FACTORS INFLUENCING SUSTAINABILITY OF
HORTICULTURAL FARMING IN KENYA: A CASE OF
KIAMBU COUNTY

BY

WILLIAM MWANGI SHABANGU

UNITED STATES INTERNATIONAL UNIVERSITY-
AFRICA

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A Research Project Report Submitted to the Chandaria School of Business in Partial Fulfillment of the Requirement for the Degree of Master of Business Administration (GLOBAL)

UNITED STATES INTERNATIONAL UNIVERSITY - AFRICA

SUMMER, 2019
STUDENT’S DECLARATION

I, the undersigned, declare that this is my original work and has not been submitted to any other college, institution or university other than the United States International University Africa in Nairobi for academic credit.

Signed: ___________________________       Date: _________________________

William Mwangi Shabangu (Reg. No 657747)

This project has been presented for examination with my approval as the appointed supervisor.

Signed: ___________________________       Date: _________________________

Timothy C. Okech, PhD

Signed: ___________________________       Date: _________________________

Dean, Chandaria School of Business
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ABSTRACT

The purpose of the study was to examine the factors influencing Sustainability of Horticultural farming in Kiambu County. In order to realize this, three research questions guided the process namely: to what extent does empowerment influence sustainability of horticultural farming in Kiambu County in Kenya? to what extend does credit accessibility influence sustainability of horticultural framing in Kiambu County in Kenya? and How does adoption of emerging technology influence the sustainability of horticultural farming in Kiambu County in Kenya? A descriptive survey research design was adopted targeting horticulture farmers in Kiambu. The study applied cluster sampling by dividing the county into sub-counties from which a few farmers were selected. In the study, Krejcie and Morgan formula was adopted to determine the sample size. Data was collected using a structured questionnaire that contained both open and closed ended questions. To ensure reliability and validity of the researcher designed questionnaire, a test-retest method was adopted. The data was collected was analyzed in terms of both descriptive and inferential statistics. These were in terms of mean, median, mode and standard deviation. Others were frequency tables, pie charts, graphs, correlation, ANOVA and regression analysis.

Regarding research question one, the study found that through farmers groups in the County, the farmers receive training and financial support to improve their farming activities (49.6%) and that the government rarely organizes training for horticultural farmers in the County. Majority of the farmers rarely attend training on modern horticultural farming methods (59.5%). For those who have participated in the training, this has enhanced their productivity and hence sustainability (62.8%). The linear regression analysis revealed that empowerment positively and significantly predicted sustainability of horticultural farming, leading to rejecting the null hypothesis that empowerment has no significant influence on sustainability of horticultural farming.

The study finding of research question two echoed that there is need for financial capital to improve and sustain farming ventures (73.6%), that farmer groups do not provide sufficient funds for farmers to invest in horticulture (43.1%). Similarly, majority of the respondents 193 (56.6%) disagreed that the government provides affordable credit to horticulture farmers for their activities. Respondents however, acknowledged the role of credit in improving their ventures through investing in modern technology and practices.
The linear regression analysis of the study revealed that credit accessibility significantly predicted sustainability of horticultural framing, leading to rejecting the null hypothesis that credit accessibility style has no significant influence on sustainability of horticultural farming.

In response to research question three this study found that majority of the respondents was adequately aware of the available technology for use in horticulture farming. They were aware that the use of technology in horticulture farming has enhanced productivity and sustainability of their venture (29.9%). However, the study found that the respondents were not able to afford the available technology for use in horticultural farming (72.7%), despite majority indicating that the use of technology has made it possible to store products in good conditions thus attracting good value (43.1%). The regression analysis revealed that emerging technology positively and significantly predicted sustainability of horticultural framing, leading to rejecting the null hypothesis that emerging technology has no significant influence on sustainability of horticultural farming.

Based on the findings, the study made various conclusions. In terms of the first research question, the study concludes that farmers congregating in groups promote their activities and enhance their empowerment which is not exhaustively used to provide training and financial support to improve their farming activities. On the second research question, the study concludes that there is absolute need for financial capital in horticultural farming and that farmers’ groups play a significant role in sourcing for capital for the members. On the third research question, the study concludes that the level of knowledge on available and relevant technology is low thus contributing to low adoption of such technologies in horticultural farming.

Based on the findings of the first research question, the study recommends that the ministry of gender and social services in collaboration with ministry of agriculture should encourage formation of horticultural farmers’ group how about County government? Through the groups, the government will be able to organize regular trainings to help improve the knowledge of the farmers. The Ministry of Agriculture and County government should seek donor fund targeted at horticultural farming to ensure availability of training support and funding for various technologies in agriculture. Finally, the study recommends that through extension officers and the farmers’ cooperative societies, farmers should be encouraged to acquire and use modern technologies in horticulture.
ACKNOWLEDGEMENT

First of all, I wish to acknowledge the invaluable support given to me by my supervisor, Prof Okech for his timely and patience, positive critiques and constructive comments and suggestions throughout the writing of this research project. I would also like to thank my colleagues and workmates who have in every way encouraged me to work tirelessly for the success of this project proposal.
DEDICATION

A dedication to my wife Dorcas, and my daughter Jasmine: Thank you for being an encouragement and for the support you gave me throughout this project.
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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Problem

Worldwide, majority of households live in the arid and semi-arid regions are low-income earners. This is a big challenge because literally most residents in these areas depend on farming for livelihood (FAO, IFAD & WFP, 2013). Additionally, more than 70 percent of the lands that these communities depend on for agricultural production suffer from soil and terrain constraints, which impair farming activities (FAO, 2011). Therefore, for agriculture to be able to address the challenges of food security and poverty in these dry lands, strategies must be put in place which will address the high poverty levels among the small farmers, the environmental degradation which is already being experienced in these regions and climate change which is worsening the farming conditions (International Center for Agricultural Research in the Dry Areas [ICARDA], 2013). For there to be any improvement in the livelihood of residents in these said areas of the world, there must be a revision on current farming practices in addressing food crisis and security (IAASTD, 2009). This in the process will assure sustainability of farming in general.

Sustainability entails the ability of any development to meet the needs of the present without compromising the ability of the future generations to meet themselves (ULCA, 2019). Sustainable farming approaches have emerged a priority for world leaders towards achieving sustainable development (FAO, 2011). Accordingly, the emergence of Agricultural sustainability centers (ASC) on the need to develop agricultural technologies and practices that are accessible to and effective for farmers, and that lead to both improvements in food productivity and positive side effects on environmental goods and services (National Research Council of the National Academies, USA, 2010). Sustainability is emphasized to be a required foundation in the strategies for developing sustainable farming practices is one of the targets of the new agenda towards global development in the post 2015 era which is in the present focus (FAO, IFAD and WFP, 2013). It is for this reason that research findings on the future of food into 2015 recommends significant changes in the food production system in world to make it more sustainable so that it can raise yields with increased efficiency,
simultaneously raise yields while increasing efficiency in the utilization of farm inputs to eliminate negative environmental effects in food stability (FAO, 2011).

According to FAO (2011) the study recommends the adoption of sustainable crop production practices which use the ecosystem approach where inputs, such as land, water, seed and fertilizer are used to complement the natural processes that support plant growth, including pollination, natural predation for pest control, and the action of soil biota. Sustainable farming practices have been found to simultaneously raise yields, increase efficiency in the use of inputs and reduce the negative environmental effects of food production (United Nations Environment Programme [UNEP], 2012). Around the world sustainable farming practices have been found to provide small scale farmers and their households with numerous benefits through increased productivity, reduced costs of production and resilience to production limiting factors as well as risk management (SARE, 2004; CARDA, 2010; ICARDA, 2013; FAO, 2011 (Babu and Blom, 2014).

The situation in sub-Saharan Africa (SSA) is worse due to perennial droughts occasioned by unpredictable and erratic rainfall that these regions receive leading to massive crop failures and therefore lack of food security (International Center for Agricultural Research in the Dry Areas [ICARDA], 2013). Unfortunately, the same said regions for years have continued to be the most vulnerable parts of the world facing severe challenges to sustainable development with related challenges that include lack of food security, water scarcity, land degradation, and climate change (International Center for Agricultural Research in the Dry Areas [ICARDA], 2009). The already challenging state is worsened by the emerging complication of climate change (FAO, 2011).

In Kenya for example where agriculture is a major contributor to the economy and to the livelihoods for a majority of the country’s population adoption of sustainable farming practices has been low with the adoption activity being spearheaded by non-government institutions (FAO, 2009). The country’s potential to increase agricultural productivity is largely unexploited partly due to high agricultural production costs and unsustainable farming practices especially in the arid and semi-arid regions of the country (Agricultural Sector Coordination Unit [ASCU], 2011). For instance, the horticulture subsector of the country, an important s (Ministry of agriculture, 2010a). Horticultural farming contributes, define and control food security and household
incomes to a majority of people including Kenyan producers who carry out one form of horticultural production or another and it employs over six million Kenyans both directly and indirectly thus improving on their livelihoods (Ministry of agriculture, 2010a).

The horticulture industry in Kenya plays a key role in poverty alleviation, employment creation, and food security (ASCU, 2011). The industry contributes extremely to food security and household incomes to a majority of Kenyan producers who practice one form of horticultural production or another. It also employs over six million Kenyans both directly and indirectly thus improving on their livelihoods (Ministry of agriculture, 2010a). However the potential for horticultural production in the Arid and Semi-Arid Lands (ASALs) of Kenya has not been fully utilized to be of help to the communities living in those regions (Ministry of Agriculture, 2010b). This is because farming in Kenya is mostly rain fed and the arid and semi arid regions lack of enough rainfall to support sustainable rain fed farming (Ministry of Agriculture, 2010b). The farming is practiced for both export and local markets. The large scale production is mainly directed towards export of fruits, vegetables and flowers of which most farms were established during the 1980s. According to Swinnen and Maertens (2007), horticultural production ranks among the top two foreign exchange earner in the dominant agricultural sector after tea in Kenyan exports. For the sector to expand, contribute significantly to economic growth and remain sustainable there is need to support the key players in the sector who are the farmers. The support will enable them adapt to the changing climate and production methods in the sector so as to be up to date. The farmers will be able to adopt modern technology, become efficient and improve on quality of produce.

Denhen-Schmutz et al., (2010) recent studies show a general trend towards a fewer and larger horticultural growers as evident in Kenya. Horticultural production is intensive, occurring under a controlled environment this enables a year-round all season production. Horticultural crops have been grown for both domestic and export markets. UNDP (2015) while handing over farmer training center to Kiambu county government echoed that agriculture was a key driver for poverty reduction. In order to participate in expanding export markets, farmers need support in enhancing their ability to adapt to increasing requirements of management and compliance with emerging standards. It is through
addressing this issues that NGO’s can enhance horticultural produce and contribute to more sustainable development in the horticultural and overall livelihoods.

