INFLUENCE OF GREEN HOUSE FARMING ON FOOD SECURITY: A CASE OF ELDORET EAST SUB-COUNTY, KENYA.

BY

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DECLARATION

This research project report is my original work and has never been submitted for a degree or any other award in any other university or institution.

……. ……

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L50/84396/2012

This research project report has been submitted for examination with my approval as the University Supervisor.

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DEDICATION

This research project report is dedicated to my parents, Mr. Job Tonui and Mrs. Grace Tonui whose love, sacrifice and commitment towards giving each and every one of us an education remains unrivalled.

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Foremost, I am extremely thankful to the Almighty God for granting me enough strength and courage to tackle this research project. I thank the University of Nairobi for giving me a chance to undertake a Masters degree in the institution. I owe a lot of gratitude to my academic supervisor, Dr. Naomi Gikonyo for her mentorship, guidance, suggestions and encouragement that I was able to tackle this enormous task. I am also indebted to the various lecturers for their commitment and devotion in ensuring that we grasped the various concepts pertaining to this course. I am also grateful to the Resident Lecturer Mr. Julius Koringura for the constant push to graduate within the stipulated time. To fellow classmates whom I share with this journey, thank you for all your constructive criticisms during class seminars; your input to my work was indispensable. Lastly, in a very special way, I would like to thank my family for the financial, moral, and emotional support throughout this period. May God protect all of you and bless you abundantly.

However, I remain solely responsible for all errors and omissions in this research project.

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ABBREVIATIONS AND ACRONYMS

AIDS	Acquired immunodeficiency syndrome
DAP	Diammonium phosphate
HIV	Human immunodeficiency virus
FAO	Food and agriculture organization
IFPRI	International food policy research institute
KFSSG SRA	Kenya Food Security Steering Group short rain assessment
MDG	Millennium development goals
NEMA	National environmental management authority
NPK	Nitrogen phosphorous potassium
UN	United Nations
UNESCO	United Nations Economic, Social and Cultural Organization
UNICEF	United Nations children's fund
UNDESA	United nation department of economic and social affairs
US	United States
USAID	United states agency for international development
WHO	World health organization

ABSTRACT

The current situation of food security in the country has led to the introduction of green house farming. The study sought to assess the influence of green house farming on food security a case of Eldoret East Sub-County. Greenhouse is a structure which is used for the production of crops under a controlled environmental condition. It is usually a glass or plastic-enclosed structure with a framing of aluminum, galvanized steel, naturally durable or preservative treated timber. Despite North Rift being Kenya's food basket, the problem of food insecurity is further exacerbated by many people having been displaced in the surrounding farms in Eldoret unable to go back to their farms for cultivation of food crops and change in weather patterns that has lowered food production in the region and thus the need for farmers to adopt new technology of farming such as greenhouse farming. The study was led by the following objectives; to establish the extent to which cost of green house farming influence food security, to determine the extent to which knowledge in green house farming influence food security, to establish the extent to which diversification in green house farming influences food security and to establish the extent to which the size of green house influences food security. The study used descriptive design with a sample of 150 respondents. Questionnaires were used to collect data and the study used descriptive and inferential statistics as the main methods of analysis, since the data collection was both quantitative and qualitative in nature. The analysis and presentation of the data focused on the frequencies, percentages, and tables. The study was expected to benefit the farmers, the government and scholars. The study found out that initial costs of greenhouses were high for farmers coupled with the inadequate knowledge and the reliance on one kind of crop in their farms while size of greenhouse and land was found to have not been explored to its potential. This study recommends that government popularize this technology as it not only ensures food security but also creates jobs for the youths. This study also recommends that appropriate local materials be sourced to reduce the cost of construction and produce from the greenhouses and as well providing farmers with the necessary training to obtain relevant skills for use in this technology.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

More than one billion people which are nearly a sixth of the world's population suffer from chronic hunger a crisis with devastating and far-reaching effects FAO (2009). Without enough food, adults struggle to work and children struggle to learn, making sustainable economic development difficult to achieve. FAO (2010) the 2008 food price crisis illustrates the kinds of disruptions that will be experienced more often in the future. The steep rise in prices affected families in the United States and was particularly devastating for the poor in developing countries. Increased demand will come primarily from population and income growth in middle-income countries UNICEF (2001)

According to the World Bank policy study (2009), reducing hunger will set off a positive ripple effect across people's lives, communities, countries and even continents. This cannot be accomplished by short term interventions; it requires addressing the underlying causes of chronic hunger by advancing agriculture-led growth helps rural farmers who are the majority of the world's food insecure population to grow more food to feed their families and sell more of their products in commercial markets. WHO (2008) indicates that for every one percent growth in agriculture, poverty declines by as much as two percent. And because the majority of those who are hungry live in rural areas and depend on agriculture and natural resources for their livelihoods, investing in agriculture is the most efficient way to target those in need. Most of the world's remaining arable land is in developing countries, and dramatic gains in agricultural productivity are possible.

Unleashing the potential of small-scale farmers and agribusinesses to produce and sell food will substantially reduce hunger and create a more resilient global food supply for everyone. Parry et al (2009)

A survey in Accra, Ghana found on average families spent 54% of their income on food and up to 60% in the lowest income bracket Maxwell and Levin (1998). Hunger among the slum dwellers is most often attributed to problems of distribution, with gaps increasing between poor and rich countries as well as between the poor and rich within countries Maxwell (1998). Research carried out Oscar (1965), found that people in the slums produce little wealth and receive little in return. Other common perpetrators of food insecurity cited in developing countries are unemployment and the welfare crisis Riches (1998).

Latimer *et. al.* (2002) carried out a greenhouse survey in Virginia to identify the research and educational development programmes needs of greenhouse operators. The survey undertaken by the Rutgers Cooperative Extension (2003) in New Jersey, was to generate information that was helpful to greenhouse farmers in resolving most of the pressing industry challenges while the work of Onder (2009), in Eastern Mediterranean coastal areas of Turkey was aimed at determining the general management problems, structural features and weaknesses and climate control of greenhouses. This study sought to assess the influence of green house farming on food security in Kenya.

Food insecurity in Kenya has been attributed to a number of reasons, high prices of food, civil and political unrest including violence associated with the December 2007 election,

recurrent seasons of failed or poor rains, sustained high food prices, environmental degradation, outbreak of diseases and flooding UN Habitat (2007) Attention has been drawn to the vulnerable situation of the urban poor in the light of the impacts of post election violence coupled with global rising food prices on the already precarious food security situation Ayako, B.A. & Katumanga M. (1997). In January 2009, the Government of Kenya declared a national food security emergency and declared an estimated total 10 million people at risk, the largest single group affected are 4.1 million urban dwellers KFSSG SRA (2009). Therefore the purpose of this study was to establish influence of greenhouse farming on food security among farmers in Eldoret East Sub-County.

1.2 Statement of the problem

Food insecurity is recognized as an increasing problem worldwide Gopalan (2001). Food security is a critical factor for economic growth and development of a nation Akanji (1999). Assuming that current trends in population growth and the distribution of wealth continue 10-20 percent more people may be at risk of hunger by 2050 because of climate change. Of these, 65 percent are expected to live in Africa. Parry et al (2009) Climate change will alter water availability, affect the spread of pests and diseases, shift crop distribution and is projected to negatively impact specific crop yields in developing countries Nelson, Gerald et al (2009)

Opportunities may emerge to support food security programs for smallholder farmers, as the agriculture sector is increasingly considered a means of reducing poverty Parry et al (2009). The development of greenhouse farming techniques has generally resulted in

more overall food security for the whole world and helped to reduce world hunger problems. It's also been helpful in allowing people to buy almost any fruit or vegetable at their local grocers, regardless of whether the food is out of season Olivier de (2001).

Data concerning food insecurity in urban poor populations has been scarce most research addresses food insecurity in rural populations Phillip & Taylor (1998.). Urban food insecurity is global, especially in cities of developing countries. Despite North Rift being Kenya's food basket, the problem of food insecurity is further exacerbated by many people having been displaced in the surrounding farms in Eldoret unable to go back to their farms for cultivation of food crops and change in weather patterns that has lowered food production in the region and thus the need to establish the influence of green house farming on food Security.

1.3 Purpose of the study

The purpose of this study was to assess the influence of green house farming on food Security in Eldoret East Sub-County, Kenya.

1.4 Objectives of the study

The study was guided by the following objectives:

1. To establish the extent to which cost of green house farming influence food security.
2. To determine the extent to which knowledge in green house farming influence food security.

3. To establish the extent to which diversification in green house farming influence food security.
4. To establish the extent to which the size of the green house influences food security.

1.5 Research Questions.

This study sought to answer the following research questions;

1. To what extent does cost of green house farming influence food security?
2. How does knowledge in green house farming influence food security?
3. How does diversification in green house farming influence food security?
4. To what extent does size of green house farming influence food security?

1.6 Significance of the study

This study sought to generate useful insights that may be used by the government, Non-governmental organization and farmers to promote viable alternative source of food production and create employment. The study also sought to offer useful recommendation and measures to aid in the realization of the Kenya vision 2030 as well as the Millennium Development Goals (MDG)

1.7 Limitations of the study

The limitation of the study were several factors like distance between the targeted farmers with poor transport network. This was due to the fact that the area of study has rough terrain and poor roads. Availability of funds was also a limiting factor to the study since the researcher is self sponsored for transport and for buying research material and

stationery. Computer services and libraries are far away from the area of study and a lot of time spent in collecting data as the study is done during the term. There was no assurance that the respondents would return all the questionnaires duly completed, neither was there a guarantee that the interviewees would respond to all the questions put forward to them comprehensively.

