CONTRIBUTION OF WOMEN GRADUATES OF SECONDARY SCHOOL AGRICULTURE SUBJECT TO AGRICULTURAL PRODUCTIVITY IN NAVAKHOLO, KAKAMEGA COUNTY, KENYA.

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A Thesis Submitted in Partial Fulfilment of the Requirements for the Award of the degree of Master of Science in Agricultural Education and Extension of Masinde Muliro University of Science and Technology.

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DECLARATION

This thesis is my original work prepared with the indicated sources and has not been presented elsewhere for a degree or any other award.

Sign…… Date……..

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CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance of Masinde Muliro University of Science and Technology a thesis entitled**: Contribution of Women Graduates of Secondary School Agriculture subject To Agricultural Productivity in Navakholo, Kakamega County, Kenya**

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DEDICATION

This thesis is dedicated to my father Alfred Manyasi and my late mom, Emily Nanjala, for the strong education background they planted in me. My sons: Innocent Cheng'ole and Ivan Mulindo, for their computer expertise and my daughters: Joy Elizabeth and Sifa Nanjala, for company and encouragement as their role model.

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ABSTRACT

Agriculture sector is underperforming in part because women, a crucial gender contributing to farming have no sufficient knowledge and skills. To generate interest in farming at an early age, teaching of agriculture was introduced to Kenyan secondary school education system. This study, done in Navakholo sub-County, sought to establish the proportion of women graduates of KCSE Agriculture subject involved in farming and their contribution to agricultural productivity. The aim was to contribute to strategies by policy makers to enhance agricultural productivity through female education training at secondary school level. Correlational research design was used against a population of 20,000 farm families to target 8,000 women farmers of farm families. Multi-stage random sampling method was adopted to obtain a sample size of 422 women farmers. A household survey by use of a questionnaire, Focus Group Discussions by use discussion guides and key informant interviews by use of a checklist were used to collect primary data. Results from data analysis found that the proportion of women graduates of KCSE agriculture subject practising agriculture was low (25%). The KCSE women agriculture graduates' reasons for choosing agriculture subject varied from developing practical agriculture skills to high exam performance. The study established that learning agriculture subject had a positive impact on farmer productivity ($P<0.01$). Teaching more practical than theory, attending extension training sessions and learning application of new technology were proposed strategies to enhance agricultural productivity. The study concluded that more girls should be encouraged to enrol for agriculture subject in secondary schools since the skills developed increased participation and agricultural productivity. The study recommended an agriculture syllabus with a practical approach to teaching and learning with emphasis on applied technology and innovations.

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LIST OF ABBREVIATIONS AND ACRONYMS

AEO - Africa Economic Outlook

ASDS - Agriculture Sector Development Strategy

AGRA - Alliance for Green Revolution in Africa

ERS - Economic Recovery Strategy

FAO - Food and Agricultural Organisation

FGD- Focus Group Discussion

G.O.K - Government of Kenya

GDP - Gross domestic Product

HH- Households

ICT- Information Communication Technology

IFRCRC- International Federation of Red Cross and Red Crescent

ILO- International Labour Organization

IMF- International Monetary Fund

KCSE- Kenya Certificate of Secondary Examination

KIE- Kenya Institute of Education

MOE- Ministry of Education

MoPND- Ministry of Planning and National Development.

NDP - National Development Plan

OECD- Organisation for Economic Cooperation and Development

SRA- Strategy for Revitalizing Agriculture

SSA - Sub-Saharan Africa

USAID - United States Agency for International Development.

OPERATIONAL DEFINITION OF TERMS

Agricultural Education- Is the teachings of agriculture, natural resources and land management. It is a training that should develop knowledge, expose and develop practical skills, competences and attitudes among students to make them function effectively in professions or jobs chosen in agricultural related careers.

Agricultural productivity –Is the measurement of the ratio of agricultural outputs to agricultural inputs. Is the output of Agricultural produce per unit of land. It is determined by bags per acre or bags per hectare as used in the current study.

Agricultural policy-Is a documented action plan designed to achieve sustainable agricultural production to meet the set objectives. It shows specific objectives, instruments and strategies for achieving the set objectives.

Agriculture – Is the science and art of cultivating plants and keeping livestock. Agriculture has many areas that occupy people and hence it needs training for skills and competence. Proper application of skills taught in agriculture would give the expected self-sufficiency, and sustain food production.

Food security- Condition when all people at all times, have physical and economic access of sufficient, safe and nutritious food for healthy. High productivity results into a state of food security.

Household- Comprise of a group of family members staying together.

Livelihoods-Capability assets (both material and social resources) activities required for a means of living linked to survival and future well-being.

Monoculture – Cultivation of one type of crop or plants.

Poverty - Lack of access to resources and income opportunities.

Woman - An adult female person, a female worker, especially one who works with her hands. A woman is a worker because she is assumed to be responsible for accessing, availing and ensuring utilisation of food among farm families.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Many people living on the globe rely on agriculture as stated by Food and Agriculture Organization of the United Nations (FAO) (FAO, 2016) which contributes 6.4 % of the world's Gross Domestic Product (GDP) where, according to the Africa Economic Outlook (AEO) Women provide 43 % of the agricultural labour force on the globe and in some developing countries (AEO, 2016).Agriculture employs more than half of the total labour force as posted by International Monetary Fund (IMF, 2012) and provides a livelihood for small-scale producers. According to Alliance for Green Revolution in Africa, eighty percent (80%) of all farms in Sub-Sahara Africa (SSA) are smallholder and employ about 175 million people directly (AGRA, 2014). Women comprise half of the labour force as stated by Food and Agriculture Organisation (FAO, IFAD, WFP, 2015) while according to International Labour Organisation more of the working women in Africa are in low productive agriculture (ILO, 2015).

In Kenya, the services sector contributes the highest national Gross Domestic Product (GDP) while agriculture is next with 32.9% and 17.8% respectfully. About 86% of the total farmers are women out of whom 44% own the business (World Bank, 2015). Agriculture as a subject was introduced in schools syllabus as early as the colonial education as stated by Sheffield, Morris and Herman (1976), hence agriculture has been taught before and after independence to develop skill in learners. According to the Kenya Institute of Education (KIE) nearly all the schools started offering

agriculture subject at a time the 8-4-4 system of education was introduced in Kenya (G.O.K, 1984; Ngugi, Isinika, Temu, Kitali, 2002).