1.2 Statement of the Problem

In Kenya, there are more than 200,000 farmers who have been trained on organic farming principles and practices (Kenya Organic Agriculture Network annual report, 2016). Currently certified land under organic management in Kenya stands at 104,211 ha while the sector employs 12,647 producers/wild harvesters directly (Willer & Lukas, 2015). The vigorous growth of organic agriculture in the country is partially hampered by the perceived high economic risk leading to low adoption (Organic Agriculture in Kenya, 2014). This is contributed by limited empirical documentation of its economic benefits, which also limits support by government and development partners. In order to support appraisal of organic agriculture as a viable alternative production system which contributes to livelihood improvement, there is a need to evaluate its impact on profitability especially for smallholder farmers.

Despite the development of horticultural export sector in the country being led by the private sector, that is, the large scale farmers commanding commercial production (Ministry of Agriculture, 2010), majority of horticultural crops are still produced by small scale farmers contributing approximately 50% to 60% of total production. Most of these small scale farmers are driven mainly by self-sufficiency as opposed to commercialization. Thus, their ventures stagnate in terms of volume, quality and efficiency. They produce low volumes that are less than 20%, substandard quality and use low efficient technology. A production system that is economically sustainable uses methods that are efficient and result in short and long term profitability for the producer (Bos et al., 2009).

The urgency of sustainable development of agricultural production, therefore, is increasingly acknowledged as opined by Pretty (2008), Tilman et al., (2002), Wiskerke (2009). The application of sustainable systems of farming in Kenya is limited and has been mainly noted through organic farming research. The country’s potential to increase agricultural productivity is largely unexploited partly due to high agricultural production costs and unsustainable farming practices especially in the arid and semi arid regions of
the country (ASCU, 2011). Kiambu being part of the Mount Kenya region is known for the fertile volcanic soils and favorable climate characterized by predictable rains. There have however been concerns of sustainability of horticultural farming in Kenya in general and Kiambu County in particular. This study thus attempts to investigate factors influencing Sustainability of farming in Kiambu County as a study case by focusing on adoption of technology, empowerment and access to credit.

1.3 Purpose of the study
The purpose of the study was to examine factors influencing Sustainability of Horticultural farming in Kenya using Kiambu County as a case.

1.4 Research Questions
1.4.1 To what extent does empowerment influence sustainability of horticultural farming in Kiambu County in Kenya?

1.4.2 To what extent does credit accessibility influence sustainability of horticultural framing in Kiambu County in Kenya?

1.4.3 How does adoption of emerging technology influence the sustainability of horticultural farming in Kiambu County in Kenya?

1.5 Justification
This academic research largely contributes to the emerging academic debate within the Development Studies that seeks to propose alternative, sustainable horticultural practices and skills that enhances the sustainability of horticultural farming in Kenya. A case study of Kiambu County will be used to help clarify and reach the intended academic goal. The assumption of the study was that the lessons finding of the research learnt from the horticultural sector will be used to empower, enhance farmers who are in horticultural practice in Kenya and especially Kiambu County. This was fundamental in setting of governance structure’s and strategies that will enhance the policies of privatization and liberalization that will enforce horticultural-farming practices.

Respectively, the study was an attempt to address factors that influence sustainability of horticultural farming in Kiambu County, in Kenya. Respectively, the research was instrumental in showing impact of horticultural farming of farming on economic growth.
and farming as a resource to potential investors and stakeholders. The study will be a timely resource for agricultural research for institutions and individuals who want to study the trends in horticultural farming in Kiambu County.

1.6 Scope of the study
The study focuses on examining the factors influencing sustainability of horticultural farming in Kiambu County in Kenya. Respectively, the study focuses on how empowerment influences sustainability of farmers in Kiambu County, how credit availability could influence the sustainability of farming in Kiambu County and if technology advancement can influence sustainability of farming in Kiambu County. Thus, the study was conducted among horticulture farmers in Kiambu County for a period of 3 months. This study was carried out due to seasonal shortages of food in the country and Kiambu County was used as a case due to its proximity to the researcher and cost-related issues. The major limit of the study was small-scale horticultural farmers would not release all information due to fear of victimization by other farmers. This was solved by assuring the farmers that the research was only being conducted for academic purposes and the survey was hence carried out in an anonymous way with farmers not giving any of their personal contact information.

1.7 Definition of terms
1.7.1 Credit Accessibility
Credit accessibility is defined as the degree to which a product or service is used or availed to as many people as possible (Marjorie, 2016).

1.7.2 Empowerment
A management practice of sharing information, rewards, and power with employees so that they can take initiative and make (Business’s Dictionary, 2010).

1.7.3 Emerging Technology
Advancement in new ways of operates that are related to the equipment used within the agricultural context. Due to increased reliance on equipment, technological factors currently exert a considerably more important effect on the success of a business than they did only a hundred and fifty years ago (Pestle analysis, 2016).
1.7.4 Food Security
According to FAO, 2006, Food security exists when all people at all times have physical and economical access to sufficient, safe and nutritious food that meets their dietary needs, food preference for active and healthy life.

1.7.5 Horticultural Farming
According to University of Minnesota (2011), horticulture is the art and science of plant production for both beauty and utility... Rather than staple crops, horticulture focuses on value-added, luxury crops.

1.8 Chapter Summary
Chapter one presents the background of the study, introduces the problem statement, describes the purpose of the study with its significance, and elaborates research objectives, research questions and research hypothesis that are guiding the study to establish the factors influencing sustainability of horticultural arming in Kiambu County in Kenya.
CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction
This chapter presents an analysis of related literature in the order of the research questions. Literature is obtained from agency publications, government reports and empirical scholarly research. The literature is reviewed based on the study themes as outlined in chapter one which were: sustainable farming, empowerment of farmers, and access of credit and technology use in agriculture. The literature review has examined various studies and they have dealt with the concept of agriculture technology, credit and empowerment and the influence they have on farmers so far. This has been done systematically by tackling all the objectives of the study in detail. The chapter also includes summary of knowledge gaps.

2.2 Empowerment and Sustainable Horticultural Farming
The relationship between education and empowerment has been widely debated in development literature. In recent times, social capital and community-centric learning have been increasingly recognized as important variables in the empowerment process. The purpose of the study was to gain a better understanding of empowerment in the selected farming communities and to identify factors that may contribute to empowerment. The study shows that the integration of human capital (viewed purely from learning, knowledge acquisition, reflective practices, skills and competencies), social capital and financial capital, has a positive impact on development outcomes such as empowerment. This study uses the definition of empowerment by Kabeer (1999), which puts empowerment as the expansion in people’s ability to make strategic life choices in a context where this ability was previously denied to them.

When precisely 193 countries members of the United Nations General Assembly, unilaterally adopted Agenda for Sustainable Development (ASD) 2030 in New York in the year 2015, it was the precedence for the global commitment to sustainable economic change anchored on eradication of poverty among the worlds’ population (Setboonsarng & Gregorio, 2017). Similarly, the event in the year 2000 where world leaders adopted the Millennium Development Goals (MDGs) was also landmark as leaders agreed on goals and targets aimed at poverty reduction the world over. Key to these indicators was empowerment of individuals as the basic units of communities to enhance agricultural
and economic productivity. Moreover, the targets set gave various agencies and implementers the guideline and focus for achieving the set goals by the year 2015.

World Bank reports revealed that majority of the world’s poor population are farmers, of which 70% reside in rural areas and largely practice subsistence farming. Thus, the estimates indicate that nearly 1 billion of the extremely poor people in the world live in developing countries of which Kenya is one of them (World Bank, 2016). Majority of the poor are subsistence farmers in the rural areas where roughly 70% of the developing world’s 1.4 billion extremely poor people live. Increasingly, rural farmers are women taking on farming responsibilities left by men as they migrate to urban areas for jobs. This and the rise of commercial agriculture have continued the feminization of agriculture across regions, especially pronounced in Africa (World Bank, 2016).

In India, since the rural population is anchored on agriculture as the fundamental feeding source, foundations and projects have been established to empower farmers (Sehgal Foundation, 2014). The teams work in liaison with the farmers to identify and utilize agricultural practices which are practical and sustainable for each area so as to ensure sufficiency in food production. The empowerment is done through training, improving soil fertility and recommending sustainable farming practices for various crops. This has ensured improve productivity, income and living standards of the farmers (Sehgal Foundation, 2014).

FAO (2016) noted that, predominantly, dualistic farm structures exist across most of the transition countries in Europe leading to mainly subsistence and small-scale farming. This is attributable to poverty and the prevailing social vulnerability which makes it difficult for the small-scale farmers to maximize their potential which effectively leads to food insecurity leading to unsustainability. Thus, FAO envisages a scenario where it can enhance productivity through intensified production, training and better organization among through farmers. This is seen as empowerment of the population to realize their potential in farming and ensuring food security through sustainable farming.

Penunia (2011) observed that most small-scale farmers characterized by working on family farms in developing countries have fallen victims of the government’s lack of investment or under investment in small scale agriculture. This, Penunia (2011) highlighted that was a predominant case in India. The lack of/under investment in small
holder farms has deprived the farmers the capacity to exploit their potential and improve their livelihood. Specific challenges, according to Penunia (2011), is in the access of resources, poor policies not practicable to the existing situations, narrow and constrained markets for the produce, poor infrastructure for production and declining natural resource supplies. Thus, the farmers have found farming to be untenable due to risks and unprofitability which they cannot manage.

Consequently, farmers have made attempts to reverse these conditions and improve their livelihoods by improving food production and poverty reduction. This they have done through various empowerment strategies notably self-help groups as well as farmers’ organizations. According to Penunia (2011), the Farmers’ organizations and self-help groups help the farmers through skills training, providing farm inputs, produce processing and marketing. These practices ensure minimum loss in the agricultural produce, maximum production and thus maximum returns. The organizations benefit the farmers through derived economies of scale and reduced costs of production. Consequently, the farmers access large markets at competitive rates thus ensuring profitability of their ventures.

It has been observed that Commercial agriculture is the solution, but generally uses the conventional practice which is input-intensive. There is massive need for consistent and predictable cash flows for farmers to purchase synthetic fertilizers, use in pest control including purchase of pesticides and herbicides as well as monoculture of better yielding varieties through irrigation and artificial conditions. However, where reliance is on natural climatic conditions, there is massive crop failure, lower yields and overall poor returns which only perpetuates poverty among the populace (Ching, 2017).

Despite being capital intensive, empowering farmers to adopt commercial agriculture has numerous benefits among them: increased production, larger markets, quality products and premium prices for better return. This ensures sustainability of farming since the venture is profitable. The farmers are able to purchase input to further production (University of Leeds, 2010).

Providing incomes through employment is a key antipoverty strategy. The ADBI studies show a tendency for commercial agriculture to generate higher employment than conventional agriculture in cultivating the same crops thus improving sustainability.
Moreover, absorbing unskilled labor into commercial agriculture is less challenging than nonfarm sectors given the traditional farming knowledge of farmers in a marginal ecosystem, making them easily trainable for commercial farming since productivity and returns are increased.