1.8 Delimitations of the study.

The delimitation of the study was that the language used was well understood and clear for the respondents thus would ensure a smooth running of the research. Also the researcher being well known in the area made it easy for the respondents to cooperate and the agricultural extension officers offered their help by educating the local community-based about the need for the research. The study was restricted to Eldoret East Sub-County as coverage area. The respondents selected for the study were over 18 years of age.

1.9 Assumptions of the study

It was assumed that the respondents would be co-operative and provide accurate information when responding to the research questions. It was also assumed that the sample size chosen was adequate to enable the researcher draw a valid conclusion about the population.

1.10 Definition of significant terms as used in the study

Food security the state of assured access to enough food at all times for an active and healthy life.

Food insecurity the state of deprivation in the basic need for food when there is limited inadequate or insecure access of individuals and households to sufficient safe, nutritious and personally acceptable food both in quality and quantity.

Green house is a structure used for the production of crops under a controlled environmental condition.

Farmer Is the owner or a person in-charge of the greenhouse used in the production of crops

1.11 Organization of the study

Chapter one provides a background on food security, statement of the problem, research objectives and research questions that the study sought to answer, purpose of the study, and significance of the study, limitation, delimitations and definitions of significant terms as used in the study. Chapter two highlights relevant literature on how green house farming influences food security, theoretical framework and conceptual framework. Chapter three outlined the research methodology used in the study. It describes in details, research design, target population, sample, sampling procedure and data collection instruments. Chapter four contains data analysis, presentation and interpretation while chapter five provides a summary of findings, discussion, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter outlines the various literatures on what constitutes food security and green house farming as an emerging field. Secondly, it highlights the literature related to cost, knowledge, diversification and size of green house on food security. The chapter also analyzes literature related to other aspects influencing food security.

2.2 Food Security and Green House Farming

The root cause of food insecurity in developing countries is the inability of people to gain access to food due to poverty Latham (1997). The phenomenon of urban food insecurity has been attributed to the following interconnected factors: Income insecurity making an individual or household unable to purchase sufficient food or food with adequate nutrient content to assure food security, spatial factors such as living in a neighborhoods without an affordable grocery store, markets or other outlets, disproportionate income allocation to other areas, such as rent, leaving an insufficient budget for food and isolation, loss of autonomy or a lack of a social network Centraide (2002).

Greater attention has been paid to food and nutrition issues at the levels of national government especially in the less developed countries as well as by the international community Babatunde *et al*., (2007). Pinstrup-Andersen P, *et al*, (2001) this is proved by the statistics of 150 million children that are malnourished in developing countries. Of

these, 32 million are in Africa. The high levels of malnutrition in children and women in Africa still pose a challenge for child survival and development UNICEF report, (2001).

Commonly cited reasons for hunger in cities in the developing world include high rates of population growth beyond productive capabilities, high rates of income inequality, land degradation and soil erosion, as well as a host of institutional and economic factors limiting developing societies from achieving food security Allen, (1993).

Waterborne diarrhea diseases are estimated to be highly prevalent in urban areas, mainly as a result of contaminated water and food, crowding, limited access to water, and poor food and household hygiene Bradley et al. (1992).

In cities in the developing world, rapid urban growth and fiscal and foreign exchange constraints, as a result of structural adjustment programmes have created particular challenges for maintaining urban food security Von Braun et al, (1993). The evidence suggests that where economic deterioration was worst during the 1980s the food security of the urban poor was particularly adversely affected. Structural adjustment policies resulted in the removal of food subsidies and redundancies (retrenchment) among government employees, much of the impact of which was focused on the cities.

The problem in urban slums is not that there is no food available in the markets, Concern Worldwide U.S. (2009) it is that the poorest no longer have the resources to buy enough food to meet even their most basic needs. In the urban areas of low- countries, 50 per cent of the population lack access to clean drinking water and safe sanitation UNESCO, (2006).The situation is worsened by the fact that urban poor often do not have physical

access to healthcare, and even when they do, they may not be able to afford it USAID, (2004).

In Kenya Food shortages have been exacerbated by drought and poor harvests. Cooking fuel prices have risen by 30-50 percent, and the cost of water has more than doubled. KFSSG SR (2009). A survey carried out by Oxfam in Kenya concluded that falling household income rising prices and poor governance are making life a misery for the poor in Nairobi. The report adds urban dwellers are earning less but forced to pay more to survive Oxfam (2009).The higher house hold size the more difficult it is to meet basic requirements such as food, health care, school fees and other essentials of life. The report established that income is directly related to the standard of living, hence the lower the income, the lower the standard of living and the higher the poverty levels. The post election violence of 2007 in Kenya affected majority of the people where they lost their assets and food stocks they have had to depend on the food stocks and incomes of host families. This has contributed to the fast depletion of household food and majority of the hosting households are now also depending on market purchases KFSSG SRA (2008).

HIV/AIDS has been predicted to have a long-term impact on food security in sub-Saharan Africa. In 2000, the HIV/AIDS pandemic was estimated to have affected, 36.1 million people, seventy percent of whom (25.3 million) live in sub-Saharan Africa FAO, (2001). In these countries, there has been a reduction in national agricultural productivity due to loss of workforce. Access to food becomes more difficult in households where one or more of the productive members can no longer bring in income due to frequent illness associated with HIV/AIDS. According to a joint report from humanitarian groups

Concern Worldwide, Care International, and Oxfam International,(2009) the cost of cooking fuel went by as much as 50 percent in the 2009, while the price of water has doubled at the same time . A study by CARE-Kenya, 2008 adds that there is enough food in the slums but the prices are unaffordable CARE-Kenya (2008)

According to Vleeschouwer (2001), greenhouse farming is a term used to define virtually any major agriculture endeavor that is carried out using greenhouses. These allow farmers to grow many different kinds of crops in climates that may not be hospitable. The capacity to carefully control temperature is usually considered the most important advantage of greenhouse farming. Farmers can create their greenhouses using materials that maximize the heat from the sun. Some farmers may also include heaters inside the greenhouses, which can be helpful in very cold climates. Other aspects of environmental controls, including careful adjustment of humidity, are also often useful, (Vleeschouwer, 2001)

Greenhouses are designed for the protection of tender or out of season plants against excessive cold or heat and are often used for the propagation and growing of horticultural crops including vegetables, fruits and flowers, for plant research, for isolating plants from disease or insects, or any other circumstance in which plants require special growth conditions. A greenhouse is heated partly by the sun and partly by artificial means which makes it possible to have a controlled environment that can be adapted to the needs of particular plants. While in the tropical areas of Africa, there are only limited applications, there are a few situations in which a greenhouse can be justified because of the optimum growing conditions required for a high value crop or a research project. Greenhouses

protect crops from inclement weather, shield plants from dust and storms, and help to keep out pests. Light and temperature control allows greenhouses to turn unsuitable lands into lands that are suitable for the production of crops thereby improving food production.

2.3 Cost of Green House Farming on Food Security

The organic farmer (2011) magazine wrote recently that most farmers need capital and or securities to get a bank loan to start this business. For many small-scale farmers, both are not available. Greenhouse owners are often people with white collar jobs.

Another big plus for greenhouse farming is that it allows people to take advantage of vertical space. In a normal farming environment, the growing area is generally a flat expanse, but this isn't true when farming in greenhouses. Many farmers will have plants sitting in shelves or hanging from the ceilings, and this sometimes allows the farmer to pack more plants in an acre than usual thus stabilizing the situation of food security. (Vleeschouwer, 2001)

Depreciation is defined as the loss in value of an asset over time, mainly as a result of obsolescence. In the case of buildings and equipment, it is that portion of the decrease in value resulting from the passage of time. Obviously, part of the reduced value of the buildings and equipment is the result of usage and is considered a variable cost. The entire depreciation is considered a fixed cost. Anon. (1999)

Land associated with each greenhouse operation is valued per acre, irrespective of its location as determined through real estate values for good farmland suitable for a

greenhouse operation. It can be argued that allocation of such a value distorts cost of land in and around urban areas relative to farmland. Researchers are aware that land values in cities or towns are much higher it would lead to artificially much higher fixed costs that would greatly inflate overall production costs Anon. (1999)

Production materials and supplies include the purchase of cuttings, seed plants, fertilizers, chemicals, soils, vermiculite, perlite, peat moss, straw, peat pots and plastic. Costs of production materials and supplies are the actual figures provided by the study participants Amiran Kenya (2013)

Marketing charges are the actual amount paid by each greenhouse operator for having produce marketed. These charges cover grading, packaging, marketing and administrative fees Anon. (1999)

Although most of the world's poor people now live in rural areas, the numbers of urban poor, from market towns to megacities, are substantial and cannot be ignored. World population is expected to grow from 6.7 billion to 9.2 billion between 2007 and 2050. Virtually all of the 2.5 billion increases will occur in the developing world's urban areas UNDESA, (2008). By 2002, the population in extreme poverty had declined to 1.2 billion people, but the urban share had increased to 25 per cent, and the number of poor urban residents had increased to 300 million Chen and Ravallion (2007).