In primary school curriculum, agriculture is part of science but in secondary schools, it is an applied subject (KIE, 2006). The youths are taught agriculture so that they can appreciate its role in the economy, since Kenya dependents on agriculture for her economic development. However, this subject has been removed from the primary school syllabus, and is an elective subject at secondary school level. Emerging needs of young people as well as locals needs demand for educational reforms. Agriculture has been taught in secondary schools for long and therefore evidences have to be shown that some of the students who learnt agriculture subject are farmers. (G.O.K, 1984; Ngugi *et al*., 2002)

In western Kenya, people don't have enough food (Ajani and Chianu, 2008). Farmers consistently plant sugarcane that has depleted soils throughout the years although maize and beans are the main subsistence crops grown in Kakamega County, Navakholo sub-county.

1.2 Statement of the Problem

Women are useful to smallholder agriculture in sub-Saharan Africa because of their increased participation in agriculture. Lack of knowledge and skill to be used in farming continues to be a major challenge among women farmers and that is the reason for choice of women as gender for this study. According to the Kenya Institute of Education (2002) secondary school education syllabus, some of the objectives for teaching agriculture subject that support this study are to; teach principles and practices of agriculture, teach the values of agriculture, demonstrate the profitability of farming, promote self-reliance, improve food security and make it occupation. Agriculture

subject Kenya was therefore introduced to stimulate youths' participation in agriculture and improve on agriculture production in the country (G.O.K, 1984; Ngugi *et al*., 2002) to ensure food security.

Thus, there is need is to establish whether there is any significant difference in agricultural participation and productivity between women farmers who graduate with secondary school agriculture knowledge and those without. Researchers have looked at the factors that affect the decision of a student to choose agriculture subject (Ekwere, 2014) and students' perception of secondary school agriculture (Muchiri, Odilla, Kathuri, 2013). The purpose of this study is to evaluate the impact of teaching agriculture in secondary schools for feedback to inform education policy makers concerning agriculture subject in secondary schools.

1.3 General Objectives

The purpose of the study was to evaluate the contribution of former agriculture students to agricultural productivity of subsistence crops among women farmers as result of having taken agriculture subject at secondary school level in Navakholo sub county of Kakamega county, Kenya.

Specific objectives were to:

i. Establish the proportion of women graduates of agriculture subject at secondary school level participating in maize and beans production in Navakholo sub county, Kakamega County, Kenya.

ii. Evaluate the impact to agricultural productivity of women graduates of secondary school agriculture subject in Navakholo sub-county, Kakamega County, Kenya.

iii. Evaluate strategies to enhance agricultural productivity through female agriculture education training at secondary school level in Navakholo sub-County, Kakamega County, Kenya.

1.4 Research questions

The study was guided by the following questions:

i.) What is the proportion of secondary school agriculture subject women graduates participating in maize and beans production in Navakholo sub-county, Kakamega County, Kenya?

ii.) What is the impact to agricultural productivity of women graduates of secondary school agriculture subject in Navakholo sub-county of Kakamega County, Kenya?

iii.) Which strategies can be put in place to re-orient agriculture training at secondary school level to respond better to the demands of the women farmers in Navakholo sub-county, Kakamega County, Kenya?

1.5 Justification of the Study

There was lack of information in the county to show the usefulness of women Agriculture education yet Agriculture is the backbone of Kenya's economy. Women have been shown to play a major role in smallholder agriculture by previous researchers. The government tried to stimulate women interest in agriculture and impart them with farming skills by introducing agriculture subject in the 8-4-4 system of education in secondary school hoping for increased agricultural productivity to benefit the agriculture sector.

There have been arguments for and against this move (Vandenbosch, 2006), leading to removal of the subject at primary school level. One way of providing factual evidence in this discourse is to determine whether former women students of secondary school agriculture subject perform better than non-agriculture students in agricultural participation and productivity. This formed the core purpose of this study.

1.6 Significance of the Study.

It is hoped that the results obtained from this study will:

i. Provide evidence to determine whether women students of secondary school agriculture subject were trained or aided to perform better than non-agriculture women students in productivity.
ii. Help policy makers re-orient agriculture training at secondary school level to respond better to the demands of women farmers.
iii. Add new knowledge to be used by future researchers.
iv. Be used to restructure farming practices in Kenya.

1.7 Scope of the Study

The study was confined to the 4 wards of Navakholo Sub-county because it is one of the rural sub Counties of Kakamega County with suitable climatic conditions for maize production which is the main subsistence crop in the meal. It has moderate population of females for the study among other factors. The sample of interest focused on were the former secondary school agriculture subject women who are KCSE holders, non-agriculture women and have been in existence for at least 5 years within Navakholo sub-County, Kakamega County, Kenya. The main farm enterprises focused on were maize and beans since they are the staple foodstuffs for local people in the sub-county.

The target stakeholders expected to provide the information included; agricultural officers, area education officers, value chain creditors of maize and beans and opinion leaders in Navakholo sub-County.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter focuses on the review of literature of social economic and demographics of women graduates of agriculture subject at secondary school level (Former Secondary School Agriculture Subject Students), women agricultural productivity, legal policy frameworks, instruction processes and strategies to enhance learning of agriculture, education level and the impact of agriculture subject on agricultural productivity.

2.2 Contribution of Women to Agriculture: A Global Perspective

Women comprise about 43% of agricultural labour force globally and in developing countries (AEO, 2016). Women's roles are diverse varying across regions and countries; they participate in large numbers in rural labour markets at regional level yet paid less than men (FAO, 2011). Women attitude and participation in agriculture is positive as stated by MOSAVI, OMMAMI, ALLAHYARI (2011).Youthful women have higher ability to participating in agricultural production (Abdulhamid, Iliyasu, Mohammed, Sani (2016). Time spend by women in agriculture varies from crop produced and production cycle (FAO, 2011; Team and Doss, 2011). Quantifying how much is produced and resource used by women in relation to other household members involved is difficult. (Team and Doss, 2011).

