income • Land • Credit • Water	• Rate of adoption • Land size • Willingness to take loans • Number of loans • Water availability	• Questionnaire • Interviews • Document analysis • Field visit	Nominal Ordinal Ratio	Parametric Non-parametric	Descriptive
3	To establish how cost influences adoption of greenhouse horticultural farming in the area of study.	Independent Dependent	• Price	• Rate of adoption • Awareness of cost • Ability to afford	• Interviews • Field visits	Nominal Ratio Ordinal	Parametric Non-parametric	Descriptive

4.	To investigate how extension support influence adoption of greenhouse horticultural farming in the study area.	Independent Dependent	• Extension agents • Extension visits • Demonstrations • Farmer training	• Number of extension visits • Number of demonstrations • Number of training	• Questionnaire • Interviews	Nominal Ordinal	Parametric Non-parametric	Descriptive
5	To assess how level of education influences adoption of greenhouse horticultural farming in the area of study.	Independent Dependent	• Level of education • Training	• Number of years spent in school • Number of trainings	• Secondary data • Interviews • Questionnaire	Nominal Ratio	Parametric Non-parametric	Descriptive

Table 3.3: Operationalization of variables

Operarationalization of variables involves preparation of the research questions from the objectives, identifying the appropriate indicators, and types and levels of measurement of the indicators.

3.11 Summary

The chapter has discussed correlation research design that was used in the research which was used to collect both *qualitative and quantitative data*. *The target population* has also been discussed which has led to attainment of the sample size. Sampling procedure on how the sample size was arrived at has been analyzed. The research instruments that were used and the validity and reliability of the instruments have also been analyzed. Finally, data collection procedure and analysis methods have also been discussed. The chapter concludes with the operationalization table which gives the research objectives and the type of variables, their indicators, means of measuring them, data collection methods, level of scale, type of analysis and the level of analysis.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter focuses on the questionnaire return rate, demographic information of the respondents, presentations, interpretation and discussions of findings. The presentations were done based on the research questions. Items addressing the same research question were grouped and discussed together. Tables were used to present data while frequencies (f) and percentages (%) were used to discuss the findings.

4.2 Questionnaire return rate

Completion rate is the proportion of the sample that participated as intended in all the research procedures. Out of the 187 questionnaires administered to the farmers, 185 (98.8%) were returned. This questionnaire return rate was deemed adequate for data analysis since it was above 80%.

4.3 Demographic characteristics of Respondents

This section involves presenting the findings of demographic factors which are likely to influence adoption of greenhouse farming in Mirigamieru Division Imenti North District. It includes the general characteristics of the farmer as gender, age, family size and education level among other variables. The findings are presented in form of frequency distribution tables and percentages followed by interpretations. The demographic data of the respondents focused on their gender, age and farmer level of education and training . These demographic data are presented in the following section.

4.3.1 Gender of the respondents

The study sought to establish gender distribution of the household heads and whether it influenced adoption of greenhouse farming. The gender distribution of the household heads is presented in Table 4.1.

Table 4.1 Gender and adoption distribution

Gender	F	%
Male	100	54.5
Female	85	45.5
Total	**185**	**100.0**

The study sought to establish the gender distribution of household heads. The information in Table 4.1 shows that the majority of household heads were male constituting 54.5% while the rest were females constituting 45.5%. The data shows that there was an almost parity in terms of gender of the respondents.

4.3.2 Age and adoption distribution

The researcher further sought to establish the age of the farmers. The results are presented in Table 4.2.

Table 4.2 Age and adoption distribution

Age	F	%
22-35	40	21.4
36-45	52	28.9
46-55	47	25.1
Above 56	46	24.6
Total	**185**	**100.0**

The study in Table 4.2 showed that the respondents were in the ages of 22 and above. Most of the respondents 28.9% were in the age bracket of 36 and 45 years while 25.1% were in the age bracket of 46 and 55. This constitutes the major working age and the self employed. 24.6% were above 56 years while 21.4% were between 22 and 35 years.

4.3.3 Education Level and adoption distribution

The study also sought to establish the level of education of the respondents. The finding is presented in Table 4.3.

Table 4.3 Distribution of respondents by level of education

Level of education	F	%
Never been to school	22	11.9
Primary education	119	64.3
Secondary education	39	21.1
College/university	5	2.7
Total	**185**	**100.0**

According to Table 4.3 majority of the farmers 64.3% had primary education, 11.9%' of farmers had never been to school, 21.1% of farmers had secondary education while only 2.7% of farmers had College/University education. This shows that literacy level is quite low and is likely to have an influence in the adoption rate of greenhouse farming. The data implies that most of the farmers had low level of education which may hinder innovativeness in adopting greenhouse farming. Education is a determinant issue in adoption of new ideas in many aspects of live. Those without education may be against new innovations which include greenhouse farming.

The study further sought to establish the number of the respondents who were practicing greenhouse horticultural farming. Their responses are presented in Table 4.4.

Table 4.4. Distribution of respondents practicing greenhouse horticultural farming

Statement	Yes		No	
	F	%	F	%
Farmers practicing greenhouse horticultural farming.	11	5.9	174	94.1

Table 4.4 indicated that only 11 farmers constituting 5.9% had adopted greenhouse horticultural farming. This is a negligible representation of the adopters hence the need to carry out this study on the prevailing factors that influence the adoption of greenhouse horticultural farming.

4.4 Influence of availability of information on adoption of greenhouse horticultural farming

The study sought to establish how availability of information had influenced the adoption of greenhouse horticultural farming. The respondents were therefore required to respond to several statements that sought to provide that information. Farmers were asked to indicate whether they had information about greenhouse farming. Their responses are presented in Table 4.5

Table 4.5 Distribution of respondents who had information about greenhouse horticultural farming

Statement	Yes		No	
	F	%	F	%
Farmers who had information about greenhouse horticultural farming	76	41.1	109	58.9

Findings in Table 4.5 show that majority of the farmers 58.9% lacked information about greenhouse farming while 41.1% of the farmers indicated that they had the information. The farmers who had information about greenhouse farming were asked to indicate where they got the information. Results are presented in Table 4.6.