With an aging farming population close to sixty 60 years (UNDP, 2011), showed that in a decade or two farming activities will reduce if this is not made attractive to participate in. In this decade, a lot of activities are being digitized, thus farming technologies should be modernized to make it interesting to participate in. These modern technologies reduce the bulkiness of agricultural work, increases the returns per unit area thus providing a regular income. The answer is in horticulture production for export, where only 4% of the total horticulture production is exported and 96% goes to the domestic markets. In 2012, the revenue from domestic horticulture was at Ksh 217 billion covered an extent of 662,835 hectare with a volume of 12.6 million tons produced, while the export market produced 380,000 MT of exported produce which was valued at Ksh 87 billion which is a contribution of a probable 36 percent of the agricultural GDP and is one of the fastest growing sub-sectors with growth rates of between 15 and 20 percent per year (Horticulture validated report, 2012).

In Kenya, the Smallholder Horticulture Empowerment and Promotion (SHEP) Approach project was initiated with the aim of is initiating an innovative development modality which was developed by the collaborative efforts of the government of Japan and Kenya. The horticulture empowerment was provided to the small holder farmers through improving the capacity in management of market oriented horticulture farming and their technical skills to produce as per the market requirements. Through this approach, the farmers have been able to raise incomes from horticulture. Other interventions that were promoted through the SHEP initiative include business linkage establishment between service providers and the farmers, strengthening farming couples through promotion of gender equality trainings, introduction to saving culture, use of horticulture as a form of employment and farmer initiated market surveys. The SHEP initiative resulted in improved productivity and farmers’ incomes through the horticulture initiatives and their livelihoods have improved not only during the intervention period, but also for years after the intervention. This projects’ impact can be seen clearly from the now self-reliance the farmer groups have and the creativity in increasing the ventures into their horticultural farming businesses thus ensuring self-employment (JICA report, 2014).
In Sierra Leone today, farmers face a disheartening constraint: an economic scenario where acquiring honest employment especially in rural areas has been largely brought about by lack of job opportunities. An array of other issues further worsens the situation due low educational levels of many young people and inadequate work experience leading to low demand for labor. This employment constraint has been given precedence by the Government of Sierra Leone (GoSL) and is a key factor to its national development agenda in both the Prosperity Agenda (2013 -2017) and Agenda for Change (2008 -2012).

2.3 Credit Access and Sustainability of Horticultural Farming
That agriculture is a fundamental sector in Kenya economy is not questionable. Further, it acknowledged that agriculture is capital intensive (Economic survey, 2018). Thus, the availability and accessibility of such credit to facilitate agricultural production is significantly important. Farmers need to access the capital through credit in a timely manner and at affordable cost from the institutions and agencies, which provide such facilities.

According to World Bank (2015), approximately (70%) of all SMEs in developing markets lack access to credit making it difficult for SMEs business to survive. In as much as the gap varies significantly between regions and countries, it is particularly wide in Africa and Asia. In Africa, access to credit gap for formal SMEs was estimated to be US$ 1.2 trillion, while the credit gap for informal SMEs stood at US$ 1.4 trillion. The World Bank study further suggests that between 365-445 million SMEs are in the emerging markets, out of which, about 30 million are formal SMEs; about 70 million are formal micro enterprises, and about 345 million are informal enterprises. One of the major challenges emerging markets face is moving informal SMEs from the informal sector to the formal sector, to enable them enhance access to financial credit and other government support services. The large number of SMEs both in the in the formal and informal sector need better access to finances (Rambo, 2013). Therefore, enhancing access to finance to SMEs will not only enhance their capability to be established and to thrive, but also expand governments’ development and growth, in addition to reducing unemployment (Niskanen, 2010). Most agricultural ventures in Africa and the rest of the third world, Kenya included, are SMEs.
The financial system in most of Africa is under-developed however and so provides few financial instruments. Capital markets are in their infancy; shareholding is rare and no long-term financing is available for SMEs. Non-bank financial intermediaries, such as microcredit institutions, could be a big help in lending money to the smallest SMEs but they do not have the resources to follow up their customers when they expand (Badulescu & Badulescu, 2010). Bank loan is the principal source of external financing for SMEs. Low productivity banks find it costly to evaluate and monitor small-value loans. Introduction of public credit institutions, such as a CRB makes the evaluation of firm credibility cheaper for banks; however, lack of adequate market penetration of CRB information concerning SMEs dissuades them from lending to small enterprises. Moreover, deficiencies in the legal system hinder the enforcement of contracts, especially debt, and result in relatively high collateral requirements that small firms find slightly more difficult to meet (Rambo, 2013).

SMEs require easy access to short and long term capital. In general terms, it appears that lending to SMEs is seen as a high-risk business since most of these enterprises lack collateral. The problem does not appear to be lack of funds but rather how to make them accessible to SMEs by increasing information symmetry between SME to external financiers (Badulescu & Badulescu, 2010). Credit ensures that farmers can purchase the necessary farm inputs while also engaging the right labour skills and farm practices to ensure efficiency and sustainability in production (Maitima, Rakotoarisoa & Kang’ethe, 2010). This becomes even more necessary due to the nature of farm holdings in Kenya as well as the varying climatic conditions. The small-scale nature of the farmers makes it difficult for them to have the necessary security required by mainstream financial institutions to secure credit. Thus, the concern of the Kenyan Government is to provide accessible and affordable credit to the farmers.

Similarly, in India, the Government has incorporated and commissioned several policy measures to ensure the accessibility of farmers to the institutional sources of credit. The programmes set by the government focus on progressively institutionalizing credit facilities accessible to small scale farmers in the vulnerable sphere of the society so as to enable them acquire modern technology in farming as well as modern farming practices to increase productivity (Ramakrishnan & Kumar, 2010). The policy, in India, is implemented through planning, adoption of tailor-made strategies unique to each area and
streamlining the lending process thus increasing uptake of institution-based credit among the vulnerable households (Setboonsarng et al., 2005).

To this end, the government established Kisan Credit Card Scheme for small scale farmers to ensure ease and timely access of credit in 1998/99. Through the credits the farmers can promptly and regularly plan to purchase farm inputs including seeds and fertilizers during planting seasons as well as pesticides for subsequent pest control. The card is an initiative implemented nationally through commercial banks and cooperatives thus facilitative structural flow of agricultural activities (Ramakrishnan & Kumar, 2010). Further, the Government of India has been able to cover farmers on personal accidents thus securing them against personal injuries and accidental death, a strategy aimed at poverty eluviation.

From the market laws, the type and amount of benefits available to farmers is based on their bargaining strength which inherent in the asset and scale of operation of the venture. In general, small enterprises or farming units do not have access to adequate capital as they have few assets and lack alternative income (Key & Runsten, 2009). Consequently, if such farms organize themselves into groups, their asset and income increase allowing for easy access of affordable and significant credit (Glover, 2007; King, 2002). The credit offering firms will have sense of security in providing credit to organized farmers groups than individuals. The groups then can ensure the farmers have access to the input they require while also searching for markets for the produce.

According Grosch (2014), the farmers’ in their groups benefit from contract farming through communication between the credit lenders and the farmers’ organization, training of individual farmers, guarantee for higher loans as well as larger economies of scale. Thus, the government can facilitate farming and ensure sustainability by regulating contract farming. This can be done through providing complementary infrastructure and regulations on the contract terms and creating joint ventures between the contracting firms and the farmers’ organizations.

A paper done by the Rwandan Government (2011) on programs dealing with financial access to farmers revealed that the financial sector where an estimated 12% of total credit is provided to farmers even though they are important contributors to private enterprise. Lending to farmers comprises a portfolio of 22% and 23% specifically from MFIs and
SACCOs respectively. This is even with the 2011 Establishment Census showing that with the exclusion of farmers’ participation in agriculture, 26% of the enterprises are led by women.

Agricultural credit constraints according to Minh Chau Tran et al (2016) there are some problems or constraints in access to agricultural credit. Agricultural credit problems will be related to the condition of a region or country. Credit as an important source to improve the welfare and production of farm households. But in the process, it is almost the same as incidence in many other developing countries, in rural Vietnamese agricultural households accessing credit to formal financial institutions is exempt due to high transaction costs and information asymmetries, lack of guarantees; weak credit contract enforcement and underdevelopment of insurance services make formal financial managers unable to serve the market this. Another problem in accessing credit is the different treatment in the ease of obtaining credit. The distinguishing factors are the characteristics of head of household (age, sex and education), household characteristics (factors related to physical capital, factors related to human capital, social capital related factors and factors related to the economy), factors geographical factors (distance to markets or formal lenders increase the transaction costs of households, the livelihood of local credit institutions and the development of local production.

With the constraints in accessing credit, it will certainly affect the production activities and welfare levels of farmers. Mamudu Abunga Akudugu (2016) examined the relationship between Horticultural agricultural productivity and credit in a paper entitled "Agricultural productivity, credit and farm size in Ghana: a case study of Ghana. Overall, the results show that formal and informal credits have a positive and significant effect on agricultural productivity. The impact of formal credit on agricultural productivity is lower than that of informal credit. Although the size of the land is found not to be a linearly significant determinant of agricultural productivity of farm households, the quadratic term is. The implication of the results of this study is that efforts to promote agricultural productivity in Africa in general and Ghana in particular should focus on finding the right size of agricultural land for farmers taking into account the context in which farmers operate to be able to produce so as to produce at optimal Pareto.
In making policy interventions in increasing agricultural productivity in Africa and Ghana in particular should be in accordance with the size of land owned by farmers. This is to ensure that farmers operate within the appropriate range of farm sizes that will make them economically viable. In addition, pre-harvesting contracts that are used as a proxy for market access have an insignificant effect on agricultural productivity. This suggests that interventions aimed at improving agricultural productivity should not focus on providing pre-harvest market contracts as this may lead to a decrease in productivity.

In Kenya, the involvement of state in the promotion of contract farming not only ensures access of credit, but also crucial in eliminating opportunistic behavior that exploits small scale farmers thrashing them into vicious cycles. Similarly, Simmons (2002) emphasized the role of governments in regulating the financial market to offer safeguards against abuse in the agro-business sector to curtail its power. Further, Pham (2005) asserted the government’s role in improving conditions of micro and macro farming enterprises through contract farming. Specifically, the government has designed changes which reduce contracting costs while also providing training, research, provision of extension services to farmers and also acting as an arbiter in the dispute resolution among the contracting parties viz. the firms and the farmers’ organizations. Training programs for smallholders in literacy, accounting, and cash management reduces communication challenges and improves ability to repay credit thus helping the smallholders to transit from the micro to macro statuses (Dollo, Chaudhury & Sundriyal, 2006).