Employed and unemployed women provide labour force. Abdulhamid*, et al.*, (2016) reported as high as 60 % of rural women attended not more than primary school and

thus their low overall agricultural productivity. Secondary school leaver women participate more in Agriculture compared to primary school leavers and those who are illiterate (Abdulhamid *et al.,* 2016). Skilled human resource brings about development, modernization, growth and food security as stated by Mangheni, Ekirikubinza-Tibatemwa, Forsythe (2010). In this view, Education programs in higher education should encourage more female enrollment in agricultural Sciences, research and innovations (Mangheni *et al,* 2010). Reduced education opportunities for women and girls and bias technological change that only ease-men's labour are barriers to women full participation in agriculture development (Squire, 2003).

In Kenya about 86% of farmers are women, 44% of whom work in their own right and 42% who represent their husbands in their absence (World Bank, 2015). In Western Kenya 69% of people are food insecure (Ajani and Chianu, 2008). The sugarcane production has depleted soils through continuous production (Nambiro, 2007). Maize and beans are the main subsistence crops grown in Navakholo sub-county, Kakamega County, Kenya. (Ministry of Agriculture, 2017) Navakholo sub-county report.

The level of education and age affects the ability to participate in agriculture meaning the knowledge provided at secondary school level should be sufficient to improve on food security and sustain it. In the study we compared the participation of former secondary school women who graduate with knowledge in agriculture subject at Kenya Secondary School Education (KCSE) level and those who did not learn agriculture subject. This was to compare the level of decision making and self-confidence developed after at least five years of participation and experience in agriculture.

2.3 Contribution of Agriculture Subject at Secondary School Level to Agricultural Productivity

According to the Kenya Certificate of Secondary School (KCSE) education syllabus, some of the objectives for teaching agriculture subject that support this study are to; teach principles and practices of agriculture, teach the values of agriculture, demonstrate the profitability of farming, promote self-reliance, improve food security and make it an occupation.

Lack of knowledge on modern farming and marketing as well as limited access to land among women makes agriculture to remain unattractive. Normally, women participate in agricultural services as men do. According to a study on agricultural sector gender statistical profile in Uganda (Hansen, Jensen, Skovsgaard, 2012), from the total number of women engaged in crop production, more than half were unpaid household workers. Earlier in farming season, women take more days laboring before men get involved (Hansen, 2012).

Women need basic agriculture that is offered at secondary school level to assist them to use productive resources if they access them, (FAO, 2011). Change in attitude, self-perception and productivity are of conceptual significance for education offered to women (If women are educated). Literacy training for women and increased education for young girls will increase productivity now and in future. Their potential to use resources will also increase. Food production needs a combination of various assets, labour, land and finance, intermediate goods and services. All the indirect factors presented in objective one on labour participation and output shows clearly that women's agricultural productivity is high (FAO, 2011).

FAO (2014) indicates that rural poverty is reduced if youths are facilitated to participate in agricultural productivity. Youths' insufficient access to knowledge, information and education limits productivity and skills acquisition (FAO, 2014). Hence, it's vital for the youths to be given the right information so as to respond to the needs of modern agricultural sector.

Gender roles are determined by socio-cultural factors which also differ depending on existing dynamics such as age, wealth, type of assets and economic returns (Grace, 2004). Roles between different women depend on factors like marital status, assets owned by households, involvement in income generating activities and if they also employ other women (Grace, 2004).

Food development and extension strategies have to be reviewed and re-designed so that development packages reach women farmers to motivate them to participate more actively and increase output through technology (Ogbonna and Okoroafor, 2004). Women's education has strong socio- economic effect as it empowers them to use credit, own land, adopt technologies, practice their rights and responsibilities hence increasing productivity and rural livelihood (Ogbonna and Okoroafor, 2004).

Agricultural productivity in SSA can be increased by balancing Technology development with accessibility and adoption (AGRA, 2016). There has been no link between access and adoptions of these technologies especially for women, yet they comprise most of the smallholder farmers, to realize sustainable intensification, increased agricultural productivity, closed yield gaps and poverty reduction (AGRA, 2016).

In Kenya, there is a negative relationship between female labour participation, productivity and years of agricultural activities (Hansen *et. al*., 2015).It is expected

that agriculture education offered to young girls should improve productivity now and in the future such that as years of experience increase, participation and productivity increase.

Agriculture, though done on low resource base is the main source of livelihood for the majority of the population in Kakamega County (Nambiro, 2007). Consequently, new technologies to increase productivity and restore the resources should be used. The study in Navakholo sub-county seeks to find out if agriculture education offered to girls can assist them to use the limited resources available to increase women's participation and productivity of the main subsistence crop needed. Education has a socio-economic effect if it increases productivity due to increased potential to use and access resources (FAO, 2014; Ogbonna and Okoroafor, 2004).

This study sought to understand the general impact of agricultural education to women's participation and productivity. The previous researchers sought to understand the ability to use resources but it is wise for the curriculum developers and implementers to be informed of how the former agriculture students applied the skills taught. This is to reinforce the objectives or re-orient them to meet the objectives of introducing the subject in secondary schools.

2.4 Policies and Strategies to Enhance Agricultural Productivity through Female Agricultural Education Training at Secondary School Level.

Many people living on the globe rely on agriculture (FAO, 2016) contributing 6.4 % of the world's GDP. Women provide 43 % of the agricultural labour force on the globe and in developing countries (AEO, 2016). According to International Monetary Fund (IMF) agriculture employs more than half of the total labour force (IMF, 2012) and provides a livelihood for small-scale producers and about 80% of all farms in SSA are

smallholder and employ about 175 million people directly (AGRA, 2014). Women comprise a half of the labour force (FAO, IFAD, WFP, 2015) while more of the working women in Africa are in low productive agriculture (ILO, 2015).