Table 4.6 Source of information

Source of information	F	Percent
Friends	19	10.2
Neighbors	41	22.2
School/college	16	8.7
Not applicable	109	58.9
Total	**185**	**100.0**

Table 4.6 shows that 10.2% of the farmers got greenhouse farming information from friends, 22.2%) of farmers got it from neighbors, 8.7% of the farmers got it from school/college while 58.9% had not heard of greenhouse farming from any source. Findings show that majority of the farmers may have failed to adopt greenhouse farming because of lack of information.

The study further sought to establish whether the farmers had agricultural extension officers providing information of greenhouse farming.

Table 4.7 Responses on whether farmers failed to adopt greenhouse farming because of lack of information.

Statement	Yes		No		Not sure	
	F	%	F	%	F	%
Farmers with agricultural extension officers providing information of greenhouse farming.	26	14.1	159	85.9	-	-

Findings in Table 4.7 show that majority of the farmers 85.9% lacked agricultural extension officers providing information of greenhouse farming while 14.1% of the farmers had agricultural extension officers. The data implies that lack of extension officers providing information could be a hindrance to farmers not adopting agricultural innovations.

The researcher also sought to establish whether lack of information was a hindrance to greenhouse farming. The responses are presented in Table 4.8.

Table 4.8 Responses on whether farmers would adopt greenhouse farming if they had information about it.

Statement	Yes		No		Not sure	
	F	%	F	%	F	%
Farmers have agricultural extension officers providing information of greenhouse farming.	26	14.1	159	85.9	-	-
Farmers fail to adopt greenhouse farming because of lack of information.	132	71.4	53	28.6	-	-
Farmers would adopt greenhouse farming if they had information about it.	39	21.1	107	57.8	39	21.1

The study in Table 4.8 shows that majority of the farmers 57.8% indicated that if they had information about greenhouse farming, they would not adopt, 21.1% of the farmers said they would adopt it, while another 21.1% of the farmers were not sure whether they would adopt it. The researcher was also interested in establishing whether lack of information about greenhouse farming hinders farmers from practicing it. Farmers' opinions are presented in Table 4.9.

Table 4.9 Responses on whether lack of information was a hindrance to greenhouse farming

	F	Percent
Strongly agree	44	23.8
Agree	57	30.8
Disagree	26	14.1
Strongly disagree	27	14.6
Undecided	31	16.8
Total	**185**	**100.0**

Table 4.9 shows that 23.8% of the farmers strongly agreed that lack of information about greenhouse farming hinders farmers from practicing it while 14.6% of the farmers strongly disagreed with the statement.

The researcher sought to investigate whether attending seminars and workshops influenced adoption of greenhouse farming. The finding is presented in Table 4.10

Table 4.10 Responses on whether attending seminars and workshops influenced adoption of greenhouse farming.

Statement	Yes		No	
	F	%	F	%
Farmers have attended seminars or workshops on greenhouse farming.	26	14.1	159	85.9
Farmers are able to get information on greenhouse farming when you require it.	53	28.6	132	71.4

According to Table 4.10 majority of the farmers 85.9% had not attended seminars or workshops on greenhouse farming while only 14.1% of farmers had attended. The table also showed that majority of the farmers 71.4% said that they were not able to get information on greenhouse farming when they required it while 28.6% of the farmers were able to get the information. These findings indicated that lack of information was a hindrance to adoption of greenhouse farming.

The respondents were also asked to indicate how lack of information affected the farmers' attitude towards adoption of greenhouse farming. Farmers' responses are presented in Table 4.11

Table 4.11 Responses on how lack of information affects farmers' attitude towards adoption of greenhouse farming

Statement	for the Rich		for the educated		New technology		Needs training	
	F	%	F	%	F	%	F	%
Lack of information affect the farmers attitude towards adoption of greenhouse farming,	32	17.3	40	21.6	91	49.2	22	11.9

The findings on Table 4.11 indicated that most of the farmers 49.2% viewed greenhouse farming as a new type of farming, 21.6% as a preserve for the educated, 17.3% viewed it as a farming technology practiced by the rich while 11.9% of the farmers were of the opinion that they needed training on the new technology so that they could adopt the farming method.

Regression analysis was carried out to establish whether availability of information influenced the adoption of greenhouse horticultural farming by farmers. The information factor selected by the researcher in this aspect was "do you have information of greenhouse farming'. This was correlated with performance in mean scores. The findings are presented in Table 4.12

Table 4.12 Model summary for relationship between availability of information and adoption of greenhouse farming

	R	R squared	R adjusted	Std. Error of estimate	Change statistics	
Model 1					R Square Change	F statistic
	0.596	0.312	0.234	2.7432	0.312	10.217

Predictor (constant) 'Do you have information of greenhouse farming?'

The results in Table 4.12 indicate that, the correlation coefficient(R), as computed using the regression, was 0.596 showing that the predictor variable, represented by information factor ("do you have information of greenhouse farming'), contributes more than a half to the adoption of greenhouse horticultural farming. The R-Square shows that availability of information explained 31.2% of all the information about adoption of greenhouse farming. There is thus a strong positive relationship between access to information adoption of greenhouse horticultural farming. In other words, adoption of greenhouse agricultural farming may be explained by the prevailing access to information.

4.5 Influence of availability of resources on adoption of greenhouse farming

The study was also interested in establishing how availability of resources affected adoption of greenhouse farming. Several items were presented to the respondents to gauge h ow availability of resources influenced the adoption of greenhouse farming. This section presented that data. For example the farmers were asked to indicate their occupation. Their responses are tabulated in Table 4.13

Table 4.13 Distribution of respondents by occupation

Occupation	F	Percent
Farmer	120	64.9
Employed	65	35.1
Total	**185**	**100.0**

Table 4.13 shows that majority 64.9% were farmers while 35.1% of respondents were employed. The employed category was made up of farmers in civil service (8.5%), farmers employed by private organizations (11%) and majority of the farmers (15.6%) were working as casuals. The finding shows that majority of the respondents were small scale farmers while most of those employed were in low paying jobs.