2.4 Technology and Sustainable Horticultural Farming

Agriculture being a global practice exploits resources faster leading to imbalance in the environment in form of soil erosion, pollutions, wildlife shifts among others. Hutchins (2013) asserts that agricultural practices are undeniably "unnatural", regardless of whether the production is a one square meter vegetable garden in Tokyo or a one million hectare rubber tree plantation in Malaysia. Credible arguments have been advanced to suggest that production of food via high-yield agriculture techniques can meet the nutrition requirements of the global population (Avery, 1995). Ndungu et al., (2005) in their study ‘the role of non-governmental organizations in extension’ published that the development and uptake of new agricultural technologies would clearly benefit from a closer collaboration of existing research institutes and NGOs in the study area.
According to AATF, The NBA has approved open-air trials of Biotechnology (But) maize; which could be selling by 2018. But maize is among seven crops that have been under controlled trials in the country at KARI. The others are BT cotton, drought-tolerant maize, bio fortified sorghum, viral resistant cassava, nutritionally enhanced cassava and gypsophila paniculata cut flowers. The approval of the WEMA but maize will go a long way mainstreaming the use of science, Technology and innovation in boosting Kenya’s food security. It is notable that food insecurity is still a challenge for Kenya that is faced with recurrent food shortages, especially maize, which occasionally necessitate food imports.

Today, research in agriculture has provided a range of technologies/practices to ensure increased productivity and sustainable agriculture. This includes use of improved seeds, chemical fertilizers, modern machinery, integrated pest management, and contacts with extensions agents. These technologies have been introduced and used from the last three decades but in spite of all this most of the developing counties have failed to achieve the desired goals of the development (Ahmad, 2007). Increasing number of NGOs in the agricultural development opt to introduce new technology at the same time train the farmers to ensure utilization. Prasad (1994) in his findings argued that training remains an important mechanism for the transfer of technology and improvement human skills in agriculture.

The supply of inputs effectively is essential more so when there is change of technology or an advancement of the same. According to Tripp (2001), low supply of seeds has slowed the adoption of new varieties of crops. Omamo and Mose (2001) argue that increasing fertilizer use has been curtailed by issues to do with the provision of the right products packed in affordable units. The major problems for many innovations are not the conventional seed chemical technologies but the establishing the systems to provide those inputs. Wambugu and Kiome, (2001) argue that in order one to deliver banana plantlets in Africa; a network of intermediary nurseries is required. Bohringer and Ayuk, (2003) further argue that nurseries are essential for the growing of many technologies but getting farmer groups to adopt this has not been easy.

Technological change is an important factor in economic growth and development. Historical experience suggests that technology, by raising productivity of factors (e.g. labor, capital, land and other natural resources), played an important role in economic
growth (Tisdell, 1988). Though developed countries, being the forerunner in technological innovations, benefited most from technological change, particularly industrial technology, and the developing countries also benefited from the technological innovations, particularly in agriculture (Hayami and Ruttan, 1985).

In Bangladesh, it is increasingly felt that the productivity from this new agricultural technology is declining and is a threat to sustainability of economic development (Alauddin & Tisdell, 1991). Conway (1986) suggested that alternative agricultural technologies need to be judged against the criterion of stability (of yields and incomes) and sustainability (of production and yield). In recent years, focus of evaluation has shifted on considering the sustainability of the ecosystems and environmental factors on which agriculture depend (Alauddin & Tisdell, 1991 and Redclift, 1989). Adoption of modern technology is dependent upon availability of land, irrigation facilities, fertilizers, pesticides, infrastructure, human capital, etc. Also, it was widely accepted that there is a greater degree of complementarily in these sets of technologies: water control, biological (new seed varieties) and chemical (fertilizers) technologies (Hayami & Ruttan, 1985). Moreover, since the ‘Green Revolution’ technology is modern input intensive, it subsequently increased dependency on imported inputs.

Further, it is agreeable that farmers will always adopt new skills to increase production for family consumption. But chances of farmers innovating and investing in terms of cash, labor or learning are highly motivated by the knowledge of markets that are secure. It is argued that the government’s role in stabilizing output prices was the key feature of many successful early Green Revolution environments. The same cannot be said in Africa was a function which has been dismantled in Africa where innovation has been limited (Forward, 2004). Unreliable maize markets in Malawi have made many farmers to do farming inefficiently, (Orr & Orr, 2002).

To a large extent, the rate of technological development and the degree of innovation in future technologies will greatly influence the stability, and certainly the productivity, of agriculture (Hutchins and Gehring, 2003). Technology, in the classical sense, includes the development and use of nutrients, products for pest control, crop cultivars and agricultural equipment; but it also includes the vision of genetically modified crops that provide greater nutritional efficiency (more calories per yield or more yield), the manipulation of
natural pest control agents and the use of farm management techniques that focus on productivity of the entire farm over time, not just annual production per hectare. Consider the basic premise of biotechnology: the least expensive and most renewable energy source on Earth is the sun and the most abundant and predictable mechanism to convert the sun's energy into usable energy is photosynthesis: biotechnology has allowed methods to direct abundant natural sources. energy for new more efficient or unique food products. Kader (2002) imagination is literally the limit of opportunities. The short-term objectives, of course, will focus on performance, quality and the reduction of inputs. However, in the long term, genetically created "transmissions" will focus on creating super nutritious food for animals, plants that produce the subtractive influence of pests (making "tolerance" a key pest management tactic) physiological adaptation to overcome competition from adjacent species (eg, weeds), drought stress tolerance and general improvement in the rate of photosynthesis (which leads to any number of industrial applications).

2.5 Chapter Summary
In this chapter literature has been reviewed thematically. The first sub-section reviewed literature in terms of empowerment and sustainability, followed by adoption of technology and sustainability. The last sub-section provides literature in terms of access to credit and sustainability. The next chapter provides the research methodology followed by results and findings in chapter four. The last chapter provides summary, discussion, conclusion and recommendations.
CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Introduction
This chapter describes the methodology that was used in conducting the study. This includes: The research design; target population, sampling design and procedures; research instruments for data collection; the research process; validity and reliability of the research instruments as well as data processing and analysis techniques.

3.2 Research Design
Research design refers to the procedures selected by the researcher for studying a particular set of questions or hypothesis, this includes the researcher’s choice of quantitative or qualitative methodology, and how, if all, causal relationships between variables or phenomena are to be explored (Orodho, 2003). Research design is therefore, a summation, strategy applied to aid in realizing feedback to a problem in analysis. Thus, this study adopted descriptive design which was used to generate detailed information regarding the key aspects in order to develop profiles of those aspects and causal design aimed at determining causal factors. This can be done when enough information is available for testing cause and effect relationships in a phenomenon. This study will focus on the factors influencing sustainability of Horticultural farming in Kenya: A case of Kiambu County. The study used a descriptive research design, which seems ideal for the purpose of the study.

3.3 Population and Sampling Design
This section focuses on study population, sample size, sample frame and sampling techniques to help in research on factors influencing sustainability of horticulture farming in Kenya: A case of Kiambu County.

3.3.1 Population
According to Mugenda and Mugenda (2003), an acceptable sample size should be between 10 to 30 percent of the target population. Sometimes if the target population is below 200, the researcher may sample half of the population. Mugenda and Mugenda is supported by Marshalls (2012) who says half of the population is less than 200. This brings authenticity to the findings that the researcher may come up with. Population means all elements and people who share one or some common quality in a special
geographical scale. Cooper and Schindler (2009) also describe a population as the total collection of elements whereby references have to be made. In this study the target population will be all people directly involved in farming. According to the annual development plan of the County Government of Kiambu (2017/2018), there are 304,449 people who are directly or indirectly employed by farming and agriculture related activities of which 121,780 are farmers of varying scales (County Government of Kiambu, 2016). This formed the target population.

3.3.2 Sampling Design

A sample is a group from the population that is the representative of the population (Banerjee & Chaudhary, 2014). Sampling design is a technique used in selecting a proportionate representation from the total sample size which is the population under study. Sampling enables: lower cost, accuracy of results, increased speed of data collection, and availability of population elements. Sampling design is a working plan specifying the population frame, sample size, sample selection, and estimation method in detail.

3.3.2.1 Sample Frame

According to Saunders, Lewis and Thornhill (2016), a sampling frame can be defined as a list of all the cases in the target population from which the sample is drawn. Without the sampling frame the researcher cannot select a probability sample. In this study the list of small scale horticultural farmers from Kiambu County, Kenya obtained from Ministry of Agriculture was the sampling frame.

3.2.2.2 Sampling Technique

Sampling technique refers to the method or procedure the research intends to obtain the study sample from the target population based on a defined statistical principal. This study used stratified random sampling technique. Stratified random sampling is a modification of random sampling in which the population is divided into two or more relevant and significant strata based on one or more attributes (Saunders, et. al., 2016). This sampling design was used because it is deemed suitable for a highly concentrated geographical area where face to face contact is required and also where the population can be divided into two or more sub units based on certain internal characteristics.
(Mugenda and Mugenda, 2003). The advantage of stratified sampling is said to be its ability to ensure inclusion of subgroups, which would otherwise be omitted entirely by other sampling methods because of their small number in the population. The sample size of 384 was divided uniformly across the 12 Sub Counties of Kiambu County to ensure that each Sub County was adequately represented in the study.

3.3.3 Sample Size

The sample size is an important feature of any empirical study as inferences about a population are made from a sample (Creswell, 2014). A sample is a selection of respondents chosen in such a way that they represent the total population as fairly as possible; a representative sample comprises a sample in which each and every member of the population has an equal and mutually exclusive chance of being selected (Banerjee & Chaudhary, 2014).

Banerjee and Chaudhary (2014) acknowledges that stratified random sampling technique produces sample of entire population with high accuracy and ensures that a representative sample is obtained from a population that is homogeneous. Stratified random sampling technique was considered appropriate since it leads to fair representation of the groups. Within each stratum, the researcher used simple random sampling technique to select the respondents. Simple random sampling was considered appropriate since it gave all respondents an equal chance of being selected as a study respondent.

The sample size was determined using the Krejcie and Morgan (1970) For the purposes of this study, the Yamane (2001) formula was used to determine the sample size within each stratum of the Horticultural farming. The Yamane (2001) formula was considered appropriate for use in this study, first, because it is easy to use, and second, because empirical data shows this formula is widely accepted for determining sample sizes in different contexts. It is evident that in any sampling situation, complete accuracy cannot be guaranteed and conventional precision errors which are widely accepted include precision errors of 0.01, 0.05 and 0.1. The precision error for this study was 0.05.

For the purpose of this study, where the population comprised all the horticultural farmers in Kiambu county, a confidence level of 95% was considered acceptable thereby allowing for a margin of error of only 5% within the sampling calculation. In the domain of social sciences, a precision error of 0.05 has wide acceptance. The formula is as given here-below:
\[ n = \frac{N}{1 + N(e)^2} \]

Where:

- \( n \) refers to the sample size
- \( N \) is the population
- \( E \) is the margin of error—5%.

### 3.4 Data Collection Methods

The study used a questionnaire as the main tool for collecting data. Gay (1996) explains that descriptive data are usually collected using questionnaires. Others like Simons (1998); Cohen and Manion (1998) have also identified questionnaires and interviews as crucial instruments of data collection in descriptive research. A questionnaire is an instrument specifically designed to elicit information that was useful for analysis (Babbie, 2009). This study adopted both the open ended and closed type of questionnaires; the questionnaires were administered by the researcher on the respondents to gather and recorded their responses. The questionnaire was divided into two sections with section a capturing questions aimed at obtaining general information about the respondents, while section B contained questions based on thematic issues of the study.