Agriculture is a practical subject as well as a Science and it's expected to develop skills and provide knowledge to the learners. According to Robinson-Pant (2016) "skill development" should take place through formal, informal and non-formal education system simultaneously during the learning period of a student. The reinforcement of the (MDGs) through Universal Primary Education is vital as it emphasizes access to lifelong learning opportunities for skills and competencies development. Hence, according to the Economic Commission for Africa (ECA) goals such as food security, job opportunity for the people, poverty eradication and rural income generation will be met (ECA, 2005, MoA, 2016)). Many skill development programmes that are less profitable reproduce gender stereotypes (Robinson-Pant, 2016)

The enrolment of female students in Agriculture Science in secondary and tertiary institutions is not encouraging. In Nigeria, low enrolment of girls in Science related courses has been reported, although, the government insists on equal opportunities for all. This has reduced the number of girls entering agriculture sector (Egun and Egun, 2015). Stouracova, (2016) reported increase in the number of girls who access secondary schools, and most of them complete their courses by undertaking KCSE agriculture. The current study seek to understand if the female students who access secondary school and enroll for KCSE Agriculture subject, apply the skills taught by participating in agriculture and if improves their level of productivity.

There exists the most serious gender differences in the policy applied during subject selection in secondary schools. Students are asked to choose between "Arts" and

"Science" streams so that girls end up choosing on Arts stream while the boys select Science stream where Agriculture is incorporated. Hence Agriculture becomes a negative and gendered perception subject leading to low enrollment to the subject courses after secondary school. (Mangheni *et al*., 2010).

Abdulhamid *et al*., (2016) indicates that illiteracy affected agricultural productivity since Agricultural Technology development and extension programs are for men while (Duveskog, 2013) asserts that change in the environmental conditions and markets need farmer's innovation and skills application. Relevant information and knowledge for farmers improves the agricultural performances and livelihoods (Tandi, Stilwell, Ngulube, 2011). Supportive policies in agricultural services and agricultural institutions seek to increase agricultural productivity. It also prioritizes and sequences interventions integrated across agricultural research, technology development and exchange (AGRA, 2016).

Kenya as a government has been reinforcing the following policies and strategies to improve agriculture sector:

i. National Development Plan (NDP)2002-2008.

ii. Economic Recovery Strategy for creating Employment (ERS,2004).

iii. Agricultural Sector Development Strategy for the period 2010-2020 (ASDS,2009).

iv. Strategy for Revitalizing Agriculture (2004-2014).

Squire, (2003) stated the following strategies for enhancing women participation in agricultural development; (i) women and girls should be provided with formal and

informal literacy programs through agriculture extension as well as advanced education to improve their overall socio- economic status. (ii) Educated women are likely to use capital more productively. This breaks their dependence on men. (iii) During enrolment the recruitment process for courses, women student's recruitment should be made flexible. (iv). The agricultural Education Training and Employment policies should be enacted, to enable women to get training and employment in the formal agricultural Industry in the sub-Saharan Africa.

The Smallholders agricultural producer poor women have the challenges of the lower literacy levels, access to and control over resources and network to people who can assist and support their projects. They require donors to provide finances and extension workers to give them direction. Agricultural education policy at secondary school level should consider the needs of the poorest women since Social and political factors influence women's ability to participate in the agricultural development. Some of these factors include girls' completion of secondary education, and improving literacy as stated by the Organisation for Economic Cooperation and Development (OECD, 2012).

Kenya Secondary School agricultural education curriculum should include future extension services since the poorest women cannot afford. These include competences for extension workers such as demonstration of knowledge, competence and having information on problem solving as well as organising farmers for decision making. This will make learners to be more knowledgeable and develop skills so that they reduce their dependency on extension workers during agricultural production processes after school. This can be done through the current agricultural innovations and Technology as stated by the Ministry of Planning and National Deve (MoPND, 2007).

In Kenya, the services sector contributes the highest national GDP followed by agriculture with 32.9% and 17.8% respectfully. About 86% of the total farmers are women out of whom 44% own the business (World Bank, 2015). Agriculture as a subject was introduced in schools curriculum as early as the colonial education (Sheffield *et al*., 1976). All the schools started offering agriculture subject in 1985, the time when the practical 8-4-4 system began (G.O.K, 1984; Ngugi *et al.,* 2002).

In primary school curriculum, agriculture is part of science but in secondary schools, it is an applied subject (KIE, 2006).The youths are taught agriculture so that they can appreciate its role in the economy since Kenya dependents on agriculture for her economic development. However, this subject has been removed from the primary school syllabus, and is an elective subject at secondary school level. Emerging requirements of young people as well as local agricultural needs demand for educational reforms. Agriculture has been taught in secondary schools for long and therefore evidences have to be shown that some of the students who learnt agriculture subject are farmers (KIE, 2006).

In western Kenya most people don't have enough food (Ajani and Chianu, 2008).Sugarcane and continuous food crop production have depleted soil nutrients. Maize and beans are the main subsistence crops grown in Kakamega County, Navakholo sub-county. The study in Navakholo sub-county aimed to find out if the agricultural curriculum content and more so the process of training given to the girls at secondary school level is sufficient enough and necessary to allow them compete favourably with the non-agriculture women. This subject should equip learners with competencies and skills to suit the current agricultural technology and innovation emphasized by the agricultural extension department in Kenya.

Agriculture is a practical subject taught in secondary schools so that the youths can appreciate its role in the economy. Youths are expected to apply these skills immediately they complete their secondary Education. Ever since the implementation of the practical 8-4-4 system and introduction of the subject researchers have been keen on factors affecting the implementation of the curriculum and not the graduates of the system .This study sought to find out the level of participation and productivity of agriculture subject KCSE holders as compared to the non-agriculture subject students. It was hoped that the results would help education policy makers to re-orient the curriculum to suit the current economic demands.

2.5 Adoption of Agricultural Extension Messages

The need for extension services in Kenya has not been achieved since the implementation process has not been efficient and effective hence not sustainable (Ochienno, 2014). This is because the skills used by extension staff and research extension linkages did not allow much interaction and hence low impact on farmer efficiency as well as productivity in crops.

The extension services should target the areas and groups that will give greatest impact. In this case, women do participate in agriculture more than men. Hence extension services should target women who have greater impact in farming. It should use a learner and less intensive system that has a wider coverage (Ochienno, 2014). It should also avoid use of uniform methodology to communicate important messages for effectiveness and efficiency, and should focus on empowering farmers to deliver extension messages to others through cost sharing. Information flow should be fast and reliable depending on local technological and economic conditions. This forms the first step towards adoption of techniques.