Table 4.14 Distribution of respondents by monthly income

Amount	F	Percent
Less than 5000 Ksh	28	15.1
5001 - 10,000 ksh	36	19.5
10001 - 15,000 Ksh	43	23.2
15,001 20,000 ksh	51	27.6
Above 20,000 Ksh	27	14.6
Total	**185**	**100.0**

Table 4.14 shows that 15.1% of the farmers earned less than Ksh 5000, 19.5% of the farmers earned between ksh5001 – and 10,000, 23.2% of farmers earned between Ksh10001and 15,000 , 27.6% of farmers earned between ksh 15,001 and20,000 while 14.6% of farmers earned above 20,000 Ksh. These findings show that farmers were earning relatively low incomes rendering them incapable of investing in greenhouse farming which calls for high investments.

To establish whether the farmers' incomes were enough for their monthly spending, they were asked to indicate the same. Their responses are tabulated in Table 4.15.

Table 4.15 Distribution of respondents by adequacy of resources

Statement	Yes		No		Not s	
	F	%	F	%	F	
Income is enough for farmers monthly spending.	53	28.6	132	71.4	0	(
Farmers have surplus after their monthly spending.	52	28.1	133	71.9	0	(
The surplus adequate for involvement in greenhouse farming.	53	28.6	95	51.4	37	2
Farmers have water for greenhouse farming.	64	34.6	121	65.4	0	(
The source of water is reliable.	55	29.7	130	70.3	0	(

Findings in Table 4.15 show that majority of farmers (71.4%) said that their income was not enough for their monthly spending while only 28.6% of farmers said that their income was enough. Majority of the farmers (71.9%) said that they lacked surplus after monthly expenses while only 28.1% of farmers had surplus.

Majority of farmers (51.4%) said that the surplus was inadequate for involvement in greenhouse farming, 28.6% of farmers said it was adequate while 20.0% of farmers were not sure on the statement. These findings confirm previous findings that farmers were not in a position to invest in greenhouse farming.

The study also showed that majority of farmers (65.4%) lacked water for greenhouse farming while 34.6% of farmers had water. The study further investigated whether the source of water was reliable. Majority of farmers (70.3%) said that the source of water was not reliable while 29.7% of farmers said that the source of water was reliable.
Asked to indicate the size of their farms, they responded as indicated in Table 4.16.

Table 4.16 Distribution of farmers by farm size

Size	F	Percent
Less than an acre	87	47.0
1 - 2 acres	72	38.9
3 - 4 acres	20	10.8
Above 4 acres	6	3.3
Total	**185**	**100.0**

Table 4.16 shows that 47.0% of farmers had less than an acre, 38.9% of farmers had between 1 - 2 acres, 10.8% of farmers had 3 - 4 acres while only 3.3 % had above 4 acres of land. The data shows that almost half had less than an acre. This acreage may not be adequate for farmers to adopt greenhouse farming which would in some cases need a large area.

The respondents were also asked to respond to statements that sought how availability of resources was a hindrance to adoption of greenhouse farming. Their responses are presented in Table 4.17.

Table 4.17 Responses on how availability of selected resources affected adoption of greenhouse farming

Statement	Yes		No		Not sure	
	F	%	F	%	F	%
Farmers land is adequate for farming.	52	28.1	133	71.9		
Lack of land hinders farmers from practicing greenhouse farming.	40	21.6	73	39.5	72	38.9
Farmers have the required resources for practicing greenhouse farming.	26	14.1	159	85.9	0	00.0
Farmers feel the resources required for greenhouse farming are expensive.	144	77.8	41	22.2	0	00.0
Farmers would adopt greenhouse farming if they had resources.	136	73.5	49	26.5	0	00.0
Farmers are able to access credit facilities to adopt greenhouse farming.	71	38.4	114	61.6	0	00.0
Farmers would take up a loan to adopt greenhouse farming.	91	49.2	94	50.8	0	00.0
Lack of resources hinders farmers from practicing greenhouse farming.	104	56.2	81	43.8	0	00.0

According to Table 4.17 majority of farmers 71.9% said that their land was inadequate for farming while 28.1% of farmers said that their land was adequate. The table also shows that 38.9% farmers were not sure whether lack of land hinders farmers from practicing greenhouse farming, 39.5% of farmers said it did not hinder them while 21.6% of farmers said it hindered them. Majority 85.9% of farmers said that they lacked the required resources for practicing greenhouse farming while 14.1% of the farmers had the required resources. Majority 77.9% of farmers felt that the resources required for greenhouse farming were expensive while 22.12% of farmers said they were not expensive.

Majority of the farmers 73.5% said if they had the resources, they would adopt

greenhouse farming while 26.5% of farmers said they would not adopt it. The researcher further examined whether the farmers were able to access credit facilities to adopt greenhouse farming. Table presents the findings. Majority 61.6% of farmers were unable to access credit facilities to adopt greenhouse farming while 38.4% of farmers were able to access. Majority 50.8% of farmers said they would not take up a loan to adopt greenhouse farming while 49.2% of farmers said they would take. A further majority 56.2% agreed that lack of resources is a hindrance to farmers from practicing greenhouse farming while 43.8% of farmers disagreed with the statement.