### 3.5 Research Procedure

Relevant authorization from the University was sought from where the researcher obtained an introduction letter to be given to the respondent. The researcher then sought research permit from National Council for Science and Technology Innovation (NACOSTI) to conduct the research. The letter defined the purpose and geographical coverage of the research. After obtaining the letter of introduction, the researcher conducted a reconnaissance to enumerate the possible respondents in the study area and assigned them arbitrary numbers to be used for random sampling. The arbitrary coding was done to categorize the participants into two categories: directly and indirectly involved in farming as defined in the sample frame. When sampling, the researcher wrote down the arbitrary numbers and put them into three boxes based on the three categories. From these boxes, the numbers were picked randomly until the maximum sample size for each category was reached. Having identified the sampled participants, the researcher
visited the villages to introduce the study and book appointments to administer the questionnaires. Completed questionnaires were collected, checked and filed for data entry and analysis.

3.6 Data Analysis Methods
Data analysis started with data entry which started as soon as questionnaires were collected from the field and sorted. Data was entered into excel spreadsheet for subsequent qualitative analysis. Data was analyzed using descriptive statistics to include mean, median and mode and presented into frequency tables, pie charts and graphs. The data obtained from farmers were summarized and responses analyzed to give frequency of the farmers favoring particular views. Consequently, percentages were computed to show prevalence of each view. The analyses were in terms of both descriptive and inferential statistics to obtain frequency tables, charts, correlation ANOVA and regression.

3.7 Chapter Summary
This chapter describes the methodology that was used in conducting the study. This includes: The research design; target population, sampling design and procedures; research instruments for data collection; the research process including validity and reliability of the research instruments as well as data processing and analysis techniques. The next chapter provides results and findings followed by summary, discussion, conclusion and recommendations in chapter five.
CHAPTER FOUR

4.0 RESULTS AND FINDINGS

4.1 Introduction

This chapter presents the data analysis findings and the presentation of the data in relation to the research question. Questionnaires were used in collecting data. The chapter begins by presenting the demographic information of the respondents of the study. The findings were presented following the three main research questions. Analyses, presentations and interpretation have been made based on the responses of the participants. Generally, responses were coded and processed through the use of SPSS. The findings were presented in frequency tables, pie charts and bar chats.

4.2 Background Information and Response Rate

In order to understand the suitability of the respondents in providing information for the study, the researcher collected information on their background as well as the demographics. These included age, gender, level of education and duration taken in horticultural farming. Further, the researcher considered the dully filled questionnaires against the number issued to establish whether the returned questionnaires were sufficient for analysis. Response rate and background information is presented in the subsequent sub-sections.

4.2.1 Response Rate

The study sampled 384 horticulture farmers and persons engaged in related activities within Kiambu County. Thus questionnaires were issued out to the respondents who filled in then returned to the researcher. The questionnaires were verified and checked for completeness upon which 341 questionnaires were found to be complete and subsequently used for analysis thus giving a return rate of 88.8%. According to Mugenda and Mugenda (2003), a return rate of at least 60% is considered adequate for social sciences research. Thus, the attained response rate was deemed adequate for the study. Figure 4.1 shows the response rate.
The researcher sought information on the distribution of respondents by age groupings. This was in cognizant of the fact that different age groups prefer different income generating activities as their engagement. Thus the respondents indicated the age group they belonged which was summarized and presented in the bar chart in Figure 4.2. From the findings, majority of the study participants (66.3%) were aged 40 years or more with another 29.6% aged between 20 and 39 years. However, only 4.1% of the participants were aged below 20 years. This shows that majority of those who favor or are engaged in horticultural farming were elderly. In general, the youth tend to keep away from farming including horticulture.
4.2.3 Gender of Respondents

Similarly, the researcher sought to establish the extent to which the composition of participant was representative in terms of gender. The self-reported gender was summarized and presented in the pie chart in Figure 4.3. From the findings, the study participants were almost evenly distributed in terms of gender with male participants (51.9%) being the slight majority compared to the female participants who were 48.1%. This shows that the views across gender were adequately represented in the findings.

![Distribution of Respondents by Gender](image)

*Figure 4.3: Distribution of Respondents by Gender*

4.2.4 Level of Education

Horticultural farming is not a traditional farming practice in Kenya. Thus, knowledge through academic systems and programmes induces the possibility of various individuals engaging in the practice. Consequently, the researcher sought to establish the level of education attained by the participants so as to be able to understand their involvement and practice of horticultural farming. The findings were summarized and presented in the bar chart in Figure 4.4. From the findings, majority of the participants (37.2%) had basic primary education with another 23.8% having non formal education. Thus cumulatively, 61% of the participants had primary education or no formal education at all. However, 18.5% of the participants had secondary education, 12% had diploma certificates with the other 8.5% having degree level of training as their highest level of qualification. The findings explain the low levels of involvement in horticulture attributable to lack of knowledge and exposure to take up the practice.
Understanding the duration the participants had taken the practice of horticulture was necessary in determining whether the participants had adequate information regarding horticultural farming in Kenya especially Kiambu County. Thus, the researcher categorized the respondents based on their duration in horticultural farming. The findings were summarized and presented in the bar chart in Figure 4.5. Majority of the study participants (54.8%) had practiced horticulture farming for between 1 and 5 years with another 36.7% having practiced horticulture for more than 5 years. However, only 8.5% of the participants reported having practiced horticulture for less than 1 year. This shows that majority of the participants had practiced horticulture for a considerably longer duration thus had adequate information relating to horticulture in Kenya.
4.2.6 Engaging in other Income Generating Activities

The researcher also sought to establish whether horticulture was the main and only income generating activity the participants engaged in. This will explain the commitment and reliance on the practice for livelihood. Thus, the participants were asked to indicate whether they engaged in other income generating activities away from horticulture farming. The findings were summarized and presented in the pie chart in Figure 4.6. From the findings, majority of the participants (69.5%) engage in other income activities away from horticulture with only 30.5% of the participants having horticulture as their only income generating activities. This shows that majority of the residents of Kiambu, and by extension Kenyans, do not rely on agriculture thus the low extent to which it is practiced. About 30.5% who rely on horticulture represent a significant proportion thus the need for increased funding and use of technology to make it reliable and sustainable.
4.3 Empowerment and Sustainability of Horticultural Farming

The first research question sought to find out the extent to which empowerment influences sustainability of horticultural farming in Kiambu County in Kenya.

4.3.1 Descriptive Findings on Empowerment and Sustainability

A 5 item 3-point Likert scale was developed to measure the extent to which empowerment influenced horticultural farming in which respondents were rated the items as rarely, sometimes and always. The items sought views on the ratings by the respondents on various conceived circumstances in horticultural farming.

The finding shows that majority of the study participants do not take part in activities of the farmers’ group. Specifically, Majority of the participants (52.5%) indicated that they participate in the activities of farmers groups in Kiambu County only sometimes with another 67 (19.6%) indicating that they rarely participate. However, there is a significant 95 (27.9%) of the study participants who indicated that they always participate in the activities of farmers groups in Kiambu County giving a mean = 2.08 (SD = 0.342).

Further, the study found that majority of the study participants 169 (49.6%) believe that through the farmers groups in the County, Horticultural farmers receive training and financial support to improve their farming activities but only sometimes with another 55 (16.1%) indicating that horticultural farmers rarely receive training and financial support despite 117 (34.3%) agreeing. Similarly, majority of the participants 199 (58.4%) indicate that the government rarely organizes training for horticultural farmers in Kiambu.
County with another significant 97 (28.4%) indicating that the government only sometimes organize training for horticultural farmers in Kiambu County.

The study also found that majority of the participants 203 (59.5%) indicated that they rarely attend training on modern horticultural farming methods with another 94 (27.6%) indicating that they sometimes attend training on modern horticultural farming methods. However, majority of the participants 214 (62.8%) reported that training always enhances horticultural productivity and sustainability while another 86 (25.2%) indicated that it sometimes enhances. Thus, cumulatively 88% of the participants believe that training enhances horticultural productivity and sustainability. The findings were summarized into frequency and percentage and presented in Table 4.1.

**Table 4.1: Empowerment and Sustainability of Horticultural Farming**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Always</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>I participate in the activities of farmers groups in Kiambu County</td>
<td>67</td>
<td>179</td>
<td>95</td>
<td>2.08</td>
<td>0.342</td>
</tr>
<tr>
<td>Through the farmers groups in the County, Horticultural farmers receive training and financial support to improve their farming activities.</td>
<td>19.6%</td>
<td>52.5%</td>
<td>27.9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The government organizes training for horticultural farmers in Kiambu County</td>
<td>199</td>
<td>97</td>
<td>45</td>
<td>1.55</td>
<td>0.712</td>
</tr>
<tr>
<td>I attend training on modern horticultural farming methods</td>
<td>203</td>
<td>94</td>
<td>44</td>
<td>1.53</td>
<td>0.381</td>
</tr>
<tr>
<td>Training enhances horticultural productivity and sustainability</td>
<td>41</td>
<td>86</td>
<td>214</td>
<td>2.51</td>
<td>0.207</td>
</tr>
<tr>
<td><strong>Aggregate</strong></td>
<td>33.12%</td>
<td>36.66%</td>
<td>30.22%</td>
<td>1.97</td>
<td>0.372</td>
</tr>
</tbody>
</table>

*4.3.2 Regression output for Empowerment and Sustainability*

In order to determine the effect of empowerment on sustainability of horticulture farming in Kiambu County, a regression analysis was conducted. To obtain values for regression, summated score on the empowerment scale was obtained with a minimum score of 3 and
a maximum score of 15 for the 5 items in the scale for each of the respondents. Similarly, summated scores for sustainable horticulture farming were obtained. The findings in the regression output shows that $R^2 = .052$ (p < .001). Thus empowerment accounts for 5.2% of sustainability in horticulture farming. This was found to be statistically significant as p < .05 thus for positive change towards empowerment results into enhanced sustainability of horticulture farming. Table 4.2 shows the model summary.

**Table 4.2: Model Summary Empowerment and Sustainability**

<table>
<thead>
<tr>
<th></th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model Summary</td>
<td>.229a</td>
<td>.052</td>
<td>.050</td>
<td>3.67180</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Sustainability of Horticultural Farming

The ANOVA table shows that regression is a good fit for modeling the data with $F(1, 339) = 252.589$ (p < .001; < 0.05) as the model is statistically significant. Thus, there is a statistically significant difference in mean between empowerment and sustainability of horticulture farming in Kiambu County. The ANOVA table is presented in Table 4.3.

**Table 4.3: ANOVA for Empowerment and Sustainability of Horticulture Farming**

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>252.589</td>
<td>1</td>
<td>252.589</td>
<td>18.735</td>
<td>.000b</td>
</tr>
<tr>
<td>ANOVAa Residual</td>
<td>4570.449</td>
<td>339</td>
<td>13.482</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4823.038</td>
<td>340</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. Predictors: (Constant), Empowerment

The co-efficient of the constant term ($B = 9.778; p < 0.001$) and the coefficient of empowerment ($\beta = .229; p < .001$) are statistically significant as p < 0.05. This shows that empowerment statistically significantly affects sustainability of horticulture farming such that, for every unit positive increase in empowerment, sustainability of horticulture farming increases by 0.229. The coefficients Table is presented in Table 4.4.