Poor financial management in extension is more expensive but less effective. In agriculture subject, learners are taught agricultural economics which gives them knowledge on how to manage finances to making production processes less expensive but effective (Ochienno, 2014).

2.5.1 Extension Methods for Women

Women are busy and therefore the extension methods used should ensure their presence before the dissemination of new technologies (Ochienno, 2014). The suitable methods to be used to pass knowledge include:

i. **Radio** for airing programmes about innovations.
ii. **Group activities** to covers a wider area.
iii. **Demonstrations** to be managed in their own homesteads.
iv. **Fairs and field days extension events** outside homestead in groups of both men and women.

The more the extension agents communicate with farmers, the more the adoption rates. Action to improve non-adoption include sourcing funds to facilitate dissemination of technology, training more farmers to train others, train lady trainers, developing instruction manuals, farmer exchange programmes (Ochienno, 2014).This kind of information should also be disseminated in one way or another to reach secondary school agriculture subject students to ensure that they are well trained to be able to apply the knowledge as soon as they finish school.

It had been realised that there were very few young farmers in the sub County many of them graduated from secondary school with knowledge of agriculture. Hence the current study sought to understand to which extend the former agriculture students

could independently participate in agriculture. More knowledge and involvement in farming activities creates awareness and contact to new techniques (innovation) (Feder, Just, Zilberman, 1985; Rodgers, 1995). This allows faster diffusion of innovations among farmers.

2.5.2 Adoption of innovations.

Adoption is a decision made by individuals to accept or reject an innovation and therefore it's a behavioural utilisation of an innovation (Ndah, Schuler, Uthes, and Zander 2010). Individuals look at innovations as new techniques and may accept them or not. Agricultural innovations are modern agricultural technologies. Adoption may fail due to social and or economic barriers (Ochienno, 2014).

Adoption as a process goes through five stages before a technology is adopted.

i. Awareness/Knowledge of new ideas.
ii. Interest or change of belief about an idea.
iii. Evaluating or judgement on whether to take the idea or not.
iv. Demonstration to test the idea.
v. Applying/adoption of the idea.

Innovations bring about change. Extension services have a role to change productivity as shown by Theory of Change for agricultural extension by Fabregas, Kremer, Robinson, Schilbach, 2017), if they pass over the information to farmers since farmers are ignorant (Birkhaeuser, Evanson, Feder, 1991). According to Kenya Agricultural and Livestock Research Organisation, increased adoption of productive technologies increase productivity (KALRO, 2014).

It had been expected that women farmers who had learnt agriculture be fully equipped with agricultural information and therefore do not need extension officers. The kind of knowledge and skills taught in secondary school agriculture subject does not contain the current innovations that farmers are taught by extension officers hence all farmers are assumed to be ignorant and can only learn after (adopt an innovation) when information is send or flow to them.

2.6 Food Security Assessment.

Kenya is food insecure and this can be associated with the continued aid provided in the year 2010 by as stated by United States Agency for International Development (USAID) to help recover effects after a long period of drought (USAID, 2010). Food security can be determined by climatic events in Kenya. La Nina events lead to lower than normal rainfall in Eastern Kenya hence drought effects persist and above average rainfall in western Kenya which affect food productivity (USAID, 2010).

Navakholo sub-county is in western Kenya and is potentially affected by higher than average rainfall weather effects, a condition that can lead to food insecurity (low productivity of stable foodstuff, maize and beans).It is an area with most of the households engaged in sugarcane production and such an area is potentially vulnerable to food security and assessment since it may not meet the nutritional needs of its people. The presence of food in an area does not guarantee people to consume it (Dreze and Asen, 1989). It's possible that people suffer from food insecurity (Gillespie and Haddad, 2004).Women have been chosen for this study since they are known to be more responsible for accessing, availing and ensuring food utilizing among existing farm families.

Food security assessment is done basing on food availability, food access and food utilization. Food availability means that food is present since it has been produced. Food accessibility refers to means of obtaining the available food while food utilization is the way food is used. According to International Federation of Red Cross and Red Crescent, different people utilize food basing on quality, preparation, nutritional information and their needs for various types of food (IFRCRCS, 2006).

Factors that affect the sustainability of food security include income, knowledge, skill, extension activities, sex, land tenure, water, politics, group work organization and networking with stakeholders. It's vital for Kenyan communities to adopt the following measures to increase food security and sustainability.

i. Involving stakeholders in project design.
ii. Implementation.
iii. Funds contribution.
iv. Monitoring and evaluating. (Wabwoba and Wakhungu, 2013).

This study sought to determine the productivity of stable foodstuff (maize and beans) in the Sub County which affects its access and utilization, since women are responsible for accessing food and utilization, agricultural education is vital study for them. The knowledge obtained is expected to empower them to access food by practicing farming. It's therefore important that the current study gets information on the impact of secondary school agriculture subject on agricultural productivity using women who are the main stakeholders in food security in Kenya.

2.7 Agricultural Development Theories and Models

Agricultural development aims at improving material as well as social welfare of the people. It requires one to drop the view of traditional societies about agriculture and adopt modern ones and find new ways of making Agriculture to speed up its rate of growth in term of output and productivity. One of agricultural development theory is the conservation model (Udemezue and Osegbue, 2018). It emphasizes the evolution of a sequence of increasingly complex land and labour intensive cropping system, the production and use of organic manures and labour intensive capital formation, to more effective use of land and water resources. The model is handy to most of world's farmers and it sustains agricultural production. (Udemezue and Osegbue, 2018)

In the diffusion model the agricultural development relies on some differences in land and labour productivity among farmers and regions. That agricultural development is possible with more effective dissemination of technical knowledge to farmer while considering regional differences. This involves testing and refining farmer innovations, testing and adoption of exotic varieties of crops to improve the productivity. The model insists on the relationship between diffusion rates and personality, characteristics and educational achievements of the farmer (Udemezue and Osegbue, 2018)

The models are relevant to the current study since the study embraces the educational achievements of the farmer as a characteristic that brings about or induce agricultural development for rural development and sustainability. Agricultural education given to secondary school learners should empower them to improve their agricultural productivity. The former agriculture students should easily adopt the extension education offered to them by extension officers and effectively disseminate this

technical knowledge to other farmers. This will assist embrace one of the big 4 Agenda "food security".