To statistically analyze whether availability of resources influenced adoption of greenhouse farming, regression analysis was carried out. In doing this, the researcher selected the factors that she deemed very important among the factors in availability of resources which was "Do you have the required resources for practicing greenhouse farming?" and regressed with adoption of greenhouse horticultural farming. This aimed at comparing results from the independent variable availability of resources and adoption of greenhouse horticultural farming. The results are presented in Table 4.18

Table 4.18 Model summary for relationship between availability of resources and adoption of greenhouse farming

	R	R squared	R adjusted	Std. Error of estimate	Change statistics	
Model 1					R Square Change	F statistic
	0.521	0.381	0.231	2.59900	0.381	12.158

Predictor (constant) *Do you have the required resources for practicing greenhouse farming?*

The results in Table 4.18 indicate that, the correlation coefficient (R) is 0.521 as computed using linear regression, showing that the predictor variable, represented by

availability of resources (Do you have the required resources for practicing greenhouse farming?), contributes more than a half to the adoption of greenhouse horticultural farming. The R-Square shows that availability of resources explained 38.1% of all the resources about adoption of greenhouse farming. There is thus, a strong positive relationship between availability of resources and adoption of greenhouse horticultural farming.

4.6 Influence of cost on adoption of greenhouse horticultural farming

The study also sought to establish how cost influenced the adoption of greenhouse horticultural farming. The respondents were posed with questions that sought to establish the same. This information is presented in this section. The farmers were asked to rate the cost of buying the implements for greenhouse farming. Table 4.18 tabulates the findings.

Table 4.19 Responses on whether buying the implements for greenhouse farming was costly

Cost	F	Percent
Very expensive	117	63.2
Not expensive	32	17.3
I am not sure	36	19.5
Total	**185**	**100.0**

The study in Table 4.19 showed that majority of farmers 63.2% said that the cost of buying the implements for greenhouse farming was very expensive, 17.3% of farmers rated it as not expensive while 19.5% of farmers said they were not sure of the statement. Asked the extent to which they agreed that cost hindered farmers from adopting greenhouse farming, they responded as indicated in Table 4.20.

Table 4.20 Opinion on cost of practicing greenhouse farming

Responses	F	Percent
Strongly agree	93	50.3
Agree	74	40.0
Disagree	12	6.5
Strongly disagree	6	3.2
Total	**185**	**100.0**

Findings in Table 4.20 show that 50.3% of farmers strongly agreed that cost hinders farmers from practicing greenhouse farming while 3.2% of farmers strongly disagreed with the statement.

Asked whether if they had the necessary financial support, they would adopt greenhouse farming, majority 64.3% of farmers said that if they had the necessary financial support, they would adopt greenhouse farming while 35.7% of farmers said they would not adopt it. They were further posed with statements that sought to establish how cost influenced their adoption of greenhouse farming. The responses are presented in Table 4.21.

Table 4.21 Influence of cost on adoption of greenhouse farming

.Statement	Strongly Agree		Agree		Disagree		Strongly Disagree	
	F	%	F	%	F	%	F	%
The cost of greenhouse farming is high	41	22.2	110	95.5	14	7.6	20	10.8
Farmers in this area are low earners and hence unable to adopt greenhouse farming	48	25.9	75	40 5	46	24.9	15	8.6
Farmers need to take loans so as to adopt greenhouse farming	48	25.9	57	30.8	52	28.1	28	15.1

Results as tabulated in Table 4.21 indicated that majority 59.5% of farmers agreed that the cost of greenhouse farming is high while 10.8% of farmers strongly disagreed with the statement. It was also revealed that 40.5% of farmers agreed that farmers in their area

were low earners and hence unable to adopt greenhouse farming while 24.9% of farmers disagreed with the statement. The findings also revealed that 30.8% of farmers agreed that farmers need to take loans so as to adopt greenhouse farming while 28.1% of farmers disagreed with the statement. The results showed that several cost related factors influenced farmers' adoption of greenhouse farming.

To analyze whether cost influenced adoption of greenhouse horticultural farming, regression analysis was carried out. In doing this, the researcher selected variables on cost which in this case was "Does cost hinder farmers from adopting greenhouse farming?' and regressed it with adoption of greenhouse farming. This finding was necessary to compare results from the independent variable cost and those from the exogenous variables so as to determine whether the variable had a greater influence on adoption of greenhouse farming. The results are presented in Table 4.22.

Table 4.22 Model summary for relationship between cost and adoption of greenhouse farming

	R	R squared	R adjusted	**Std. Error of estimate**	**Change statistics**	
Model 1					**R Square Change**	**F statistic**
	0.615	0.328	0.241	2.6770	0.328	11.168

Predictor (constant) *Does cost hinder farmers from adopting greenhouse farming*

The results in Table 4.22 indicate that the correlation coefficient (R) is 0.615 as computed using linear regression. This shows that the predictor variable, represented by cost (does cost hinder farmers from adopting greenhouse farming?), contributes more than a half to adoption of greenhouse horticultural farming. R-Square shows that cost explained 32.8% of cost about greenhouse farming. There is thus, a strong positive relationship between

cost and adoption of greenhouse farming. In other words, adoption of greenhouse farming may be explained by the cost that goes with that.

4.7 Influence of extension support on adoption of greenhouse horticultural farming

The researcher was also interested in establishing the influence of the extension support on adoption of greenhouse horticultural farming. They were, therefore, asked to indicate whether there were extension support services in their area. Data showed that 43.8% of farmers lacked extension support. This shows that majority of the farmers did not have extension services which implied that farmers could not have the necessary expertise to advice them on greenhouse farming which could have hindered its adoption. The study further sought to investigate the frequency at which farmers met the extension officers. Table 4.23 tabulates the findings.

Table 4.23 Responses to whether farmers met the extension service

Frequency	F	Percent
Often	1	0.5
Rarely	103	55.7
Never	81	43.8
Total	**185**	**100.0**

Table 4.23 shows that majority 55.7% of farmers rarely met the extension officers, 43.8% of farmers never met them while only a significant number 0.5% of farmers often met them. The study further sought to investigate the extent to which the officer supported the farmers in provision of information. The findings indicated that apart from not having extension officers, farmers themselves rarely met them which would imply that there were no such supports. Among those that indicated that they met them, they were asked the extent to which the services were helpful to the farmers. The finding is presented in Table 4.24.