Historically, the most significant difference between food access in urban and rural areas has been that rural people can often produce their own food, whereas urban people are more dependent on food purchases. A study in Accra found that households purchase 90

percent of their food Maxwell et al. (1998. The prevalence of urban food poor households as a percentage of total population in Africa was estimated at 42.58% in 1992 Redwood, (2008).

2.4 Knowledge in Green House Farming for Food Security

The following forms the basis that a farmer should know in the practice of green house farming as suggested by (Amiran Kenya 2013. Smith P et al. 2008):

Seedlings are raised in the nursery. The nursery site should be chosen where potatoes, brinjals, peppers, and other solanaceous crops have not grown in the last three years due to the risk of crop infection by soil-borne diseases and pest infestations. The seeds should be raised in nursery beds, seed boxes or germination trays. The seedlings should be later thinned to 7cm in rows so as to ensure sturdy seedlings. Transplanting is done a month after germination. The seedlings are uprooted with a ball of soil at 4 to 6 leaves stage. Soil should be well-prepared, thoroughly dug to 1.5 feet deep to loosen the soil. Apply one (1) wheelbarrow of manure per meter and mix well with the soil. The land should then be divided into beds of 1m wide, after which DAP/NPK fertilizers are applied to the surface of each bed by sprinkling sparingly at a rate of 100g/meter square.

To recover the huge investments, high value crops such as tomatoes, peppers, eggplants or chilies are planted in greenhouses. This is a very small choice of crops, and all of them belong to the nightshade family which is susceptible to early and late blight, but also to different pests like white flies. Pathogens and insects can establish in a greenhouse environment in a very short time, and they are very difficult, if not impossible, to get rid of effectively. (Smith P et al. 2008) To avoid this, organic farmers usually rely on crop

rotation. This prevents pests and diseases associated with any crop family to accumulate in the soil. But when farmers grow the same crop in a greenhouse over and over again without rotation, diseases and pests become a big problem. This or even total crop failure may force the farmer to pull down the expensive structure. (Smith P et al. 2008)

2.5 Diversification of Green House Farming and Food Security

The greenhouse operation provides products for sale to both the seed industry and to Farms' direct marketing avenues. The majority of that production is plugs grown for the seed industry. These include crops such as cabbage, cauliflower, broccoli, brussel sprouts, radishes, beets, and chard. The farmers also grow a number of vegetables in the greenhouses for sales through the produce stand, farmers' markets, and restaurants Smith et al. (2008)

Vleeschouwer (2001) views greenhouse farming as more flexible than regular farming, especially when farmers have multiple separate buildings. For example, a farmer can set up a building that was perfect for growing a particular tropical species and then set up other buildings that grow plants that thrive in cooler climates. Each building can have perfect environmental controls to maximize the growing potential of each species. Finally, the greenhouse operation gives farmers the opportunity to offer consistent, year round employment to their workers, which keeps employee satisfaction and productivity high Amiran Kenya (2013). The crops that can be cultivated under greenhouses vary and are many including sugarcane, sweet potatoes, Irish potatoes, onions, green bean, carrots, cucumber, olive tree, citrus tree, bamboo seedlings among others Onder J. (2009)

2.6 Effects of Size of Green House on Food Security

Greenhouses can be free standing, single greenhouses, or gutter-connected bays. If you plan to build more than one greenhouse, the gutter-connected formation is more economical. Each side-by-side pair of houses will share a common gutter, reducing the number of sidewalls by two, thereby decreasing construction costs. In addition, there will be less surface area for heat loss, so there is an energy savings as well. (Richard G. Snyder 1992)

Typical lengths of greenhouses for tomatoes are 96 feet and 130 feet. The 96-foot greenhouse is a convenient size because plastic covering is easily found in 100-foot lengths. This is the longest practicable run from intake vent to exhaust fan that will provide adequate cooling. A greenhouse longer than 150 feet will have too much of a temperature gradient from the intake end to the exhaust end. For greenhouses longer than 150 feet, consider ventilating across the width of the greenhouse. (Pat Harris *et al* , 1993) The side walls need to be vertical for greenhouse tomatoes, rather than the ground-to-ground or Quonset styles, which have curved side walls. The vertical side wall should be a minimum of 8 feet high (10 feet preferred), at which point the gutter would be placed in a gutter-connected greenhouse. Above the side wall, an arch-shaped top, with or without trusses, is most common. A large green house leads to a large production of food and thus increasing food security. (Richard G. Snyder 1992)

2.7 Theoretical Framework

The researcher will adopt innovation theory to provide an overall framework for analyzing the linkages of innovation on food security as proposed by Schumpeter (1934)

According to Schumpeter (1934), an innovation is the introduction of a new idea or doing something that has been done in the past years but in a new way. This is what he refers to as "new combinations" that is, making the most effective combinations between new and old technologies and uncovering the most conducive new fields of application. The forms of innovation given by Schumpeter include: new products, new production process, and new sources of supply, new markets and new industrial organization. This includes innovations which organizations are the first to develop and those that have been adopted from other organizations or individuals.

Lately, innovation has been described as a process. Mytelka (2000) defines an innovation as a process by which firms master and implement the design and production of goods and services that are new to them, irrespective of whether they are new to the individuals or the world. Innovation therefore includes the many large and small improvements in such areas as product design and quality, production organization and management routines, and marketing. It also includes modifications in the production process and techniques that collectively reduce costs, increase efficiency, provide for human welfare and ensure environmental sustainability as applied in greenhouse farming technology.

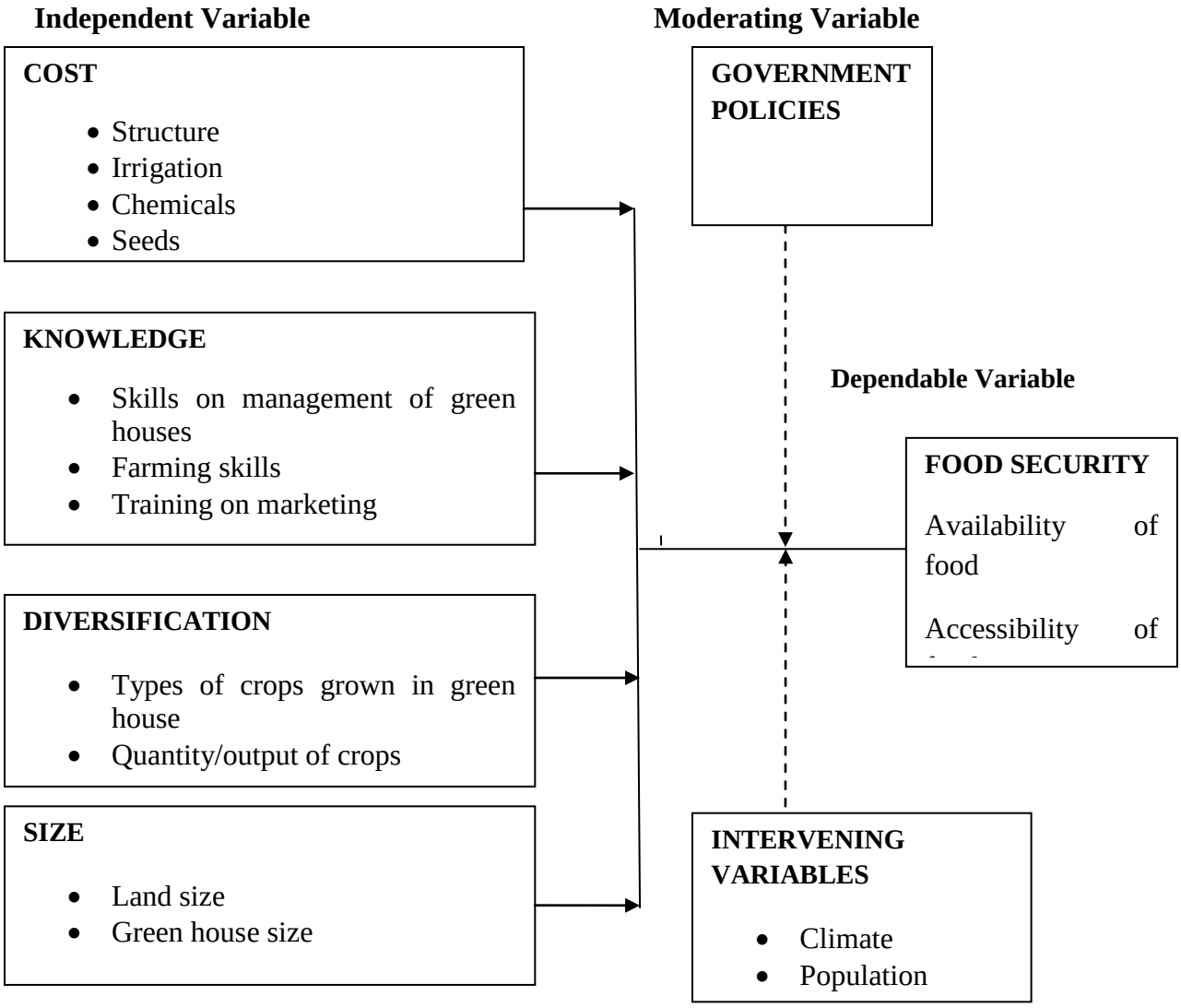
Another way of looking at the nature of innovation is based on the degree of innovativeness. Innovation studies in Africa show that most of the innovations adopted by firms are of incremental nature (Robson *et al*., 2009; Oyeleran-Oyeyinka *et al*., 1996). Radical innovations in Africa are rare. Incremental/adaptive innovations are said to be introductions of products, services and processes that are new to organizations but not new to industry. Robson *et al*., (2009) argues that incremental innovation is a wide and

cautious approach to innovation in developing countries as it enables the individuals to manage risk by building on the innovations of others. This is especially so in a resource-poor environment where the financial consequences of business failure are devastating and potentially affecting food security. Incremental innovation therefore reduces some of the risks associated with innovation. The greenhouse farming type of agriculture is an innovation that acts as a major step in ensuring food security in light of declining land and water availability, urbanisation and climate change in Kenya and world over.