2.8 Conceptual framework

In research conceptual framework is a vital section since it binds together the specific objectives. Hence the interrelated ideas based on concepts that clarify why things are the way they are, are collected and tied or bound together. This allows for understanding of the problem under investigation. The role of women secondary school agriculture subject in productivity is the independent variable while productivity of maize and beans is dependent variable. Hence the study focuses on finding out the relationship between the impacts of women secondary Agriculture subject, on productivity of maize and beans in agriculture.

Agriculture subject was meant to train farm management practices that will assist learners to become competent farmers after school and also adopt acceptable technology in agriculture faster and more easily. Intervening variables affecting farming practice adopted by women farmers affect their productivity (dependent variable). The intervening factors affecting agricultural productivity include, legal policy framework, markets, availability of credit facilities.

The basic principle in this case is the principle of diffusion of information communicated to female farmers through learning agriculture over a period of four years and the decision they make after secondary education which is either to apply the principles or reject. Dependant variables are specifically food productivity of the maize and beans.

The conceptual framework above is based on the diffusion theories and models in agricultural development which states that agricultural development is possible with more effective dissemination of technical knowledge to farmers to improve productivity. Girl's secondary school agriculture subject was introduced to equip learners with competences and skills suitable for agricultural productivity. It is therefore expected that the subject provides current agricultural technology and innovations emphasised on by the agriculture extension in Kenya to improve productivity. The model insists on the relationship between diffusion rates, characteristics and educational achievements of the farmer.

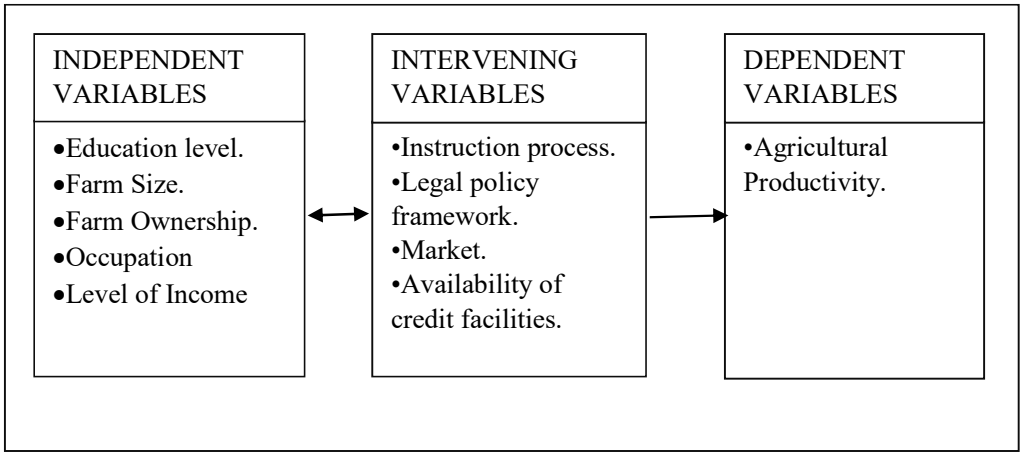

Figure 2. 1: Conceptual Framework model for study on former Agriculture subject women in Navakholo Sub-county Kakamega County Kenya.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the study site, targeted study population, research design, methods used to get the sample for the study, it gives information on how both primary and secondary data was obtained, analysed and presented. It also gives information on validity and reliability of the data, limitations, assumptions and lastly ethical considerations during actual data collection.

3.2 Study Site

The study was conducted in Navakholo Sub County of Kakamega County in Kenya because there is no documentation to show that Navakholo Sub County of Kakamega County is food insecure. Navakholo borders Kakamega North to the east, Kakamega Central to the south, Bungoma south to the North, Matete sub-county to the north East, Mumias sub County to the west and Matungu sub County to the North. (**Figure 3.1)** It lies between latitudes 0º18'0'N and longitudes 34º33'0'E.

It's inhabited by Banyala, Batsotso and Wanga ethnic clans. The sub-county has five wards namely Bunyala West, Bunyala East, Ingotse-matiha, Shinoyi and Bunyala Central (**Figure 3.1**). Its total population is 137,165people distributed in area of 257.9 km^2 (MoA, 2017).

The soils are mainly clay loam and sandy loam on the upper side of the division although clay loams are the predominant soil type. The rainfall ranges between 1800

and 2100mm per annum and is bi modal; short rains July to October and temperature ranges from 18ºC to 22.5ºC. (MoA, 2017).

Well known rivers traversing the sub county are rivers Isasala, Lusumu, Kochwa, and Msamba to drain their water to river Nzoia which which drains it water to Lake Victoria.