Table 4.24 Extent of importance of the extension support services

Extent	F	Percent
Very great extent	2	1.1
Great extent	10	5.4
Less extent	30	16.2
No extent	22	11.9
Not applicable	121	65.4
Total	**185**	**100.0**

Table 4.24 shows that 5.4% of farmers said that the extension officers supported the farmers in provision of information at a great extent while 6.2% of farmers said they supported them to a less extent. The farmers were also asked to indicate whether they waited, visited or requested for the extension support services. The farmers' responses are presented in table 4.25.

Table 4.25 Response to whether the farmers waited, visited or requested for extension services

	F	Percent
Wait	82	44.3
Visit	83	44.9
Request	20	10.8
Total	**185**	**100.0**

The study in Table 4.25 shows that 44.3% of farmers waited for the extension officers for support, 44.9% of farmers visited them while 10.8% of farmers requested for the support of the officers. These findings show that only a few visited the extension officers which implies that the services could not be as helpful to farmers as when the provision of such services were available.

The researcher was also interested in knowing the extent to which the extension support had affected adoption of greenhouse farming. Table 4.26 presents the findings.

Table 4.26 Response to whether extension support affected adoption of greenhouse farming

Extent	F	Percent
Very great extent	7	3.8
Great extent	24	13.0
Less extent	51	27.6
No extent	103	55.7
Total	**185**	**100.0**

The study in Table 4.26 shows that 13.0% of farmers said that extension support had affected adoption of greenhouse farming to a great extent while 55.7% of farmers said that it did not affect adoption of greenhouse farming. Majority of farmers 54.1% had no extension officers educating farmers on modern methods of farming while 45.9% of farmers had them. The respondents were also asked to indicate the extent to which they agreed or disagreed with the statement that lack of extension support had made them not to adopt the greenhouse farming. In this item, 9.7% of the farmers strongly agreed that lack of extension support has made farmers not to practice greenhouse farming while 10.3% of farmers disagreed with the statement. However, majority of the farmers 59.5% said that extension workers were ready to support farmers to adopt greenhouse farming while 40.5% of farmers said they were not ready.

To analyze whether extension support influenced the adoption of greenhouse horticultural farming, Pearson's Product Moment Correlation Coefficient was used to analyze the relationship between extension support and adoption of greenhouse farming. This is presented in Table 4.27.

Table 4.27 Correlations for extension service and adoption of greenhouse farming

		Mean scores	Age
Pearson	Age	1.000	0.362
Correlation		0.362	1.000
Sig (2-tailed)	Mean score	1.000	
	N	**100**	**100**

Table 4.27 indicates the Pearson's Product Moment Correlation Coefficient results for the relationship between extension services and adoption of greenhouse farming. From the analysis, it is clear that extension services weakly but positively with a correlation coefficient of 0.362 influenced adoption of greenhouse farming. This implies that for every unit change in the level of farmers' education and training, adoption rate of greenhouse farming changed by 36.2%.

4.8 Influence of level of education and training on adoption of greenhouse farming

The researcher was further interested in establishing the influence of education and training in the adoption of greenhouse farming. They were, for example, asked to indicate whether they had any background training in agriculture. The finding shows that 50.8% of farmers lacked background training in agriculture while 49.2% of farmers had background training in agriculture. This implies that majority of them lacked such background training which may affect their adoption of greenhouse farming. They were also asked whether the level of education of the famers affected the adoption of greenhouse farming? The responses are tabulated in Table 4.28.

Table 4.28 Responses to whether lack of education affected adoption of greenhouse farming

Extent	F	Percent
Very great extent	127	68.6
Great extent	33	17.8
Less extent	22	11.9
No extent	3	1.6
Total	**185**	**100.0**

As indicated in table 4.28, majority of the farmers 68.6% said that the level of education affected adoption of greenhouse farming to great extent while 11.9% of farmers said it affected at less extent. To establish whether inadequate education has led farmers not to practice greenhouse farming, the farmers were asked to respond to several items that sought to establish the same. Table 4.29 presents the findings.

Table 4.29 Responses to whether education affected adoption of greenhouse farming

Statement	Strongly Agree		Agree		Disagree		Strongly Disagree	
	F	%	F	%	F	%	F	%
Inadequate education has led farmers not to practice greenhouse farming	74	40.0	51	27.6	36	19.5	24	13.0
People in this area need to be more educated to adopt greenhouse farming	90	48.6	56	30.3	39	21.1	0	00.0
Adopting greenhouse farming requires high level of education	94	50.8	41	22.2	38	20.5	12	6.5

Findings in Table 4.29 show that 40.0% of farmers strongly agreed that inadequate education has led farmers not to practice greenhouse farming while 19.5% of farmers disagreed with the statement. Findings further indicated that 48.6% of farmers strongly agreed that people in the area need to be more educated to adopt greenhouse farming while 21.1% of farmers disagreed with the statement. The study further sought to investigate whether adopting greenhouse farming requires high level of education. The table also indicates that majority 50.8% of farmers strongly agreed that adopting greenhouse farming requires high level of education while 20.5% of farmers disagreed with the statement. They were asked how the level of education affected adoption of greenhouse farming; the respondents were of the opinion that farmers needed to be trained in modern methods of farming such as greenhouse horticultural farming.

Regression analysis was carried out to establish whether adoption of greenhouse farming was influenced by level of education. The remuneration factor selected by the research in

this aspect was "farmers' level of education and training". This was correlated with adoption of greenhouse farming. The findings are presented in Table 4.30

Table 4.30 Model summary for relationship between level of education and training and adoption of greenhouse horticultural farming

	R	R squared	R adjusted	Std. Error of estimate	Change statistics	
Model 1					**R Square Change**	**F statistic**
	0.623	0.343	0.234	2.7432	0.312	10.217

Predictor (constant) Level of education

The results in Table 4.30 indicate a correlation coefficient (R) of 0.521 as computed using linear regression. This shows that the predictor variable, represented by remuneration factor (level of education and training), contributes more than a half to adoption of greenhouse horticultural farming.