2.8 Conceptual Framework

The conceptual framework that guides this study is constructed from four independent variables; cost of green house farming, knowledge of green house farming, diversification of green house farming and size of green house farming. The government policies, climate and population are the intervening and moderating variables for the dependent variable food security.

Figure 1: Conceptual Framework



2.9 Summary of Literature Reviewed and Research Gaps

This chapter has presented a review of literature related to food security and green house farming among the rural farmers. Administrative and regulatory burdens on farmers according to reviewed literature are key barriers for people in developing countries and needs to be reformed. The provision of farming education at primary, high school or

training at tertiary level is also inadequate and needs to be addressed. This study therefore sought to find and recommend measures of mitigating the above shortcomings for effective development of green house farming. From the review there was lack of disaggregated and long term data on the food security, causes and coping strategies among residents of rural farmers, not only in Eldoret East Sub-County but in Kenya as a whole. There was need for ongoing reliable data collection and synthesis to increase the knowledge base.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the methodology used in the study. The following topics are discussed; research design, target population, sampling procedure, data collection method and instruments, ethical consideration and operationalization of variables.

3.2 Research design

The survey design was best suited for this study because the data required for analysis was to be collected from a large population, in which it might be hard to observe the features of each individual. According to Mugenda and Mugenda (2003) a descriptive research determines and reports the way things are, and attempt to describe possible behavior, attitude, values and characteristics of such things. The descriptive design was selected in this study because it allowed the researcher to gather numerical and descriptive data to assess the relationship between the variables. This made it possible for the researcher to produce statistical information on the factors affecting the utilization of green house farming for food security.

3.3 Target Population

The study targeted the small and large scale farmers. There were a total of 300 green house farmers. They were broken down as follows; 138 greenhouse farmers from Ainapkoi Division and 162 greenhouse farmers from Moiben Division in Eldoret East Sub-county. (District Agricultural Extension Office Eldoret East, 2013)

3.4 Sample size and Sampling procedure

Kothari, (2004) defined a sample design as a definite plan for obtaining a sample from the sampling frame. It refers to the technique or the procedure the researcher adopted in selecting some sampling unit from which inferences about the population was drawn. Sample of 50% was determined before any data was collected. Thus the study sample size was 150 respondents as follows; 50% from each Division and therefore were broken down to (50% of 138 = 69, and 50% of 162 = 81 greenhouse farmers) while 50% of 4 = 2, therefore taking one Agricultural extension officer from each Division. This is in agreement with Fischer (1992) who recommends 50% of the total population in a social research. Simple random sampling technique was used for this research. This method was ideal because each individual was given an equal probability of being selected and the sample being generalized to the larger population.

3.5 Research instruments

Questionnaires and interviews were used for collecting information from farmers. The questionnaires had structured open and closed ended questions. The open ended questionnaires were used to collect qualitative data while the close ended ones were used to get quantitative data.

The questionnaire items were mainly developed based on the themes in the literature review section and research objectives. The researcher collected the Questionnaires after one week from date of issue in order to give enough time to the respondents to fill them. Interviews were also conducted on Agricultural extension officers.

Secondary data required included books, published materials, internet, census reports, newspapers, journals and research reports and was collected from library sources, government offices and internet data base.

3.6 Validity of instruments

This was the degree to which an instrument measures what it is supposed to measure (Kothari, 2004). A content validity test was used to measure instrument validity. This type of validity measures the degree to which data collected using a particular instrument represents a specific domain of indicators or content of a particular concept (Mugenda and Mugenda, 1999). An expert in the field of green house farming was given the instruments to assess the degree to which they could measure and determine the content of a particular concept.

3.7 Reliability of instruments

Reliability refers to a measure of the degree to which research instruments yield consistent results (Mugenda and Mugenda, 2003). Before the research instruments were finally administered to the participants, a pilot study was undertaken using 30 sample sizes representing about 10% of the sample size for clarity and flow. This was measured through split-half method. According to Fraenkel and Wallen (1996) the process of obtaining split-half reliability begins by splitting in half all items of a test that are intended to probe the same area of knowledge in order to form two sets of items. The entire test was administered to a group of individuals, the total score for each set was computed, and finally the split-half reliability was obtained by determining the correlation between the two totals set scores. Scores obtained from the tests were

correlated to get the coefficient of reliability. The two halves of the test/scale are parallel forms of one another, the Spearman Brown prophecy formula was used to estimate the reliability coefficient of the entire test/scale as follows;

The Spearman Brown prophecy formula is: $\rho_{xx'} = 2\rho_{YY}, / 1 + \rho_{YY},$

Where $\rho_{xx'}$ is the reliability projected for the full-length test/scale, while $\rho_{YY`}$ is the correlation between the half-tests**.** ρ_{YY}, is also an estimate of the reliability of the Test/scale if it contains the same number of items as that contained in the half-test. Now that I had two halves of the test, the Pearson Product- Moment Correlation between them was used getting r = 0.8 implying that that the half-test were closely correlated.

3.8 Procedures for Data Collection

Clearance to conduct the research was sought from the University of Nairobi. The researcher before collecting data from the participant informed respondents in advance about the study. Due to the geographical spread of the sample, data was collected through self administered questionnaires to the respondents and document content analysis. Follow up was done to ensure the response rate was enhanced as possible. Since the information required involved daily operational issues encountered by the respondents, the data collected were assumed to give an insight the study sought to achieve.

3.9 Method of data analysis

Statistical package for social sciences (SPSS) was used for analysis of data. Descriptive and inferential statistics were the main methods of analysis, since the data collection was

qualitative in nature. The analysis and presentation of the data focused on the frequencies tables and percentages.

3.10 Ethical consideration

The researcher endeavored to obtain an informed consent from the respondents before undertaking to collect data from the field. The researcher informed and explained the objectives of the research in order to solicit informed consent from the respondents. High level of confidentiality on the information provided by respondents through interview or questionnaires was maintained.

3.11Operationalization of variables

Table 3.1 shows how variables were operationalized

Table 3.1 Operationalization of variables

Objectives	variables	indicators	Measures	Measuring scale	Type of analysis	Tool of analysis
To establish the extent to which cost of green house farming influence food security	Independent	cost	The cost of green house	Ratio	Descriptive statistics Inferential	Mean Percentages
To determine the extent to which knowledge in green house farming influence food security.	Independent	Knowledge and training	Number of farmers with the knowledge	Ordinal	Descriptive statistics Inferential	Mean Percentages
To establish the extent to which diversification in greenhouse farming influence green house farming.	Independent	Crops types.	Varieties of crops on diversification	Ratio	Descriptive statistics Inferential	Mean Percentages
To establish the extent to which the size of the green house influences food security	Independent	Green house size.	The size of land and green house	Ratio	Descriptive statistics Inferential	Mean Percentages

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter is a documentation of the results on the research that sought to assess influence of green house farming on food security in Eldoret East Sub-county. Data was analyzed using descriptive tools, findings interpreted with frequencies and percentages while presentation was done using tables. Data findings were then linked with the researcher's opinion as well as the existing body of knowledge for the elaborate interpretation and discussion. The chapter is organized in sections beginning with presentation of respondents background information and subsequent sections have been organized following the research objectives.

4.2 Response Return Rate

In order to accomplish the collection of data that would be analyzed to answer the research questions, 150 questionnaires were administered to green house farmers in Eldoret East District. In response, 146 questionnaires representing 97.3% return rate were duly filled and returned for analysis.

4.3 Background Information of Respondents

This subsection describes the basic statistical characteristics of the respondents studied. This included the ages, gender and level of education attained, as shown in Table 4.1,Table 4.2 and Table 4.3

Table 4.1: Age range of respondents

Age Range	Frequency	Percentage (%)
18-27 years	41	28.08
28-37 years	47	32.19
38 and above years	58	39.73
Totals	146	100

The results from Table 4.1, shows that 58 of the respondents representing 39.73% were between the ages of 38 and above, 47 respondents were between the ages of 28 and 27 years representing 32.19% while 41 respondents representing 28.08% were between the ages of 18 and 27 years. This result shows that majority of the green house farmers in Eldoret East District are those that have advanced in their age falling between the ages of 38 and above years.

Table 4.2 Gender distribution

Gender	Frequency	Percentage (%)
Male	89	60.96
Female	57	39.04
Totals	146	100

The results from Table 4.2 show that 89 of the respondents were male representing 60.96% while 57 of the respondents representing 39.04% were female. This result shows that majority of male farmers practice and embraces green house farming.

Table 4.3 Level of Education attained

Level	Frequency	Percentage (%)
Primary	25	17.12
Secondary	45	30.82
Technical and Vocational	42	28.77
University	30	20.55
None	4	2.74
Totals	146	100

Table 4.3 revealed that a majority of the respondents (30.82%) had the secondary school education as their highest level, 28.77% had technical and vocational, 20.55% had University education, 17.12% having only the primary education while a small percentage (2.74%) had no educational background.