**Table 4.4: Regression output for Empowerment and Sustainability**

<table>
<thead>
<tr>
<th>Coefficientsa</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>9.788</td>
<td>.592</td>
<td>16.528</td>
<td>.000</td>
</tr>
<tr>
<td>Empowerment</td>
<td>.358</td>
<td>.083</td>
<td>.229</td>
<td>4.328</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Sustainability of Horticultural Farming
b. Predictors: (Constant), Empowerment
4.4 Credit Accessibility and Sustainability of Horticultural Farming

The second research question sought to establish the extent to which credit accessibility influence sustainability of horticultural framing in Kiambu County in Kenya.

4.4.1 Credit Accessibility and Sustainability

A 5 item 3-point Likert scale was developed to measure the extent to which credit accessibility influenced horticultural farming in which respondents were expected to rate the items as rarely, sometimes and always. The items sought views on the ratings by the respondents on various conceived circumstances on credit accessibility in horticultural farming.

The findings show that majority (73.6%) of the participants agreed that there is need for financial capital to improve and sustain their farming ventures with a further 17% being neutral in regard to the statement. However, only 9.4% of the participants disagreed that they needed financial capital to improve their horticultural ventures. Further, majority of the respondents 147 (43.1%) disagreed that farmers groups provide sufficient funds for farmers to invest in horticulture with another 104 (30.5%) not being sure whether that was the case. On a positive note though, 90(26.4%) of the participants agreed that farmers groups provide sufficient funds for farmers to invest in horticulture.

Similarly, majority of the respondents 193 (56.6%) disagreed that the government provides affordable credit to horticulture farmers for their activities with only 15.8% of the participants agreeing that they receive affordable credit from the government to support their activities. The study also found that an overwhelming majority of the participants (66.6%) disagreed while 19.1% were not sure thus neutral. This is an indication of the tedious and complicated process of acquiring credit from financial institutions thus affecting the activities of horticultural farmers. However, the participants acknowledged the role of credit in improving their ventures through investing in modern technology and practices. Based on this view, despite majority of the participants (43.7%) disagreeing that availability of credit us enabled me to invest in modern practices and promote my horticulture farm, a significant 103 (30.2%) agreed. The findings were summarized into frequency and percentage and presented in Table 4.5.
Table 4.5: Credit Accessibility and Sustainability of Horticultural Farming

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is need for financial capital to improve and sustain our farming</td>
<td>251</td>
<td>58</td>
<td>32</td>
<td>2.64</td>
<td>0.197</td>
</tr>
<tr>
<td>ventures</td>
<td>73.6%</td>
<td>17.0%</td>
<td>9.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farmers groups provide sufficient funds for farmers to invest in horticulture</td>
<td>90</td>
<td>104</td>
<td>147</td>
<td>1.83</td>
<td>0.892</td>
</tr>
<tr>
<td></td>
<td>26.4%</td>
<td>30.5%</td>
<td>43.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The government provides affordable credit to horticulture farmers for their activities.</td>
<td>54</td>
<td>94</td>
<td>193</td>
<td>1.59</td>
<td>0.531</td>
</tr>
<tr>
<td></td>
<td>15.8%</td>
<td>27.6%</td>
<td>56.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The process of acquiring credit from financial institutions is clear and readily accessible.</td>
<td>49</td>
<td>65</td>
<td>227</td>
<td>1.48</td>
<td>0.213</td>
</tr>
<tr>
<td></td>
<td>14.4%</td>
<td>19.1%</td>
<td>66.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability of credit us enabled me to invest in modern practices and promote my horticulture farm.</td>
<td>103</td>
<td>89</td>
<td>149</td>
<td>1.87</td>
<td>0.653</td>
</tr>
<tr>
<td></td>
<td>30.2%</td>
<td>26.1%</td>
<td>43.7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Aggregate</strong></td>
<td><strong>32.08%</strong></td>
<td><strong>24.06%</strong></td>
<td><strong>43.88%</strong></td>
<td><strong>1.88</strong></td>
<td><strong>0.497</strong></td>
</tr>
</tbody>
</table>

4.4.2 Regression Results for Credit Accessibility and Sustainability

In order to determine the effect of credit accessibility on sustainability of horticulture farming in Kiambu County, a regression analysis was conducted. To obtain values for regression, summated score on the credit accessibility scale was obtained with a minimum score of 3 and a maximum score of 15 for the 5 items in the scale for each of the respondents. Similarly, summated scores for sustainable horticulture farming were obtained. The findings in the model summary shows that $R^2 = .040$ (p < .001). Thus credit accessibility accounts for 4.0% of sustainability in horticulture farming. This shows that
changes in credit accessibility with positive effect results into proportionate increase in sustainability of horticulture farming.

**Table 4.6: Model Summary Credit Accessibility and Sustainability**

<table>
<thead>
<tr>
<th>Model Summary</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.199</td>
<td>.040</td>
<td>.037</td>
<td>3.69632</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Sustainability of Horticulture Farming

The ANOVA table in the regression output shows that regression is a good fit for modeling the data with F (1, 339) = 14.006 (p < .001; < 0.05) as the model is statistically significant. Thus, there is a statistically significant difference in mean between credit accessibility and sustainability of horticulture farming in Kiambu County. ANOVA output is presented in Table 4.7.

**Table 4.7: ANOVA output for Credit Accessibility and Sustainability of Horticulture Farming**

<table>
<thead>
<tr>
<th>ANOVAa</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>191.357</td>
<td>1</td>
<td>191.357</td>
<td>14.006</td>
<td>.000b</td>
</tr>
<tr>
<td>Residual</td>
<td>4631.681</td>
<td>339</td>
<td>13.663</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4823.038</td>
<td>340</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. Predictors: (Constant), Credit Accessibility

The co-efficient of the constant term (B = 10.091; p < 0.001) and the coefficient of credit accessibility (β = .199; p < .001) are statistically significant as p < 0.05. This shows that credit accessibility statistically significantly affects sustainability of horticulture farming such that, for every unit positive increase in credit accessibility, sustainability of horticulture farming increases by 0.199. The coefficients are presented in Table 4.8.

**Table 4.8: Regression output for Credit Accessibility and Sustainability**

<table>
<thead>
<tr>
<th>Coefficientsa</th>
<th>Unstandardized</th>
<th>Standardized</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>10.091</td>
<td>.599</td>
</tr>
<tr>
<td>Credit Accessibility</td>
<td>.307</td>
<td>.082</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Sustainability of Horticulture Farming
b. Predictors: (Constant), Credit Accessibility
4.5 Adoption of Emerging Technology and Sustainability of Horticultural Farming

The third question sought to find out how adoption of emerging technology influences the sustainability of horticultural farming in Kiambu County in Kenya.

4.5.1 Descriptive Statistics Results for Adoption of Emerging Technology and Sustainability

A 5 item 3-point Likert scale was developed to measure the extent to which adoption of emerging technologies influenced horticultural farming in which respondents rated the items as rarely, sometimes and always. The items sought views on the ratings by the respondents on various conceived emerging technologies in horticultural farming. The study found that majority of the participants 212 (62.2%) disagreed that they were adequately aware of the available technology for use in horticulture farming. Further, 25.5% of the participants were unsure as to whether they were adequately aware of such technologies choosing to be neutral to the statement. Similarly, whereas 102 (29.9%) of the participants agreed that use of technology in horticulture farming has enhanced productivity and sustainability of their venture, an almost equal proportion (28.7%) disagreed with the other 41.3% being neutral.

The study also found that the participants overwhelmingly (72.7%) disagreed that they were able to afford the available technology for use in horticultural farming with only 8.5% agreeing that they were able to afford the available technology for use in horticultural farming. However, majority of the participants indicated that the use of technology has made it possible to store our products in good conditions thus attract good value for our products (43.1%) and that technology has increased efficiency and magnitude of production of horticultural produce (40.5%). The findings were summarized into frequency and percentage and presented in Table 4.9.
Table 4.9: Adoption of Emerging Technology and Sustainability

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am adequately aware of the available technology for use in horticulture farming</td>
<td>42</td>
<td>87</td>
<td>212</td>
<td>1.50</td>
<td>0.497</td>
</tr>
<tr>
<td>Use of technology in horticulture farming has enhanced productivity and sustainability of my venture.</td>
<td>102</td>
<td>141</td>
<td>98</td>
<td>2.01</td>
<td>0.298</td>
</tr>
<tr>
<td>I am able to afford the available technology for use in horticultural farming.</td>
<td>29</td>
<td>64</td>
<td>248</td>
<td>1.36</td>
<td>0.751</td>
</tr>
<tr>
<td>Use of technology has made it possible to store our products in good conditions thus attract good value for our products.</td>
<td>147</td>
<td>94</td>
<td>100</td>
<td>2.14</td>
<td>0.213</td>
</tr>
<tr>
<td>Use of technology has increased efficiency and magnitude of production of horticultural produce.</td>
<td>138</td>
<td>74</td>
<td>129</td>
<td>2.03</td>
<td>0.253</td>
</tr>
<tr>
<td><strong>Aggregate</strong></td>
<td>26.86%</td>
<td>26.98%</td>
<td>46.14%</td>
<td>1.01</td>
<td>0.402</td>
</tr>
</tbody>
</table>

4.5.2 Regression Results for Adoption of Emerging Technology and Sustainability

In order to determine the effect of adoption of emerging technology on sustainability of horticulture farming in Kiambu County, a regression analysis was conducted. To obtain values for regression, summated score on the adoption of emerging technology scale was obtained with a minimum score of 3 and a maximum score of 15 for the 5 items in the scale for each of the respondents. Similarly, summated scores for sustainable horticulture farming were obtained. The findings in the regression output shows that $R^2 = .091$ (p < .001). Thus Adoption of emerging technology accounts for 9.1% of sustainability in horticulture farming. Increased adoption of technology in horticulture farming results into
increased sustainability of horticulture farming as a venture. Model summary is presented in Table 4.10.

**Table 4.10: Model Summary for Adoption of Emerging Technology and Sustainability**

<table>
<thead>
<tr>
<th>Model Summary</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>.302</td>
<td>.091</td>
<td>.088</td>
<td>3.59620</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Sustainability of Horticulture Farming

The findings also gave $F (1, 339) = 33.934 (p < .001; < 0.05)$ indicating that the model is a good fit. The co-efficient of the constant term ($B = 9.223; p < 0.001$) and the coefficient of adoption of emerging technology ($B = .400; p < .001$) are statistically significant as $p < 0.05$. ANOVA output is presented in Table 4.11.