The R-Square implied that farmers' level of education and training explained 34.5% about adoption of greenhouse farming. There is thus, a strong positive relationship between farmers' education level related factors and school performance in secondary school.

4.9 Summary of the relationships between variables investigated

Table 4.31 Summary of the relationships between the variables investigated and adoption of greenhouse farming

Predictors	Percentage of influence
Information availability	31.2
Resources availability	38.1
Cost	32.8
Extension services	36.2
Farmers' education level and training	34.3

4.10 Summary of the chapter

The analysis from the study shows that adoption of greenhouse horticultural farming in Mirigamieru East division was being positively and significantly influenced by availability of information, availability of resources, cost, extension services and farmers' education level and training albeit in different percentages.

CHAPTER FIVE

SUMMARYOF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the study, discusses the findings of the study and presents conclusions, recommendations and suggestions for further research.

5.2 Summary of findings

Objective	Type of analysis	Main findings
To assess how availability of information influences adoption of greenhouse horticultural farming in Mirigamieru East Division.	Descriptive Linear Regression	Availability of information with a correlation coefficient of 0.596 positively and significantly influenced adoption of greenhouse horticultural farming in the division
To determine how availability of resources influences adoption of greenhouse horticultural farming in Mirigamieru East Division.	Descriptive Linear Regression	Availability of resources with a correlation coefficient of 0.596 positively and significantly influenced adoption of greenhouse horticultural farming in the division
To establish how cost influences adoption of greenhouse horticultural farming in Mirigamieru East Division.	Descriptive Linear Regression	Cost positively and significantly influenced adoption of greenhouse horticultural farming in the division with a correlation coefficient of 0.615

To investigate how extension support influences adoption of greenhouse horticultural farming in Mirigamieru East Division.	Pearson's Product Moment Coefficient Correlation	Extension support positively influenced adoption of greenhouse horticultural farming in the division with a correlation coefficient of 0.362
To investigate how farmers' level of education and training influences adoption of greenhouse horticultural farming in Mirigamieru East Division	Descriptive Linear Regression	Farmers' level of education and training significantly influenced adoption of greenhouse horticultural farming with a regression coefficient of 0.523.

5.3 Discussions of the Findings

This section contains discussions of the findings obtained during the research. Linear regression analysis and Pearson's Product Moment Coefficient Correlation were used to determine the relationships between independent and dependent variables. Descriptive analysis was done to capture demographic characteristics of the respondents, availability of information, availability of resources, cost, extension support and farmers' level of education and training.

5.3.1. Demographic characteristics of the respondents

Demographic characteristics of the respondents was sought to assess if their backgrounds affected adoption of greenhouse horticultural farming in any way. It was found that 54.5% were male while 45.5% were female. This showed an almost gender parity which implied that the responses were not gender biased. The finding also indicated that the majority of the respondents 28.9% were middle aged (between 36 to 45 years) these are the people with families and financial responsibilities. 24.6% were found to be above 56 years who in most cases were dependants.

5.3.2. Influence of availability of information on adoption of greenhouse horticultural farming.

Findings on the influence of availability of information on adoption of greenhouse horticultural farming revealed that majority of the farmers 58.9% lacked information about greenhouse farming and only 41.1% had the information. Lack of information could have led to the high level of non-adoption of greenhouse horticultural farming. This is in line with Beets, (1990) statement that appropriate technologies are often not available to farmers. Majority of the farmers 85.9% lacked agricultural extension officers providing information of greenhouse farming and only 14.1% had access to them. 85.9% of farmers had not attended seminars or workshops on greenhouse farming while only 14.1% had attended. Lack of exposure to information increases subjective uncertainty and therefore, reduces likelihood of adoption of new technologies. The predictor generated a correlation coefficient (R) of 0.596 implying a strong positive relationship between availability of information and adoption of greenhouse horticultural farming. This is supported by Asiabaka *et.al.,* (2001)who suggest that for farmers to adopt a new agricultural technology, they must be aware of the technology, have valid and up to date information the technology and receive the technical resistance necessary to adopt the technology.

5.3.3. Influence of availability of resources on adoption of greenhouse horticultural farming

Findings on the influence of availability of resources on adoption of greenhouse farming revealed that majority 64.9% of the respondents in the area are small scale farmers. Thus, they are not in a position to earn a lot of money where they can spend the surplus on greenhouse farming. Majority of the farmers 42.7% were earning relatively low incomes (below 10,000ksh) rendering them incapable of investing in greenhouse farming which calls for high investments. 71.9% of farmers lacked surplus after monthly expenses. 61.1% of farmers could not access credit and only 38.4% had the access. This implied that majority of farmers were unable to access credit facilities to adopt greenhouse farming. The World Development Report, (2008) states that lack of credit translates into inadequate working capital and farmer inability to purchase productivity enhancing inputs. The findings also indicate that majority of the respondents 85.9% had below 2

acres of land and only 14.1% had above 2 acres. This acreage may not be adequate for farmers to adopt greenhouse farming as well as allow for their subsistence farming. This is in line with Ingle &Wayazade, (1989) finding that size of land holding and annual income are positively and significantly associated to the extent of adoption of new technologies. Results also indicate that majority of farmers 70.3% lacked reliable water source while 29.7% had a reliable source. This is confirmed by the Ministry of Planning and National Development's Report, (2008) that water is already under stress at the current population levels. The predictor generated a correlation coefficient (R) of 0.521 implying a strong positive relationship between availability of resources and adoption of greenhouse horticultural farming. The findings are supported by Shrivastava and Singh, (1990) who argue that the major constraint to farmers' adoption of new farming technologies is lack of facilities, equipment and resources.