4.4 Cost of green house farming on food security

The farmers' capabilities of acquiring greenhouses for production of crops are greatly influenced by the initial costs that are encountered. This greatly has direct influence on food production. The researcher wanted to establish the extent to which cost of green house influences food security.

4.4.1 Response on practice green house farming

Table 4.4 shows the response on whether the respondents practiced green house farming

Table 4.4 Response on practice greenhouse farming

Response	Frequency	Percentage (%)

Yes	144	98.63
No	2	1.37
Totals	146	100

On the question of whether the farmers were practicing green house farming, a majority of the respondents representing 98.63% were practicing the green house farming while 1.37% was not practicing green house farming. This results therefore indicate that most farmers with green houses practice farming while a small number have the green house structure but do not use for farming.

4.4.2 Farmers understanding of food security

Table 4.5 shows the respondents opinion of their understanding of food security

Table 4.5 Farmers understanding of food security

Statement	Frequency	Percentage
Being self sufficient of food supply	49	33.56
No hunger or fear of starvation	41	28.08
Availability of adequate nutritious safe foods	36	24.66
Don’t know	20	13.70
Totals	146	100

Table 4.5 shows that 33.56% believed in being self sufficient of food supply as their understanding of food security, 28.08% went by the opinion that food security is a state of no hunger or fear of starvation, 24.66% had the opinion that food security is the

availability of adequate nutritious safe foods while 13.70% did not understand the meaning of food security.

4.4.3 Household food taken in the last one year

Table 4.6 shows the response of the household food taken in the last year and whether it was affordable or within reach. Table 4.6 below, shows that 54.11% of the respondents had enough of the kinds of food they wanted to eat in their households, 23.29% had enough but not always the kinds of food they wanted to eat in their households, 14.38% had sometimes not enough to eat in their households, 6.16% said they had often not enough to eat in their household while 2.06% did not want to comment on this issue.

Table 4.6 Household food taken in the last year

Statement	Frequency	Percentage
Enough of the kinds of food I/we want to eat.	79	54.11
Enough but not always the kind of food we want	34	23.29
Sometimes not enough to eat	21	14.38
Often not enough	9	6.16
No comment	3	2.06
Totals	146	100

4.4.4 Response on who constructed greenhouse

Table 4.7 shows who constructed the green house for the farmers

Table 4.7 Response on who constructed the green house

Response	Frequency	Percentages
Sponsoring organization(s)	66	45.21
Farmer/Self	80	54.79
Totals	146	100

A greater percentage of the respondents indicated that they had constructed the greenhouses by themselves representing 54.79% while 45.21% had constructed their greenhouses through a sponsoring organization. This results shows that most of the respondents were financially able of putting up a greenhouse with their own resources.

4.4.5 Cost of construction of one unit of a greenhouse

Table 4.8 shows the response on the cost of construction of one unit of a greenhouse.

Table 4.8 Cost of constructing one unit of greenhouse

Cost range in Kshs	Frequency	Percentage
10,000 – 49,999	0	0
50,000 – 99,999	2	1.37
100,000 – 149,999	56	38.36
150,000 – 199,999	68	46.58
200,000 – 249,999	17	11.64
250,000 and above	3	2.05
Totals	146	100

Majority of the respondents indicated that the cost of construction of one unit was within the range of between Kshs 150,000 – 199,999/= representing 46.58%, followed closely by 38.36% indicating that it would cost between kshs 100,000 to 149,999/= , 11.64%

indicated that the construction cost lied between kshs 200,000 to 249,999/=, 2.05% said it cost them above kshs 250,000/=, a small percentage for 1.37% said it cost them between 50,000 and 99,999/= while none indicated that it costs bellow kshs 50,000/=

4.4.6 Cost of installation of irrigation system

Table 4.9 shows the opinions of cost of installation of irrigation system in the green house

Table 4.9 Cost of installation of irrigation system

Cost range in Kshs	Frequency	Percentage
1,000 – 19,999	0	0
20,000 – 39,999	1	0.68
40,000 – 59,999	30	20.55
60,000 – 79,999	72	49.32
80,000 – 99,999	37	25.34
100,000 and above	6	4.11
Totals	146	100

Table 4.9 reveals that 49.32% of the respondents had installed the irrigation system at between kshs 60,000 to 79,999, 25.34% installed at between 80,000 to 99,999, 20.55% installed at between 40,000 to 59,999 while 4.11% had installed at100,000 and above. A small percentage of respondents 0.68% had installed at the range of between 20,000 to 39,999. However none of the respondents indicated the installation costs at between 1,000 and 19,999.

4.4.7 Cost of procurement of chemicals

Table 4.10 shows the cost of procuring chemicals for use in the greenhouse by the respondents

Table 4.10 Cost of procurement of chemicals

Cost range in Kshs	Frequency	Percentage
1,000 – 4,999	0	0
5,000 – 9,999	0	0
10,000 – 14,999	39	26.71
15,000 – 19,999	41	28.08
20,000 – 24,999	62	42.47
25,000 – 29,999	3	2.05
30,000 and above	1	0.68
Totals	146	100

The cost of chemicals for the greenhouse shows that a majority of the respondents representing 42.47% had incurred a cost of between 20,000 to 24,999, 28.08% had incurred a cost of between 15,000 to 19,999, 26.17% had purchased the chemicals at a cost of between 10,000 and 14,999, 2.05% of the respondents purchased the chemicals at between 25,000 to 29,999 while 0.68% had bought the chemicals at between 30,000 and above. None of the respondents indicated the cost of chemicals below the 9,999mark. These results therefore show that the cost of chemicals falls between 10,000 and above 30,000 and thus would probably cause the output of products to increase in the long run.

4.4.8 Cost of buying seedlings

Table 4.11 shows the response on the cost of seedlings for use in the greenhouse that farmers incurred.

Table 4.11 Cost of buying seedlings

Cost range in Kshs	Frequency	Percentage
1,000 – 1,999	10	6.85
2,000 – 2,999	23	15.75
3,000 – 3,999	45	30.82
4,000 – 4,999	21	14.38
5,000 – 5,999	20	13.70
6,000 – 6,999	18	12.33
7,000 – 7,999	7	4.80
8,000 – 8,999	2	1.37
9,000 – 9,999	0	0
10,000 and above	0	0
Totals	146	100

Data collected in Table 4.11 shows that 30.82% indicated that cost of buying seedlings was falling between 3,000 to 3,999, 15.75% indicated seedlings costs falling between 2,000 to 2,999, 15.75% of them indicated the cost of between 2,000 and 2,999, 14.38% indicated that they bought the seedlings at between 4,000 to 4,999, followed closely by those who indicated cost at between 5,000 and 5,999 at 13.70%, 12.33% indicated that it costs between 6,000 and 6,999, 6.85% had purchased the seedlings at between 1,000 and

1,999, 4.80% of the respondents indicated the cost falling between 7,000 and 7,999 while the remaining portion of respondents indicated that the costs of seedlings they bought was between 8,000 and 8,999. None of the respondents indicated the cost of seedlings above 9,000.

4.5 Knowledge in greenhouse farming for food security

The aspect of possession of knowledge in a specific field of practice is essential to ensure successful realization of the intended activity. The study sought to find out the extent to which knowledge in greenhouse farming influences food security.

4.5.1 Access of training programmes

Table 4.12 shows the percentage of respondents who had been through greenhouse management and maintenance training

Table 4.12 Access of training programmes

Response	Frequency	Percentages
Yes	99	67.81
No	47	32.19
Total	146	100

Majority of the respondents (67.81%) confirmed that they had received greenhouse maintenance and management training prior to farming while only 32.19% confirmed that they had not received it.

4.5.2 How farmers had acquired greenhouse management skills

Table 4.13 shows how farmers had acquired/accessed their management skills on greenhouse

Table 4.13 Ways that farmers acquire greenhouse management skills

Access of skills	Frequency	Percentage
Attended greenhouse farming seminars	33	22.60
Through greenhouse construction company	51	34.93
Trained by agricultural extension officer (s)	20	13.70
Through Agricultural shows	12	8.22
By self through friends, internet or books	30	20.55
Totals	146	100

Table 4.13 reveals that 34.93% had accessed their greenhouse management skills through the greenhouse construction company, 22.60% got it by attending greenhouse farming seminars, 20.55% got it by themselves through their friends, internet or books, 13.70% had been trained by the Agricultural extension officers while the remaining 8.22% had visited the Agricultural shows and acquired the skills.

4.5.3 Possession of farming skills required

Table 4.14 shows the response on possession of farming skills required for greenhouse farming

Table 4.14 Possession of farming skills required

Response	Frequency	Percentages

Yes	79	54.11
No	67	45.89
Totals	146	100

The percentage of respondents who revealed that they had in their possession the farming skills required in greenhouse was 54.11% while 45.89% had not. This could perhaps be due to the existence of fewer training programs in the study area.

4.5.4 Duration of practicing greenhouse farming

Table 4.15 shows the length of time the respondents have been practicing greenhouse farming.

Table 4.15 Duration of practicing greenhouse farming

Duration	Frequency	Percentages
Less than one year	41	28.08
2 to 5 years	72	49.32
6 to 9 years	29	19.86
10 and above years	4	2.74
Totals	146	100

Table 4.15 reveals that 49.32% had practiced greenhouse farming for between 2 to 5 years, 28.08% had practiced for less than one year, and 19.86% had practiced for between 6 to 9 years while 2.74% had practiced for 10 and above years. This is an indication that greenhouse farming is still a new concept of crop production within the study area.