**Table 4.11: ANOVA output for Adoption of Emerging Technology and Sustainability**

<table>
<thead>
<tr>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>438.857</td>
<td>1</td>
<td>438.857</td>
<td>33.934</td>
</tr>
<tr>
<td>Residual</td>
<td>4384.182</td>
<td>339</td>
<td>12.933</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>4823.038</td>
<td>340</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. Predictors: (Constant), Adoption of Emerging Technology

The co-efficient of the constant term ($B = 9.223; p < 0.001$) and the coefficient of adoption of emerging technology ($\beta = .302; p < .001$) are statistically significant as $p < 0.05$. This shows that adoption of emerging technology statistically significantly affects sustainability of horticulture farming such that, for every unit positive increase in adoption of emerging technology, sustainability of horticulture farming increases by 0.302. The coefficients output is presented in Table 4.12.

**Table 4.12: Coefficients for Adoption of Emerging Technology and Sustainability**

<table>
<thead>
<tr>
<th>Coefficientsa</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td>Beta</td>
<td></td>
</tr>
<tr>
<td>(Constant)</td>
<td>9.223</td>
<td>.547</td>
<td></td>
<td>16.850</td>
</tr>
<tr>
<td>Adoption of Emerging Technology</td>
<td>.400</td>
<td>.069</td>
<td>.302</td>
<td>5.825</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Sustainability of Horticulture Farming

b. Predictors: (Constant), Adoption of Emerging Technology
4.6 Chapter Summary

In the chapter, results and findings have been presented. This has been provided on the basis of the research questions and organized in terms of both descriptive and inferential statistics. The next chapter provides summary, discussion, conclusion and recommendations.
CHAPTER FIVE
5.0 SUMMARY, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of major findings of the study based on the guiding research questions. Further, the chapter gives a section on conclusion from the findings and, recommendations useful for improving horticultural farming. The chapter also includes suggestions for further research especially, on areas that presented as in need of more study but were essentially not covered by the study objectives.

5.2 Summary of Findings

The purpose of this study was to examine factors influencing Sustainability of Horticultural farming in Kenya using Kiambu County as a case. The study was guided by the following questions: To what extent does empowerment influence sustainability of horticultural farming in Kiambu County in Kenya?; To what extent does credit accessibility influence sustainability of horticultural framing in Kiambu County in Kenya? and How does adoption of emerging technology influence the sustainability of horticultural farming in Kiambu County in Kenya?

This study adopted descriptive design which was used to generate detailed information regarding the key aspects in order to develop profiles of those aspects and causal design aimed at determining causal factors where 121,780 residents of Kiambu County are directly involved in horticulture formed the target population (County Government of Kiambu, 2016). The sample size was determined using the Krejcie and Morgan (1970) table found in appendix I, which allowed a sample of 384 participants directly involved in farming to be selected from a population of 121,780. Stratified random sampling technique was used to select the respondents from various Sub Counties. The study used a questionnaire as the main tool for collecting data. Data was analyzed using descriptive statistics to include mean, median and mode as well as regression analysis as the inferential statistic and presented.

The study achieved a response return rate of 88.8%. Majority of the study participants (66.3%) were aged 40 years and were almost evenly distributed in terms of gender with male participants (51.9%) being the slight majority compared to the female participants
who were 48.1%. Majority of the participants (37.2%) had basic primary education with another 23.8% having non formal education and (54.8%) had practiced horticulture farming for between 1 and 5 years with another 36.7% having practiced horticulture for more than 5 years. Majority of the study participants do not take part in activities of the farmers’ group. Further, majority of the study participants 169 (49.6%) believe that through the farmers groups in the County, Horticultural farmers receive training and financial support to improve their farming activities but only sometimes and that the government rarely organizes training for horticultural farmers in Kiambu County. Majority of the participants 203 (59.5%) indicated that they rarely attend training on modern horticultural farming methods. However, majority of the participants 214 (62.8%) reported that training always enhances horticultural productivity and sustainability. The finding also showed that empowerment accounts for 5.2% of sustainability in horticulture farming which is statistically significant. The linear regression analysis revealed that empowerment positively and significantly predicted sustainability of horticultural farming, $R^2 = 0.050$, $F(1, 339) = 18.735$, $p <.05$, $\beta = 0.358$, $p <.05$ leading to rejecting the null hypothesis that empowerment has no significant influence on sustainability of horticultural farming.

Majority (73.6%) of the participants agreed that there is need for financial capital to improve and sustain their farming ventures while 147 (43.1%) disagreed that, farmers groups provide sufficient funds for farmers to invest in horticulture. Similarly, majority of the respondents 193 (56.6%) disagreed that the government provides affordable credit to horticulture farmers for their activities. However, the participants acknowledged the role of credit in improving their ventures through investing in modern technology and practices. Credit accessibility was found to statistically significantly account for 4.0% of sustainability in horticulture farming. The linear regression analysis of the study revealed that credit accessibility significantly predicted sustainability of horticultural framing, $R^2 = 0.040$, $F(1, 339) = 14.006$, $p < 0.05$, $\beta = 0.307$, $p < 0.05$ leading to rejecting the null hypothesis that credit accessibility has no significant influence on sustainability of horticultural framing.

The study found that majority of the participants 212 (62.2%) disagreed that they were adequately aware of the available technology for use in horticulture farming while 102 (29.9%) of the participants agreed that use of technology in horticulture farming has
enhanced productivity and sustainability of their venture. However, the study found that the participants overwhelmingly (72.7%) disagreed that they were able to afford the available technology for use in horticultural farming despite majority of the participants indicating that the use of technology has made it possible to store our products in good conditions thus attracting good value for our products (43.1%) and that technology has increased efficiency and magnitude of production of horticultural produce (40.5%). Adoption of emerging technology accounts for 9.1% of sustainability in horticulture farming which is statistically significant. The regression analysis revealed that emerging technology positively and significantly predicted sustainability of horticultural framing, \( R^2 = 0.091, F(1, 339) = 33.934, \ p < .05, \ \beta = 0.400, \ p < .05 \), leading to rejecting the null hypothesis that emerging technology has no significant influence on sustainability of horticultural framing.

5.3 Discussion

5.3.1 Empowerment and Sustainability of Horticultural Farming

Social welfare groups are a tool, used in Kenya, to empower various groups. Similarly, farmers congregating in groups to promote the activities enhance their empowerment. Thus, the researcher sought to establish the extent to which participants participated in the activities of farmers' groups. The finding shows that horticulture farmers in Kiambu County participate in activities of farmers groups to a moderately low extent. Similarly, the study found that the participants do not feel that through the farmers groups in the County, Horticultural farmers receive training and financial support to improve their farming activities. Specifically, majority of the study participants 169 (49.6%) believe that through the farmers groups in the County, Horticultural farmers receive training and financial support to improve their farming activities but only sometimes with another 55 (16.1%) indicating that horticultural farmers rarely receive training and financial support to improve their farming activities through groups. However, a significant 117 (34.3%) of the participants believe that through the farmers groups in the County, Horticultural farmers receive training and financial support to improve their farming activities always. The finding shows that farmers appreciate the significant benefit of training and financial support they receive by participating in the group activities. Similarly, Ching (2017) concluded that there is massive need for consistent and
predictable cash flows for farmers to purchase synthetic fertilizers, use in pest control including purchase of pesticides and herbicides as well as monoculture of better yielding varieties through irrigation and artificial conditions.

From the findings, it also emerged that the relative low rating of the value of training and financial support through farmers group can be attributed to the role of the government in organizing the training and support programmes. This emerged as majority of the participants 199 (58.4%) indicate that the government rarely organizes training for horticultural farmers in Kiambu County with another significant 97 (28.4%) indicating that the government only sometimes organize training for horticultural farmers in Kiambu County. This shows that there is very minimal effort from the government in organizing trainings for horticulture farmers to improve such ventures.

Consequently, the horticulture farmers who participated in the study reported that they rarely attend such trainings since they are rarely organized. Specifically, majority of the participants 203 (59.5%) indicated that they rarely attend training on modern horticultural farming methods with another 94 (27.6%) indicating that they sometimes attend training on modern horticultural farming methods. This is due to the extent to which such trainings are organized.

However, the participants generally agreed that training enhances horticultural production and sustainability. This emerged as the study found that majority of the participants 214 (62.8%) reported that training always enhances horticultural productivity and sustainability while another 86 (25.2%) indicated that it sometimes enhances. Thus, cumulatively 88% of the participants believe that training enhances horticultural productivity and sustainability. From the findings, the participants believe in the value of training in enhancing the value of their horticulture. Further, a research by University of Leeds (2010) found that with increased credit, farmers are able to purchase input to further production.

The regression output shows that regression is a good fit for modeling the data with F (1, 339) = 252.589 (p < .001; < 0.05) as the model is statistically significant. Thus, there is a statistically significant difference in mean between empowerment and sustainability of horticulture farming in Kiambu County. From the model summary, the finding shows that empowerment explains up to 5.2% (R square = .052; p <.001; < 0.05) of variance in the
sustainability of horticulture farming which is statistically significant. Thus, empowerment statistically significantly affects sustainability of horticulture farming although to a low small proportion. The co-efficient of the constant term (B = 9.778; p < 0.001) and the coefficient of empowerment (β = .229; p < .001) are statistically significant as p < 0.05. This shows that empowerment statistically significantly affects sustainability of horticulture farming such that, for every unit positive increase in empowerment, sustainability of horticulture farming increases by 0.229. This is consistent with the findings of University of Leeds (2010) report that despite being capital intensive, empowering farmers to adopt commercial agriculture has numerous benefits among them: increased production, larger markets, quality products and premium prices for better return. This ensures sustainability of farming since the venture is profitable. The farmers are able to purchase input to further production (University of Leeds, 2010).

5.3.2 Credit Accessibility and Sustainability of Horticultural Farming

The study found that there is need for financial capital to improve and sustain horticultural farming ventures. This emerged an overwhelming majority (73.6%) of the participants agreed that there is need for financial capital to improve and sustain their farming ventures with a further 17% being neutral in regard to the statement. However, only 9.4% of the participants disagreed that they needed financial capital to improve their horticultural ventures. The findings outlay the absolute need for financial capital in horticultural farming. On a similar note, Niskanen (2010) also found that enhancing access to finance to SMEs will not only enhance their capability to be established and to thrive, but also expand governments’ development and growth, in addition to reducing unemployment.

However, the study found that farmers groups do not provide sufficient funds for farmers to invest in horticulture. Specifically, majority of the respondents 147 (43.1%) disagreed that farmers groups provide sufficient funds for farmers to invest in horticulture with another 104 (30.5%) not being sure whether that was the case. On a positive note though, 90(26.4%) of the participants agreed that farmers groups provide sufficient funds for farmers to invest in horticulture. The finding shows that farmers groups play a significant role in sourcing for capital for the members in horticultural farming although this is still low. The programmes set by the government focus on progressively institutionalizing credit facilities accessible to small scale farmers in the vulnerable sphere of the society so
as to enable them acquire modern technology in farming as well as modern farming practices to increase productivity (Ramakrishnan & Kumar, 2010).