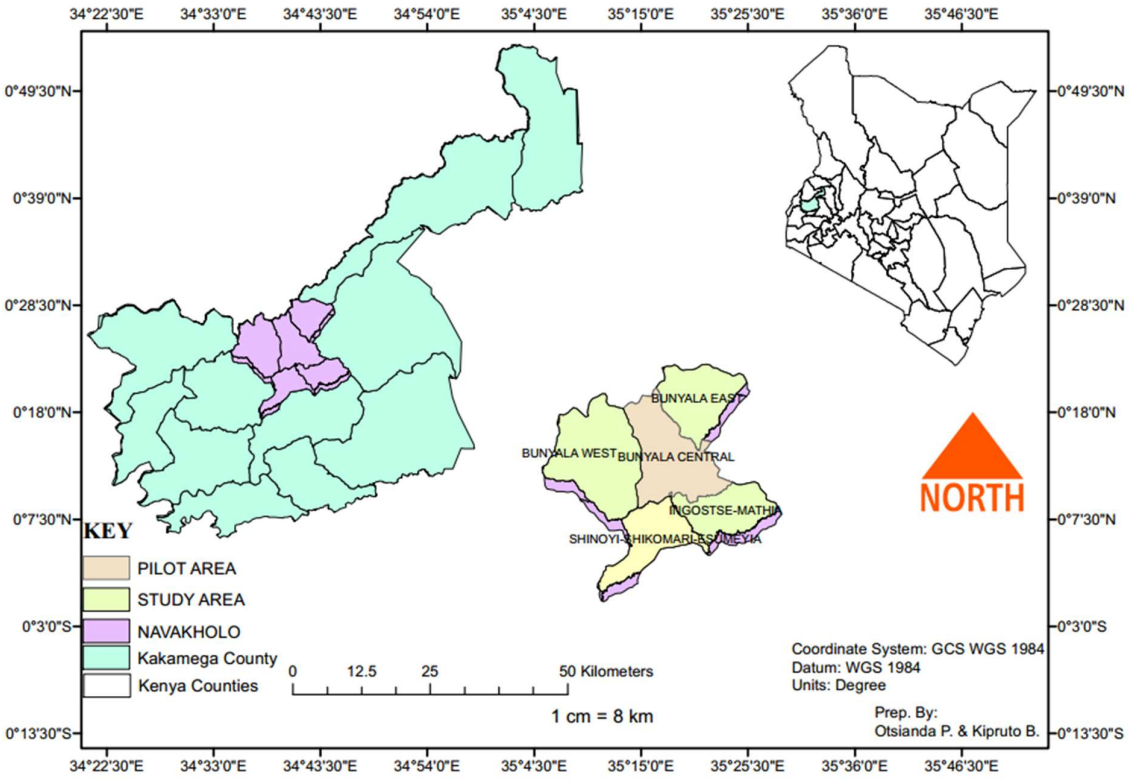

Figure 3. 1: Map of Navakholo sub County, Kakamega County, Kenya, with wards (Source: IEBC website)

To a lesser extent every household farms (Ng'etich, 2013), but practically only 73 % of the farming households are farmers. There are 20004 farm families, with approximately 0.75 acres (0.3 ha) of land under maize per household as indicated by the Navakholo ministry of Agriculture reports 2017. The sub county spreads in the AEZ covering 238 km^2 (Maize zone suitable for tea and coffee) and 19.9 km^2 area (suitable for maize and sugarcane zone). (MoA, 2017). **Table 3.1** shows a summary of

maize production in Navakholo sub County for the years before the current research was carried out.

Table 3. 1: Maize production in Navakholo Sub County for the Years before the Current Research Year

Year	Area planted (ha)	Production (bags of 90kg)
2013	4560	182400
2014	4245	161310
2015	4200	159600
2016	4815	192600
2017	5202	208080

Maize and Beans are the main subsistence crops grown in this sub-County hence these were the enterprises focused on in this study. Maize and Beans farmers with 5 years of experience and above were interviewed due to their confidence and high level of decision making. It was assumed that because of repeated seasonal production processes, at least five years of experience made women farmers experts in maize and beans production in the sub County.

3.3 Study Population

The study focused on participation and productivity of former secondary school agriculture women who are KCSE holders. Hence the study population composed of 422 household heads who are women respondents obtained from an accessible population of households, ward agriculture extension officers, education officers in Navakholo sub-county traders and creditors of Navakholo sub county, Kakamega County, Kenya. **Table 3.2** above shows the measurable variables as the specific objectives for the current study.

3.4 Research Design

A correlational research design was used for this study. To determine the relationship between levels of participation in farming by women farmers having taken agriculture

subject in secondary school with those without and in addition, to examine the relationship between agricultural productivity for two main stable crops with the level of participation in farming by in Navakholo sub-county. Cross-tabulation was used to generate the information that was analysed to provide accurate data to the research.

Table 3. 2: Summary of measurable variables/indicators as per specific objectives of the study for former women agriculture subject students of Navakholo sub-county, Kakamega County, Kenya

Specific objectives	Measurable variables/indicators
i.) Establish the proportion of women graduates of agriculture subject at secondary school level practising agriculture in Navakholo sub county, Kakamega County, Kenya.	• Years of experience • Marital status • Occupation • Proportion of KCSE Agriculture graduates. • Level of education
ii.)Evaluate the impact to agricultural productivity of women graduates of secondary school agriculture subject in Navakholo sub-county, Kakamega County, Kenya.	• Crop planted • Components of diet • Size of farm. • Inputs acquisition. • Marketing of products. • Field management practices • Practice of production and level of output
iii.) To evaluate strategies to enhance agricultural productivity through female agricultural education training at secondary school level Navakholo Sub-County, Kakamega County, Kenya.	• Government policies in education and agriculture • Challenges experienced by farmers and learners • Strategies to improve teaching of agriculture

3.5 Sampling Strategy

The sampling procedures were multistage random sampling for women farmers and purposive sampling. At first stage, purposive sampling technique was applied to identify Kakamega County, then Navakholo sub-county because it had the population of study required and mostly depended on maize as the subsistence crop. Then, secondly four wards were randomly selected from the five wards (Ingostse matiha, Bunyala East and Bunyala Central. Then basing on population density Bunyala Central

ward was randomly selected for pre-test while Bunyala east, Bunyala west and Ingotse-Matiha were selected for actual study.

Startified random sampling was used to select women farmers to provide the information required i.e. from each strata, maize female farmers were selected. The sample size of women farmers' households was determined by use of fis cher's formula (Mugenda, 2008) scale. Since the population of households in 3 wards (Bunyala East, Bunyala West, and Ingotse-matiha were almost similar, equal numbers of secondary school graduates were selected (128 women households) to make a population of 384. from which women graduates of agriculture subject were separated from the non-agriculture graduates. To reduce errors due to non-response 10% (38) respondents were added to make 422 households respondents. Using a questionnaire, the KCSE agriculture subject graduates were separated.

The Focus Group Discussions (FGD) was selected purposively through quota sampling. Hence there were 3 Focus Group Discussions of (12) people. 3 Key informants from 3 ward administrators, 3ward agricultural officers, 3 area education officers and 3 opinion leaders. These were selected purposively. Observation of the socio-economic activities of the respondents were done from their farms and recorded. Hence each study population unit had a sample size and sampling methods as summarised in **Table 3.3**.