4.5.4 Methods that farmers use to market their crops

Table 4.16 shows the response on how crops are marketed by the farmers

Table 4.16 Methods that farmers use to market their crops

Response	Frequency	Percentage
Through greenhouse farmers society	26	17.81
Take to local or urban market	83	56.85
Buyers come for the produce	37	25.34
Totals	146	100

Table 4.16 shows a majority of respondents (56.85%) marketed their produce by taking to the local or urban market, 25.43% revealed that buyers came for their produce at their farms while 17.81% marketed their produce through farmers association societies. A majority of respondents hinted that they would want to see the government link them to markets locally and abroad.

4.6 Diversification in greenhouse farming for food security

The production of a number of crops within the firms ensures that a farmer secures themselves from uncertainties associated with single crops and also ensure the output from the crops are high and of high quality to meet the demands of the market. The study sought to find out the extent to which diversification in greenhouse farming influenced food security in the study area.

4.6.1 Crops grown in the greenhouse

Table 4.17 shows percentages of what crops the respondents grow in their greenhouses

Table 4.17 Crops grown in the greenhouse

Crop (s)	Frequency	Percentages

Tomatoes	91	62.33
Vegetables e.g. Kales	12	8.22
Fruits e.g. strawberries	2	1.37
Flowers	4	2.74
Capsicum (chilies)	25	17.12
All of the above	12	8.22
Totals	146	100

Table 4.17 revealed that a majority of respondents (62.33%) were growing tomatoes in their greenhouses, 17.12% were growing chilies/capsicum, while a tie of 8.22% were among those who were growing vegetables and those growing all the crops listed above, 2.74% grew flowers while 1.37% indicated that they were growing fruits in their greenhouse. There is a need to encourage farmers to grow different crops in the study area because majority of them seem to rely on one crop.

4.6.2 Variety of crops grown in the greenhouse

Table 4.18 shows the percentages on whether farmers grow a variety of crops on the greenhouse.

Table 4.18 Variety of crops grown in the greenhouse

Response	Frequency	Percentage
Yes	98	67.12

No	48	32.88
Totals	146	100

The data on Table 4.18 shows that a majority of respondents (67.12%) grow a variety of crops in their crops while 32.88% indicated that they were not growing a variety of crops in their greenhouse.

4.6.3 Rating on which crop (s) yield more income

Table 4.19 shows the percentage of the crops that farmers believed yielded more under greenhouse farming

Table 4.19 Rating of Crop income under greenhouse farming

Crop (s)	Frequency	Percentage
Tomatoes	78	53.43
Vegetables e.g. kales	3	2.05
Flowers	10	6.85
Fruits e.g. strawberries	9	6.16
Capsicum (chilies)	38	26.03
All of the above	8	5.48
Totals	146	100

According to the data analyzed in Table 4.19, revealed that a majority of respondents (53.43%) believed that Tomatoes earned more income, 26.03% indicated capsicum/chilies, 6.85% indicted flowers, 6.16% believed in fruits, 5.48% believed that

all the listed crops above while a small percentage (2.05%) believed that vegetables brought more income.

4.6.4 Satisfaction rate on use of greenhouse farming

Table 4.20 shows the percentage on the rate which farmers are satisfied with the use of greenhouse farming.

Table 4.20 Satisfaction rate with the use of greenhouse farming

Response	Frequency	Percentage
Very satisfied	14	9.59
Satisfied	53	36.30
Somehow satisfied	41	28.08
Not satisfied	29	19.87
Undecided	9	6.16
Totals	146	100

Table 4.20 revealed that a majority of the respondents (36.30%) were satisfied with the use of greenhouses, 28.08% indicated that they were somehow satisfied, 19.87% were not satisfied, 9.59% were very satisfied while 6.16% were undecided on their satisfaction.

4.6.5 Respondents opinion on agreement level of greenhouse farming for food security

Table 4.21 shows the respondents opinion on greenhouse farming for food security

Table 4.21: Opinion on agreement level of greenhouse farming for food security

Statement	Strongly	Agree	Un-	Disagree	Strongly

	Agree		decided		Disagree
Crops takes a short period to be ready for harvest	41	72	2	22	9
Percentage	**28.08**	**49.32**	**1.37**	**15.07**	**6.16**
Green house farming is more convenient than open field farming.	85	31	21	9	0
Percentage	**58.22**	**21.23**	**14.38**	**6.16**	**0**
It can accommodate any crop	35	68	13	26	4
Percentage	**23.97**	**46.58**	**8.90**	**17.81**	**2.74**
It does not entail a lot of inputs required in farming	5	14	11	76	40
Percentage	**3.43**	**9.59**	**7.53**	**52.05**	**27.40**
The conditions can be adjusted to fit the crops being planted	12	69	34	19	12
Percentage	**8.22**	**47.26**	**23.29**	**13.01**	**8.22**
The crops in greenhouse are secured from attacks of animals	98	32	1	14	1
Percentage	**67.12**	**21.92**	**0.68**	**9.59**	**0.68**

Table 4.21 revealed that the crops in the greenhouse were secured from attacks from animals was ranked highest or strongly agreed (67.12%) while least strongly agreed was it did not entail a lot of inputs in farming at 3.43%. None of the respondents strongly disagreed on the statement that greenhouse farming was more convenient than open field farming.

4.7 Effects of size of greenhouse on food security

The size of greenhouse determines the quantity of crops that will be yielded as the output and thus size of greenhouse is somehow proportional to the output

4.7.1 Size of Land of the respondents

Table 4.22 shows the percentages of size of land respondents own.

Table 4.22 land size of the respondents

Size in acreage	Frequency	Percentage
0.1- 0.9	16	10.96
1.0- 1.9	14	9.59
2.0- 2.9	11	7.53
3.0- 3.9	5	3.42
4.0- 4.9	14	9.59
5.0 or above	87	59.59
Totals	146	100

Table 4.22 revealed that a majority of respondents (59.59%) have 5 and above acreage of land, 10.96% had land between 0.1 to 09 acres, those with between 1 to 1.9 and those with between 4 to 4.9 acres had equal representation of 9.59%, 7.53% had land size between 2 to 2.9 while 3.42% indicated that they had land size of between 3 and 3.9 acres.

4.7.2 Size of greenhouse of respondents

Table 4.23 shows the size of greenhouse that farmers own in their farms.

Table 4.23 Size of greenhouse of respondents

Measurement in meters	Frequency	Percentage
6x15	12	8.22
6x20	44	30.14

6x30	36	24.66
8x15	52	35.62
9x30	2	1.37
Totals	146	100

According to data collected and analyzed indicate that a majority of respondents (35.62%) had a greenhouse measuring 8x15, 330.14% had 6x20, 24.66% had the one measuring 6x30 while 8.22% had a 6x15. The ones with a 9x30 were a small percentage of the respondents (1.37%)

4.7.3 Number of greenhouse (s) farmer own

Table 4.24 shows the number of greenhouse (s) that farmers have built in their farms

Table 4.24 Number of greenhouses the farmer own

Number	Frequency	Percentage
1 to 2	114	78.08
3 to 4	29	19.87
5 and above	3	2.05
Totals	146	100

Most of the respondents (78.08%) had between 1 and 2 greenhouse, 19.87% had between 3 and 4 greenhouses while another 2.05% had 5 or above greenhouse. This is an indication that most farmers had either one or two greenhouses.

4.7.4 Challenges facing greenhouse farmers on food production

Table 4.25 shows the challenges facing greenhouse farmers on food production.

Table 4.25 Challenges facing greenhouse farmers on food production

Statement	Strongly Agree	Agree	Un-decided	Disagree	Strongly Disagree
Green house are prone to damage by termites and wind.	34	52	6	36	18
Percentage	**23.29**	**35.63**	**4.11**	**24.66**	**12.33**
Maintenance cost of the greenhouse is high	90	52	3	1	0
percentage	**61.64**	**35.63**	**2.05**	**0.68**	**0**
Pathogens and insects can establish in a greenhouse	68	54	6	17	1
Percentage	**46.58**	**36.99**	**4.11**	**11.64**	**0.68**
Start up cost is high	93	48	5	0	0
Percentage	**63.70**	**32.88**	**3.42**	**0**	**0**

From Table 4.25, it was revealed that a greater percentage strongly agreed with the statements on the level of agreement on the challenges facing the respondents as follows 63.70% on startup cost, 61.64% on maintenance cost as being high and 46.58% indicating that pathogens and insects can establishing a greenhouse. Those who indicated that they mildly agreed with the statements were 32.88% on startup cost, 35.88% for each on maintenance cost being high and greenhouse being prone to damage by termites and wind while 36.99% agreed that pathogens and insects could establish in the greenhouses. There were a cross cutting percentage on the undecided group on all the statements ranging from 4.11% and 2.05%

4.7.5 Outcomes on use of greenhouse farming for food security

Table 4.26 shows the response on outcomes on use of greenhouse farming for food security

Table 4.26 Outcomes on use of greenhouse farming for food security

Statement	Strongly Agree	Agree	Un-decided	Disagree	Strongly Disagree
Farmers are able to produce a variety of crops	77	48	4	17	0
Percentage	**52.74**	**32.88**	**2.74**	**11.64**	**0**
It increase food production	82	64	0	0	0
Percentage	**56.16**	**43.84**	**0**	**0**	**0**
Improved health of the house hold because of existence of food	46	58	0	34	8
Percentage	**31.51**	**39.733**	**0**	**23.29**	**5.48**
Irrigation of plants ensure there is constant supply of food	77	31	5	21	12
Percentage	**52.74**	**21.23**	**3.42**	**14.38**	**8.22**
There is existence of food throughout the seasons	89	41	1	14	1
Percentage	**60.96**	**28.08**	**0.68**	**9.59**	**0.68**
There is existence of money from selling of the crops	43	28	2	59	14
Percentage	**29.45**	**19.18**	**1.37**	**40.41**	**9.59**

The findings in Table 4.26 shows 60.96% ranked strongly that there is existence of food throughout the season on the influence that greenhouse has on food security while improved health of the household because existence of food was ranked least strongly agreed. 40.41% disagreed that there was existence of money from selling of crops while none disagreed that food production was increased from greenhouse farming.