5.3.4 Influence of cost on adoption of greenhouse horticultural farming

Findings on the effects of cost on adoption of greenhouse horticultural farming revealed that majority of farmers 63.2% said that buying the implements for greenhouse farming was very expensive while 17.3% farmers said it was not expensive and19.5% of farmers were not sure. It was also found that 56.7% of farmers agreed that if farmers could access loan, they could adopt greenhouse farming with 43.3% disagreeing with the statement. This implies that greenhouse implements were viewed to be very expensive which could nave hindered farmers from practicing greenhouse farming. The findings, as computed using correlation coefficient (R) was 0.615 showing a strong positive relationship between cost and adoption of greenhouse farming. In other words, adoption of greenhouse farming may be explained by the cost that goes with it. This is confirmed by Meti and Hanchinal, (1995) who reported that expensive farming technologies and lack of finance by the farmers account for non-adoption of new farming technologies.

5.3.5 Influence of extension support on adoption of greenhouse horticultural farming

Findings on the influence of extension support on adoption of greenhouse horticultural farming revealed that 55.7% of farmers rarely met extension officers and 43.8% never met them. Only an insignificant number 0.5% of farmers often met them. Majority of the

farmers 54.1% had never attended seminars and workshops organized by extension officers. This implied that farmers did not have the necessary expertise to advise them on greenhouse farming which could have hindered its adoption. This is strongly supported by Beets, (1990) who stated that agricultural technologies can largely be disseminated through good agricultural extension service which is sadly missing in most countries. An analysis on whether extension support influences adoption of greenhouse horticultural farming, using Pearson's Product Moment Correlation Coefficient (R) was 0.362 showing that extension services positively influenced the adoption of greenhouse farming in Mirigamieru East division. The results concur with a study carried by Kebede, (1988) in Ethiopia on the factors that influence the use of recommended farm practices in Nazarth area which found that agricultural agents' visits, attendance at field demonstrations showed a very weak positive association with adoption of maize technology.

5.3.3 Influence of farmers' level of education and training on adoption of greenhouse horticultural farming

Findings on the influence of farmers' level of education and training on adoption of greenhouse farming revealed that majority of the respondents 64.3% had attained primary education, 21.1% had secondary education while only 2.6% had College or University education and 11.9% had never been to school. The results revealed that literacy level is quite low and is likely to have an influence in the adoption of greenhouse farming. The results are supported by Nabhomba &Bahiigwa,(2003) who found that the level of education of the household head is very important. They argue that high number of years spent in school influences very positively the ability of the farmer to appreciate and take up agricultural innovations. Majority of the farmers 68.6% said that the level of education affected adoption of greenhouse farming to a very great extent. It was also revealed that 40.0% of farmers strongly agreed that inadequate education has led farmers not to practice greenhouse farming while 48.6% of farmers strongly agreed that people in the area need to be more educated to adopt greenhouse farming. Majority 50.8% of farmers strongly agreed that adopting greenhouse farming requires high level of education. The findings also revealed that 50.8% of farmers lacked background training in agriculture while 49.2% had background training. Majority of farmers 54.1% revealed that extension

officers did not educate farmers on modern methods of farming while 45.9% said extension officers educated farmers. Findings. as computed using regression coefficient (R) was 0.623, or 62.3% showing that the predictor variable, represented by level of education and training contributes more than a half to adoption of greenhouse horticultural farming. Thus, there is a very strong positive association between farmers' level of education and training and adoption of greenhouse farming. The results are supported by Adesina & Baidu-Forson, 1995) in their finding that the higher number of times a farmer participates in training activities the perceptions are influenced towards adoption of new farming technologies.

5.4 Conclusions

Based on the study, a number of conclusions can be drawn. There was a strong positive relationship between availability of information and adoption of greenhouse horticultural farming. Availability of resources, cost and farmers' level of education and training had positive significance in adoption of greenhouse horticultural farming albeit in varying degrees. However, extension support had a weak positive significance in adoption of greenhouse horticultural farming because it was not readily accessible to farmers in the area of study.

5.5 Recommendations

1. There is need to provide the necessary information to the farmers about greenhouse farming. The Ministry of Agriculture, through extension officers should conduct seminars and workshops to enhance farmers' understanding of greenhouse farming.
2. The government, should, through the Constituency Development Fund and other Monetary Institutions make credit facilities and grants available to farmers in order for them to adopt greenhouse horticultural farming.
3. The government should waive tax on greenhouse equipment in order to lower installation and running costs so that more and more farmers are able to access the facilities

5.6 Suggestions for further research

Taking the limitations and delimitations of the study the following were suggested for further study:

1. An examination of the impact of farmers' attitude on adoption of greenhouse horticultural farming.
2. Impact of weather pattern prediction on farmers' adoption of modern farming methods
3. Impact of traditional methods of farming on adoption of modern methods.

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APPENDICES

Appendix i: LETTER OF TRANSMITTAL

IMENTI NORTH DISTRICT

MERU COUNTY

Dear Sir/ Madam,

REF: LETTER OF TRANSMITTAL

I am a student at the University Of Nairobi Department Of Extra Mural Student. I am currently undertaking a Masters of Arts Degree in project Planning and Management

My research focuses on greenhouse horticultural farming in Imenti North District. I am particularly assessing the factors influencing adoption of greenhouse horticultural farming in Mirigamieru East Division.

I am humbly requesting for your assistance in getting data to be used in the research. I promise that information that will be provided will be treated very confidentially and will only be used for the purpose of this study.

Please assist and thank you in advance.

Yours faithfully,

Mururna Lucy Wambui.

Appendix 2 QUESTIONNAIRE FOR FARMERS

This questionnaire seeks to investigate the factors influencing adoption of greenhouse horticultural farming in Mirigamieru East Division. Information that will be given will be accorded total confidentiality and will be used only for the purpose of this study. Please complete every item as honestly as possible. Tick in the box next to the right response and list down your comments in the spaces provided accordingly. Your may not write your name in the questionnaire to ensure confidentiality.