The government support in way of providing credit to the horticulture farmers was also found to be low. This view emerged as majority of the respondents 193 (56.6%) disagreed that the government provides affordable credit to horticulture farmers for their activities with only 15.8% of the participants agreeing that they receive affordable credit from the government to support their activities. This shows a general disapproval on the government support in way of credit.

Similarly, the study found that the process of acquiring credit from financial institutions was not clear and readily accessible as it ought to be. Based on this statement, an overwhelming majority of the participants (66.6%) disagreed while 19.1% were not sure thus neutral. This is an indication of the tedious and complicated process of acquiring credit from financial institutions thus affecting the activities of horticultural farmers. According to World Bank (2015), approximately (70%) of all SMEs in developing markets lack access to credit making it difficult for SMEs business to survive.

However, the participants acknowledged the role of credit in improving their ventures through investing in modern technology and practices. Based on this view, despite majority of the participants (43.7%) disagreeing that availability of credit us enabled me to invest in modern practices and promote my horticulture farm, a significant 103 (30.2%) agreed. The finding shows that, with affordable and accessible credit, horticulture farmers are able to increase investment in modern horticultural practices and technology. However, this is not always the case as credit is not readily available. Similarly, Maitima, Rakotoarisoa and Kang’ethe (2010) found that credit ensures that farmers can purchase the necessary farm inputs while also engaging the right labour skills and farm practices to ensure efficiency and sustainability in production.

The ANOVA table in the regression output shows that regression is a good fit for modeling the data with F (1, 339) = 14.006 (p < .001; < 0.05) as the model is statistically significant. Thus, there is a statistically significant difference in mean between credit accessibility and sustainability of horticulture farming in Kiambu County. From the model summary, the finding shows that credit accessibility explains up to 4.0% (R square = .040; p <.001; < 0.05) of variance in the sustainability of horticulture farming which is
statistically significant. Thus, credit accessibility statistically significantly affects sustainability of horticulture farming although to a low small proportion. The co-efficient of the constant term (B = 10.091; p < 0.001) and the coefficient of credit accessibility (β = .199; p < .001) are statistically significant as p < 0.05. This shows that credit accessibility statistically significantly affects sustainability of horticulture farming such that, for every unit positive increase in credit accessibility, sustainability of horticulture farming increases by 0.199. Similarly, Maitima, Rakotoarisoa and Kang’ethe (2010) concluded that credit ensures that farmers can purchase the necessary farm inputs while also engaging the right labour skills and farm practices to ensure efficiency and sustainability in production (Maitima, Rakotoarisoa & Kang’ethe, 2010).

5.3.3 Adoption of Emerging Technology and Sustainability of Horticultural Farming

Knowledge of the horticulture farmers in Kiambu on available technology for use in their venture was found to be inadequate. Majority of the participants 212 (62.2%) disagreed that they were adequately aware of the available technology for use in horticulture farming. Further, 25.5% of the participants were unsure as to whether they were adequately aware of such technologies choosing to be neutral to the statement. Thus, the level of knowledge on available and relevant technology is low thus contributing to low adoption of such technologies in horticultural farming in Kiambu County. On the contrary, Omamo and Mose (2001) argue that increasing fertilizer use has been curtailed by issues to do with the provision of the right products packed in affordable units.

Consequently, the use of technology in horticulture farming to enhance productivity and sustainability of horticulture was found to be low. This emerged as study participants disagreed and agreed in equal proportions. Specifically, whereas 102 (29.9%) of the participants agreed that use of technology in horticulture farming has enhanced productivity and sustainability of their venture, an almost equal proportion (28.7%) disagreed with the other 41.3% being neutral. This shows that, horticulture farmers who were aware of the existing technologies and employed them in their venture obtained favourable outcomes while those who were not aware of the technologies could not apply them to enhance the productivity of their ventures. Similarly, Ndungu et al., (2005) in their study ‘the role of non-governmental organizations in extension’ published that the development and uptake of new agricultural technologies would clearly benefit from a closer collaboration of existing research institutes and NGOs in the study area.
The study also found the participants were not able to afford the available technology for use in horticultural farming. Specifically, the participants overwhelmingly (72.7%) disagreed that they were able to afford the available technology for use in horticultural farming with only 8.5% agreeing that they were able to afford the available technology for use in horticultural farming. This shows that, even if the technologies were available and the horticulture farmers aware of their value in their ventures, they are still unable to access and use in them in their practices.

Among the values of technological use in horticulture that emerged were on storage facilities as well as increased efficiency in production. Majority of the participants indicated that the use of technology has made it possible to store our products in good conditions thus attract good value for our products (43.1%) and that technology has increased efficiency and magnitude of production of horticultural produce (40.5%). However, there are a considerable proportion of horticulture farmers who do not see the benefits of technology as they have not been able to access and acquire the technology for use in their ventures. Consequently, 29.3% of the participants disagree that use of technology has made it possible to store our products in good conditions thus attract good value for our products while 37.8% disagree that use of technology has increased efficiency and magnitude of production of horticultural produce.

The study found that regression is a good fit for modeling the data with $F (1, 339) = 33.934 \; (p < .001; < 0.05)$ as the model is statistically significant. Thus, there is a statistically significant difference in mean between adoption of emerging technology and sustainability of horticulture farming in Kiambu County. From the model summary, the finding shows that adoption of emerging technology explains up to 9.1% (R square = .091; $p < .001; < 0.05$) of variance in the sustainability of horticulture farming which is statistically significant. Thus, adoption of emerging technology statistically significantly affects sustainability of horticulture farming although to a low small proportion. The coefficients of the constant term ($B = 9.223; p < 0.001$) and the coefficient of adoption of emerging technology ($\beta = .302; p < .001$) are statistically significant as $p < 0.05$. This shows that adoption of emerging technology statistically significantly affects sustainability of horticulture farming such that, for every unit positive increase in adoption of emerging technology, sustainability of horticulture farming increases by
Bohringer and Ayuk (2003) also reported that nurseries are essential for the growing of many technologies but getting farmer groups to adopt this has not been easy.

5.4 Conclusion

5.4.1 Empowerment and Sustainability of Horticultural Farming

Based on the first research question, the study concludes that farmers congregating in groups promote their activities and enhance their empowerment which is not exhaustively used to provide training and financial support to improve their farming activities. Further, the relative low rating of the value of training and financial support through farmers group can be attributed to the role of the government in organizing the training and support programmes. Moreover, farmers do not attend such trainings since they are rarely organized and that training enhances value in horticulture.

5.4.2 Credit Accessibility and Sustainability of Horticultural Farming

With reference to the findings of the second research question, on credit accessibility and sustainability, the study concludes that there is absolute need for financial capital in horticultural farming and that farmers’ groups play a significant role in sourcing for capital for the members in horticultural farming although this is still low. The study also concludes that the government does not adequately provide support to horticulture farmers in way of credit despite there being a tedious and complicated process of acquiring credit from financial institutions thus affecting the activities of horticultural farmers.

5.4.3 Adoption of Emerging Technology and Sustainability of Horticultural Farming

On adoption of emerging technologies and sustainability in horticultural farming, the study concluded that the level of knowledge on available and relevant technology is low thus contributing to low adoption of such technologies in horticultural farming in Kiambu County. Further, even if the technologies were available and the horticulture farmers aware of their value in their ventures, they are still unable to access and use in them in their practices. However, horticulture farmers who were aware of the existing technologies and employed them in their venture obtained favourable outcomes while those who were not aware of the technologies could not apply them to enhance the productivity of their ventures.
5.5 Recommendations

5.5.1 Empowerment and Sustainability of Horticultural Farming

Based on the conclusions made regarding empowerment and sustainability of horticulture farming, the study recommends that the ministry of gender and social services in collaboration with ministry of agriculture should encourage formation of horticultural farmers’ group. Through the groups, the government will be able to organize regular trainings to help improve the knowledge of the farmers.

5.5.2 Credit Accessibility and Sustainability of Horticultural Farming

Regarding the second research question on capital accessibility and sustainability of horticulture farming, the study recommends that the ministry of agriculture and county governments should seek donor fund targeted at horticultural farming to ensure availability of training support and funding for various technologies in agriculture.

5.5.3 Adoption of Emerging Technology and Sustainability of Horticultural Farming

On the third research question regarding adoption of technology in horticulture farming, the study recommends that through extension officers and the farmers’ cooperative societies, farmers should be encouraged to acquire and use modern technologies in horticulture farming.
REFERENCES


Hutchins, S. (2013). *The Role of Technology in Sustainable Agriculture*. IPM World Textbook, the University of Minnesota


### APPENDICES

Appendix I: Sample Size ($S$) required for the given population ($N$)

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**NOTE:** From R.V Krejcie and D.W Morgan (1970), determining sample size for research activities, education and psychological measurement 30,608, Sage publication
Appendix II: Questionnaire to farmers

FACTORS AFFECTING HORTICULTURAL PRODUCTIVITY IN KENYA: A CASE OF KIAMBU COUNTY

Sub-County: ______________________ Division: ___________________________

Instruction: Please tick or mark appropriate category details

Section A: Demographic Data

1. Age bracket (years)
   <20 [ ] 20-39 [ ] >40 [ ]

2. Gender
   Female [ ] Male [ ]

3. Highest education qualification
   Non Formal [ ] Primary [ ] Secondary [ ] Diploma [ ] Degree [ ]

4. Do you engage in any other income generating activity apart from farming?
   Yes [ ] No [ ]

7. Duration spent in Horticultural Farming _________ years.

8. SECTION B: EMPOWERMENT OF FARMERS

<table>
<thead>
<tr>
<th>Statement</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Always</th>
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<tr>
<td>I participate in the activities of farmers groups in Kiambu County</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Through the farmers groups in the County, Horticultural farmers receive training and financial support to improve their farming activities.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The government organizes regular training for horticultural farmers in Kiambu County</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I attend training on modern horticultural farming methods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Training enhances horticultural productivity and sustainability</td>
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</table>

9. SECTION C: CREDIT ACCESSIBILITY
### 10. SECTION D: TECHNOLOGY AND SUSTAINABILITY OF FARMING

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
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<tr>
<td>There is need for financial capital to improve and sustain our farming ventures</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Farmers groups provide sufficient funds for farmers to invest in horticulture</td>
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<tr>
<td>The government provides affordable credit to horticulture farmers for their activities.</td>
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<tr>
<td>The process of acquiring credit from financial institutions is clear and readily accessible.</td>
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<tr>
<td>Availability of credit us enabled me to as a farmer to invest in modern practices and promote my horticulture farm.</td>
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<tr>
<td>I am adequately aware of the available technology for use in horticulture farming</td>
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<tr>
<td>Use of technology in horticulture farming has enhanced productivity and sustainability of my venture.</td>
<td></td>
<td></td>
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<tr>
<td>I am able to afford the available technology for use in horticultural farming.</td>
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<tr>
<td>Use of technology as made it possible to store our products in good conditions thus attracts good value for our products.</td>
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<tr>
<td>Use of technology has increased efficiency and magnitude of production of horticultural produce.</td>
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*Thank You for Your Participation*