4.8 Government policies and regulations on greenhouse farming

Favorable government policies and regulations such as reduced tax rate, provision of subsidies and relaxed export regulations can enhance greenhouse farming.

4.8.1 Compliance with Government policies and regulations on greenhouse farming

Table 4.27 shows the opinion held by respondents on the government policies and regulations on greenhouse farming for food security.

Table 4.27 Compliance with government policies and regulations on greenhouse farming

Opinion	Frequency	Percentage
Yes	105	71.92
No	41	28.08
Totals	146	100

Table 4.27 shows the opinion of respondents in relation to whether they found it difficult to comply with the government policies and regulations. The data analyzed in Table 44.27 shows that 71.92% found it difficult to comply while 28.08% did not. This is a clear indication that government policies and regulation are a challenge to greenhouse farmers.

4.8.2 Impact of government regulations and policies on greenhouse farming for food security.

Table 4.28 shows the impact of government regulations and policies on greenhouse farming for food security.

Table 4.28 Impact of government regulations and policies

Government Policies and Regulation	Rankings							
	Very serious	%	Serious	%	Less serious	%	Not serious	%

Export rules	98	**67.12**	22	**15.06**	16	**9.59**	10	**6.85**
NEMA regulations	40	**27.40**	64	**43.84**	22	**15.06**	20	**13.70**
Subsidy policies	71	**48.63**	43	**29.45**	32	**21.92**	0	**0**
Taxation	33	**22.60**	72	**49.32**	41	**28.08**	0	**0**

According to the data analyzed in Table 4.28, Export rules were ranked as the most serious challenge to greenhouse farmers with 67.12% while Subsidy policies were ranked second. Taxations were ranked the least serious challenge with 22.60% and NEMA rules with 27.40%

4.8.3 Proposed government policies on greenhouse farming

Most respondents proposed adjustments of export rules in order to make it favorable to market more of their outputs abroad. Respondents also revealed that they would like to see government subsidizing farming inputs in order to reduce cost of production.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary of findings, discussions, conclusions reached and recommendations following the objectives of the study. Greenhouse farming has been taunted as the major source of food production. This study set out to assess the extent to which cost of greenhouse farming influences food security, the extent to which knowledge in greenhouse farming influences food security, the extent to which diversification in greenhouse farming influences food security and the extent t which size of greenhouse influences food security

5.2 Summary of findings

Relying on the responses given by the respondents, the researcher came up with findings which were used to make conclusions and give recommendations. The main findings are based on the results of data analysis in chapter four as shown in Table 5.1

Table 5.1 Summary of findings

Objectives	**Findings**
1. To establish the extent to which cost of greenhouse farming influence food security	• Most respondents (54.11%) had eaten food that they want in the past year • 46.58% of farmers indicated the construction cost was between Kshs 150,000 and 199,999 which is quite high. • 49.32% had irrigation installation cost at between Kshs 60,000 and 79,999. • 42.47% indicated cost of chemicals at between Kshs 20,000 and 24,999.

	• 30.82% indicated a figure of Kshs 3,000 to 3,999 as the cost seedlings.
2. To determine the extent to which knowledge in greenhouse farming influences food security	• 67.81% had received greenhouse maintenance and management training. • 34.93% acquired their skills through greenhouse construction companies. • 54.11% had the necessary farming skills required for greenhouse farming. • 49.32% had practiced greenhouse farming for a period of between 2 and 5 years an indication of some experience with this venture • Majority of the respondents (56.85%) marketed their crops in the local and urban market
3. To establish the extent to which diversification in greenhouse farming influences food security	• 67.12% of the respondents revealed that a variety of crops would be grown in the greenhouse. • 62.33% were growing tomatoes and 53.43% suggesting the same crop earning more income • Most respondents were satisfied with the use of greenhouse
4. To establish the extent to which the size of the greenhouse influences food security	• Land size in the study area was either 5 acres or above held a majority of respondents (59.59% • 35.62% of the respondents in the study area had a greenhouse size 8x15 (meters) • 78.08% had either 1 or 2 greenhouses in their farms

5.3 Discussions of findings

This section gives detailed discussions of findings in this study.

5.3.1 Cost of greenhouse farming on food security

From the study, it was found out that majority of the respondents had eaten food that they desired in the past year representing 54.11%. This relates to Parry M. et al (2009) literature which suggests that unleashing the potential of farmers reduces hunger and creates a more resilient global food supply for everyone. It was revealed that the construction cost of greenhouses was between Kshs 150,000and 199,999 being suggested by 46.58% of the respondents which found it to be so high. The installation of irrigation systems costs were indicated by 49.32% of all respondents to be falling between Kshs 60,000 and 79,999. On the other hand the cost of chemicals and seedlings were indicated to fall between Kshs 20,000 - 24,999 and 3,000- 3,999 representing 42.47% and 30.82% of the respondents. These prohibitive costs of construction and maintenance are assumed to be one of the reasons why many people have not ventured into business of greenhouse farming in the study area and the country in general.

5.3.2 Knowledge in greenhouse farming and food security

The literature of Latimer J. et al (2002) confirms that farmers require skills on construction, maintenance, farming and marketing. It was revealed that 67.81% of the respondents had acquired maintenance and management training as indicated by 34.93% getting it through the greenhouse construction companies. This can perhaps be attributed to the fact that greenhouse construction companies have been in the forefront in advocating for the adoption of this farming technology as opposed to being a government led project. Most respondents had the desired farming skills required in greenhouse farming represented by 54.11% of those investigated and 49.32% had now become

experienced through practicing farming for a period between 1-2 years. The works of Smith P. et al (2008) suggested that in order for a farmer to recover from the huge investments in high valued crops, marketing skills of produce was most crucial component.

5.3.3 Diversification in greenhouse farming and food security

The study revealed that 67.12% believed that a variety of crops would be grown under a greenhouse; however 62.33% were growing only tomatoes and 53.43% believing that tomatoes were the main crop that would earn more income. The crops cultivated under greenhouses in the study area included tomatoes, vegetables, fruits, flowers and chilies. The farmers in the study area have not explored the full potential of greenhouses as suggested by the works of Onder J. (2009) where he indicated that the following crops would be cultivated in the greenhouses; sugarcane, sweet potatoes, Irish potatoes, onions, French beans, green bean, carrots, cucumber, and even bamboo seedlings. Reliance on a single crop is high in the study area.

5.3.4 Size of greenhouse and food security

According to the study, 59.59% of the respondents held a land size of 5 or more acres and thus expansion space was not limited. The sponsoring organization had constructed 8x15 greenhouses and 35.62% of all the respondents adopting that size of greenhouse in their farms. Majority of the farmers represented by 78.08% had either 1 or 2 greenhouses in their farms. According to Richard G. and Snyder (1992), a large greenhouse leads to a large production of food and thus increasing food security. There is more potential that

has not been explored by the respondents in the study area. The construction cost varies with size.

5.3.5 Impact of government policies and regulations

Unfavorable government policies and regulations can be a great hindrance to development of greenhouse farming. In this study, 67.12% ranked export rules as the serious challenge while Taxation is ranked least serious with 22.60%. Most respondents revealed that they would like to see government subsidizing farming inputs in order to reduce cost of production.

5.4 Conclusion of the study

The following conclusions were made from the findings.

During the survey, a total number of 146 greenhouses were investigated. The greenhouses identified were mainly privately owned. These greenhouses have been successfully used in the cultivation of a number of precious crops which constitute a major component of the diet of the populace. To promote the development of greenhouse farming effectively, there is need to factor in the special needs of farmers when government policies on agricultural activities are being crafted in order to realize their full potential. The high cost of construction and maintenance is likely to slow down the expansion by the current farmers and entry of new farmers despite the potential return on investment that this technology posses.

Another factor which needs to be enhanced is the public enlightenment on this venture through education and trainings in order to widen the crops being cultivated as well as

increasing the number of farmers using this technology. Most land was found to be arable and lying idle and the effective production technology needs to be embraced.

As a result of the prohibitive cost of construction and maintenance and lack of awareness of its potentials, entrepreneurs have not ventured into the business of greenhouse farming in Eldoret East District and perhaps Kenya in general.

Based on the performance of the crops cultivated in these greenhouses, it is believed that whatever investment may be made in the erection of greenhouses, such could be recovered within a short period of time and hence the introduction of greenhouses for crop production as one of the many options of combating the negative effects of food insecurity is advocated.