Section A: Demographic data

1. What is your gender? Male [ ] Female [ ]

2. What is your age

   Below 22 years [ ]

   22-35 [ ]

   36-45 [ ]

   46-55 [ ]

   Above 56 [ ]

3. What is your level of education?

   Never been to school [ ]

   Primary education [ ]

   Secondary education [ ]

   College/university [ ]

4. Are you practicing greenhouse horticultural farming?

   Yes [ ] No [ ]

Section B: Influence of availability of information on adoption of greenhouse horticultural farming

5. Do you have information about greenhouse farming?

   Yes [ ] No [ ]

6. If yes where did you get the information from?

   Friends [ ] Neighbors [ ]

   School/college [ ] Not applicable [ ]

7. Do you have agricultural extension officers providing information of greenhouse farming?

   Yes [ ] No [ ]

8. Do farmers fail to adopt greenhouse farming because of lack of information?

   Yes [ ] No [ ]

9. If you had the information about greenhouse farming, would you adopt it?

   Yes [ ] No [ ]

10. Lack of information about greenhouse farming hinders the farmers from practicing it.

    Strongly agree [ ] Agree [ ]

    Disagree [ ] Strongly disagree [ ]

11. Have you attended seminars of workshops on greenhouse farming?

    Yes [ ] No [ ]

12. Are you able to get information on green house farming when you require it?

    Yes [ ] No [ ]

13. How does lack of information affect farmers' attitude towards adoption of greenhouse farming?

    _____

    _____

    _____

Section C: Influence of availability of resources on adoption of greenhouse farming

14. What is your occupation?

Farmer [ ]

Employed [ ]

15. What is your income per month?

Less than 5000 Ksh [ ] 5001 – 10,000 ksh [ ]

10001 – 15,000 Ksh [ ] 15,001 20,000 [ ]

Above 20,000 Ksh [ ]

16. Is your income enough for your monthly spending?

Yes [ ] No [ ]

17. Do you have surplus after monthly expenses?

Yes [ ] No [ ]

18. Is the surplus adequate for involvement in greenhouse farming?

Yes [ ] No [ ]

19 Do you have water for greenhouse farming?

Yes [ ] No [ ]

19. If yes, is the source of water reliable?

Yes [ ] No [ ]

20. What is the size of your farm?

Less than an acre [ ] 1 – 2 acres [ ] 3 – 4 acres [ ] Above 4acres [ ]

21. Is the land that you have adequate for your farming?

Yes [ ] No [ ]

22. Does lack of land hinder you from practicing greenhouse farming?

Yes [ ] No [ ]

23. Do you have the required resources for practicing greenhouse farming?

Yes [ ] No [ ]

24. Do you feel the resources required for greenhouse farming are expensive?

Yes [ ] No [ ]

25. If you had the resources, would you adopt greenhouse farming?

Yes [ ] No [ ]

26. Are you able to access credit facilities to adopt greenhouse farming?

Yes [ ] No [ ]

27. Would you take up a loan to adopt greenhouse farming?

Yes [ ] No [ ]

28. Does lack of resources hinder farmers from practicing greenhouse farming?

Yes [ ] No [ ]

29. In what ways does availability of resources affect adoption of greenhouse farming?

_____

_____

_____

_____

Section D: Influence of cost on adoption of greenhouse horticultural farming

30. How do you rate the cost of buying the implements for greenhouse farming?

Very expensive [ ] Not expensive [ ] I am not sure [ ]

31. Cost hinders farmers from practicing greenhouse farming.

Strongly agree [ ] Agree [ ]

Disagree [ ] Strongly disagree [ ]

32. If you had the necessary financial support, would you adopt greenhouse farming?

Yes [ ] No [ ]

33. The cost for greenhouse farming is high

Strongly agree [ ] Agree [ ]

Disagree [ ] Strongly disagree [ ]

34. Farmers in this area are low income earners and hence unable to adopt greenhouse farming

Strongly agree [ ] Agree [ ]

Disagree [ ] Strongly disagree [ ]

35. Farmers need to take loans so as to adopt greenhouse farming

Strongly agree [ ] Agree [ ]

Disagree [ ] Strongly disagree [ ]

36. How does cost affect adoption of greenhouse farming?

_____

_____

_____

Section E: Influence of extension support on adoption of greenhouse horticultural farming

37. Do you have the extension support services in your area?

Yes [ ] No [ ]

38. How often do you meet the extension officers?

Very often [ ] Often [ ] rarely [ ] never [ ]

39. To what extent do extension officers support farmers in provision of information?

Very great extent [ ] Great extent [ ]

Less extent [ ] No extent [ ]

40. Do you wait, visit or request the extension officers for support?

Wait [ ] Visit [ ] request [ ]

41. To what extent does extension support affect adoption of greenhouse farming?

Very great extent [ ] Great extent [ ]

Less extent [ ] No extent [ ]

42. Do you have extension officers educating farmers on modern methods of farming?

Yes [ ] No [ ]

43. Lack of extension support has made farmers not to practice greenhouse farming

Strongly agree [ ] Agree [ ]

Disagree [ ] strongly disagree [ ]

44. Are extension workers ready to support farmers to adopt greenhouse farming?

Yes [ ] No [ ]

45. What could be done to improve extension services?

_____

_____

_____

46. How does extension support affect adoption of greenhouse farming?

_____

_____

_____

Section F: Influence of farmers' level of education and training on adoption of greenhouse farming

47. What is you level of education?

Never been to school [ ] Primary education [ ]

Secondary education [ ] College/University [ ]

48. Have you had background training in agriculture?

Yes [ ] No [ ]

49. To what extent has level of education affected adoption of greenhouse farming?

Very great extent [ ] Great extent [ ]

Less extent [ ] No extent [ ]

50. Inadequate education has led farmers not to practice greenhouse farming

Strongly agree [ ] Agree [ ]

Disagree [ ] strongly disagree [ ]

51. People in this area need to be more educated in order to adopt greenhouse farming

Strongly agree [ ] Agree [ ]

Disagree [ ] strongly disagree [ ]

52. Adopting greenhouse farming requires high level of education

Strongly agree [ ] Agree [ ]

Disagree [ ] strongly disagree [ ]

53. How does level of education affect adoption of greenhouse farming?

_____

_____

_____

54. What do you think could be done to make farmers adopt greenhouse farming?

_____

_____

_____