5.5 Recommendations

The following recommendations were made by the researcher;

i) Public enlightenment: Even though greenhouses have been in use in the study area for some time, they have been confined to the flower firms' especially commercial farmers who perhaps would have had the resources to venture into their use or are aware about them. There is the need for massive public enlightenment on the potentials of greenhouse farming especially among the farming communities.

ii) Sourcing for local construction materials: The main reason for the high cost of the greenhouses is the materials used in construction. Appropriate local materials for use should be sourced this will go a long way to reduce the cost of produce.

iii) Training skill: Greenhouse construction and maintenance requires some skills. The training institutes should organize training skills for those interested and especially many of the unemployed youths. More Agricultural extension officers should be employed to help farmers attain the best practice in farming in the study area and the country in general..

iv) Government support and incentive: The Republic of Kenya has repeatedly restated her commitment to the food security initiatives. Greenhouse farming is one area where adequate food can be produced under any condition. Attention in terms of grants and subsidy should be provided for those who are interested in greenhouse farming.

The popularization of greenhouse farming could lead to employment creation in the sense that the construction materials can be sourced locally and technology can also be locally sourced which will make it cheap. Many youths could be given little orientation and can then be self employed either in their production or utilization for market gardening.

Extension of greenhouse farming would support the development of new branch of industrial sectors producing greenhouse materials.

5.6 Suggestions for further research

The researcher is recommending the following areas for further study.

i) An investigation of other strategies for realizing food security in Kenya.

ii) An assessment of the utilization of greenhouse farming on job creation.

iii) Effects of climate change on farming technologies.

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APPENDICES

APPENDIX 1: LETTER OF TRANSMITTAL

Ernest Kipkorir Kurgat,

P.O Box 119-40110,

Songhor.

Dear Respondent,

I am a student of the University of Nairobi pursuing a Masters of Arts Degree in Project Planning and Management. I am conducting an academic research on the "FACTORS AFFECTING THE UTILIZATION OF GREEN HOUSE FARMING FOR FOOD SECURITY IN ELDORET EAST DISTRICT". This questionnaire has been prepared to obtain information on Green house farming practiced by you individually.

Please note that all the information provided for this study will be treated with utmost confidentiality. Your ability to answer all the questions comprehensively and to the best of your knowledge will be highly appreciated.

Thank you for your co-operation and precious time.

Yours faithfully,

Ernest Kipkorir Kurgat

E-mail: ernest.kurgat@live.com

Phone: 0721 747567.

APPENDIX 2: QUESTIONNAIRES FOR THE GREEN HOUSE FARMERS

Instructions

Please tick in the appropriate box and also fill in the blank spaces provided for those questions where elaborate answers are required. You are requested to complete this questionnaire as honestly and objectively as possible. Use the space at the back of this questionnaire if you need more space for your responses.

A. Profile of the farmer

1. Age;

18-27 years [ ] 28-37 years [ ] 38 and above years [ ]

2. What is your Gender?

Male [ ] Female [ ]

3. Level of education attained

Primary [ ]

Secondary [ ]

Technical and Vocational [ ]

University [ ]

None [ ]

B. Effects of Cost of Greenhouse Farming on food security

4. Do you practice greenhouse farming?

Yes [ ] No [ ]

5. Which of the following statements fits the meaning of food security in your opinion?

Being self sufficient of food supply [ ]

No hunger or fear of starvation [ ]

Availability of adequate nutritious safe foods [ ]

Don't know [ ]

6. This question is about the food eaten in your household in the last 12 months, since (current month) of last year and whether you were able to afford the food you need.

Which of these statements best describes the food eaten in your household?

Enough of the kinds of food I/we want to eat. [ ]

Enough but not always the kind of food we want [ ]

Sometimes not enough to eat [ ]

Often not enough [ ]

No comment [ ]

7. Who constructed the green houses for farmers in your area?

The sponsoring organization [ ]

Farmer /Self [ ]

8. How much did it cost you to construct green house?

Cost range in Kshs

1,000-49,999 [ ]

50,000-99,999 [ ]

100,000-149,999 [ ]

150,000-199,999 [ ]

200,000-249,999 [ ]

250,000 and above [ ]

9. How much did it cost you to install the irrigation system in your green house?

Cost range in Kshs

1,000-19,999 [ ]

20,000-39,999 [ ]

40,000-59,999 [ ]

60,000-79,999 [ ]

80,000-99,999 [ ]

100,000 and above [ ]

10. How much did it cost you to procure chemicals required for your green house crops?

Cost range in Kshs

1,000-4,999 [ ]

5,000-9,999 [ ]

10,000-14,999 [ ]

15,000-19,999 [ ]

20,000-24,999 [ ]

25,000-29,999 [ ]

30,000 and above [ ]

11. How much did it cost you to buy the seedlings for your green house?

Cost range in Kshs

1,000-1,999 [ ]

2,000-2,999 [ ]

3,000-3,999 [ ]

4,000-4,999 [ ]

5,000 and above [ ]

C. Knowledge of green house farming

12. Were you trained on how to maintain and manage the green houses?

Yes [ ] No [ ]

13. Which of these statements is true about how you acquired your skills to manage green house?

Attended seminars that promote green house farming [ ]

Trained by the green house constructing companies [ ]

Trained by the agricultural extension officers [ ]

Acquired skills through the agricultural shows [ ]

Sourced information from the internet/ books by self [ ]

Other (s) specify……

14. Do you have the farming skills necessary for cultivation of crops under green houses?

Yes [ ] No [ ]

15. How long have you been practicing green house farming?

Less than a year [ ] 2- 5 years [ ] 6- 9 years [ ] 10 years and above [ ]

16. Which of these statements is true on how you market your crops?

Through a society formed by green house farmers [ ]

Take to the local market and urban market [ ]

Buyers come for the produce in the farm [ ]

Other (s) specify……..

D. Diversification in the green house farming

17. Which crops do you grow in your greens house?

Tomatoes [ ] Vegetables [ ] Fruits [ ] Flowers [ ]

All above [ ] Capsicum [ ] other(s) specify……..…

18. Do you plant variety of crops in your green house?

Yes [ ] No [ ]

19. Which of the listed crops in your opinion yields more income?

Tomatoes [ ] Vegetables [ ] Flowers [ ]

Fruits [ ] Capsicum [ ] All above [ ]

Other(s) specify……..

20. How satisfied are you with using green house farming in production of crops?

Not satisfied [ ] somewhat satisfied [ ]

Satisfied [ ] Very satisfied [ ]

Undecided [ ]

21. Indicate the level to which you agree with the following statement concerning the use green house farming in production of Food

Statement	**Strongly Agree**	**Agree**	**Un-decided**	**Disagree**	**Strongly Disagree**
Green house farming is more convenient than open field farming.					
It does not entail a lot of inputs required in farming					
The conditions can be adjusted to fit the crops being planted					
It can accommodate any crop					
Crops takes a short period to be ready for harvest					
The crops in greenhouse are secured from attacks of animals					

E. Size of green house

22. What is the size of your land?

Size in acreage	
0.1- 0.9	[ ]
1.0- 1.9	[ ]
2.0- 2.9	[ ]
3.0- 3.9	[ ]
4.0- 4.9	[ ]
5.0 and above	[ ]

23. What is the size of your greenhouse farm?

Measurements in Meters	
6x15	[ ]
6x20	[ ]
6x30	[ ]
8x15	[ ]
9x30	[ ]

Other (specify) ……

24. How many green houses do you have on your farm?

1-2 green house	[ ]
3-4 green houses	[ ]
5 & above green houses	[ ]

25. Indicate the level to which you agree to the following statement concerning the challenges experienced by farmers when using greenhouse farming method.

Statement	**Strongly Agree**	**Agree**	**Un-decided**	**Disagree**	**Strongly Disagree**
Start up cost is high					
Maintenance cost of the greenhouse is high					
Green house are prone to damage by termites and wind.					
Plant growth is determined by the controlled conditions inside a greenhouse					
Pathogens and insects can establish in a greenhouse					

26. Indicate the level to which you agree to the following statement concerning the influence of Green house farming on Food security

Statement	**Strongly Agree**	**Agree**	**Un-decided**	**Disagree**	**Strongly Disagree**
Farmers are able to produce a variety of crops					
It increase food production					
There is existence of food throughout the seasons					
There is existence of money from selling of the crops					
Improved health of the house hold because of existence of food					
Irrigation of plants ensure there is constant supply of food					

Effects of government policies and regulations

27. Are there any government policies and regulations which you found it difficult to cope in this kind of farming?

Yes [ ] No [ ]

28. How would you rate the regulatory challenges you face in greenhouse farming. Please indicate with a tick the scale of these challenges as very serious, serious, less serious or not serious

Regulation	Very serious	Serious	Less serious	Not serious
NEMA policies				
Taxation				
Licensing				
Export rules				
Subsidy policies				

29. What changes are needed in government policies and regulations in order to make them friendly to greenhouse farmers?

……

……

……..

APPENDIX 3: INTERVIEW GUIDE

Please tell me your name

Please tell me your designation

Cost of green house

1. What is the initial construction cost and cost of irrigation drips of a green house?
2. In your opinion do all farmers have the ability to pursue this kind of enterprise?

Knowledge on green house farming

3. Do farmers have the necessary farming skills and green house management training to run this kind of venture?
4. What marketing skills do farmers have for crops grown under green house?

Diversification in the green house

5. What varieties of crops can be grown under a green house?
6. What output comes from a green house crop as opposed to open field grown crops?

Size of green house

7. Does size of land determines the green house to be constructed?
8. Does size of green house have a relationship with the crops grown?