Table 3. 3: Summary of study population, sampling methods and sample size of the study in Navakholo Sub-county, Kakamega County, Kenya

Study population unit	Sampling method	Sample size
Household	Multi-stage random	422
Ward extension administrators	Purposive	3
Sub county officials of education	Purposive	3
Sub county officials of agriculture	Purposive	3
Ward creditors	Purposive	3
Ward marketers	Purposive	3
FGD/ stakeholders ; • Teachers. • Agricultural ward administrators. • Sub-County education officials. • Sub-county agricultural officials • Creditors. • Traders. • Women farmers	Quota	12
Total		450

Since the population was large and more than 10 000 households, the sample size was derived from the following Fischer's formulae shown below (Mugenda, and Mugenda, 2003).

$$n=\frac{Z^2pq}{d^2} \quad \text{…… Equation 3.1}$$

Where n= minimum desired sample size

Z = normal standard deviation at 95% confidence interval

p = the proportion of the target population which has the required characteristics of households (P = 0.5)

q = 1-p **where,** 1 is the whole population.

Then

q=1-0.5=0.5

d= is the level of statistical significance (0.05)

Z=1.96, q=1-0.5 and d=0.05

Hence: $n = \frac{Z^2 \; p\,q}{d^2}$

$$n = \frac{(1.96^2)\,(0.5)\,(1-0.5)}{(0.05)^2}$$

n= 384

The working sample was obtained by adding 10% of 384 to the sample size. This was essential to reduce the error experienced due to non-response of some farmers during data collection.

Therefore, working stratified random sample was: 384+38=422 Households

3.6 Data Collection

This section describes collection of primary and secondary data.

3.6.1 Primary data instruments and data collection

The researcher made prior visit to the sub county office to request the ward extension officers to inform the respondents about the data collection schedule for the current study. Primary data were collected using interviews, questionnaires, Focus Group Discussions, key informant guides and observation checklists were used as instruments. Summary of the process plan of data collection is shown in **Table 3.4**.

Data was collected was carried out on the site apart from a few households who were not available to give the information where questionnaires were left and picked. Both open and closed-ended questions were administered to household farmers as shown by

Appendix III. Closed ended questions helped the researcher get personal information and details while open-ended helped the researcher to get explanations and opinions of respondents concerning the study. Pre testing of instruments was done at Bunyala-Central ward to establish their validity and reliability.

The researcher led the Focus Group Discussions with members selected purposively by quota sampling. Most of the questions asked were similar to those in the questionnaire but with the purpose of in-depth perspectives on the study issues as shown by Appendix IV. The Focus Group Discussions had both male and female representatives for each and every ward visited.

The researcher also gathered information through observation of the signs and symbols representing farming and farming activities on household farms. For the purpose of addressing this study, photographs of farmers and activities observed taking place on their farms were taken to act as evidence of involvement in farming activities (Appendix VI).

Oral interviews were conducted to the key informants both from the education and agricultural offices using key informant instruments, since these are people who implement activities and also monitor the learning process in schools and farming activities in the agricultural sector, they provided detailed understanding of the study subject as shown by Appendix V.

Table 3. 4: Summary of the data collection instruments for Navakholo sub-county Kakamega County, Kenya

Study population unit	Sampling method	Sample size	Data collection instrument	Appendix number
Household.	Multi-stage random	422	Household uestionnaire.	III
Key informants; agricultural extension ward administrators, agricultural crops officers, area education officers	Purposive	1 per ward	Key informants interview guide	V
Focus Group Discussions.	Quota	8-12 per ward.	Focus Group Discussions guide.	IV
Observations; household women farming and marketing socio-economic activities.	Purposive	6	Observation check lists	VI

3.6.2 Secondary Data Instruments and Data Collection

This was derived from document content analysis (books, journals and review reports) at the education office, schools and Navakholo sub-county agricultural office to enhance the effect and influence of KCSE agriculture subject in shaping women's participation and productivity in agriculture.

3.6.3 Validity and Reliability of Data Collection Instruments and Tools

Validity

The instruments were prepared using the content that was based on the research objectives developed. Construct and content validity of the instrument was established by presenting it to supervisors in this study who are knowledgeable and experienced researchers in the area of study to assess the aspects measured. This was done to determine the suitability to be used to collect the information accurately. Mugenda and Mugenda (2003) assert that validity is the extent to which research instruments measure the study questions.

Reliability

According to Mugenda and Mugenda (2003), reliability is a measure of degree to which a research instrument yields consistent results after repeated trials. The reliability of an instrument is expressed as a co-relation which varies between values 0.0 and 1.00. 1.00 indicates perfect reliability and 0.00 indicates no reliability. Reliability coefficient shows the extent to which an instrument is free from error variance (Mugenda and Mugenda, 2003). The reliable instrument should have its reliability coefficient of 0.7 and above. Hence the more the instrument is free from error, the better, since it's a measure of the real differences among the subjects being assessed by the instruments (**Table 3.5**).

The split-half test measure of reliability was employed. Data collection instruments were administered to 30 respondents in Bunyala central ward. The questionnaires were split into two parts and both parts were given to secondary school graduate women farmers at the same time. This allowed the researcher to obtain the x-reliability coefficient score from 15 respondents and y-reliability coefficient from another 15 respondents.

The y-score and x-score were then correlated and found to be 0.75 which was a reliable value according to the values provided by Cronbach's Alpha reliability coefficient in **Table 3.5**.

Table 3. 5: Reliability measures for Secondary school Agriculture women practicing farming in Navakholo Sub-County, Kenya

Cronbach's alpha	Internal consistency
a >= 0.9	Excellent
0.8<= a >=0.9	Good
0.7<= a >=0.8	Acceptable
0.6<= a >=0.7	Questionable
0.5<= a >=0.6	Poor
a < 0.5	Unacceptable

Source: Orodho and Kombo (2002)

The instruments were therefore found to be reliable enough to be used during actual data collection. Since Bunyala Central ward was used pilot study, actual data collection was not carried out in this ward.

3.7 Limitation

The limitations experienced in the field during data collection include:

i.) Respondents were unwilling to respond and therefore there was need to involve the area agricultural officer who prompted them in responding to some questions.

ii.) Respondents were not available to provide information when needed. To overcome this challenge, the researcher made prior arrangements by visiting and dispatching questionnaires and request for their presence during the time of interview.

iii.) This research was confined on secondary school leaver women in Navakholo sub-County, Kakamega County and not any other part of Kenya. The researcher, therefore, worked hand in hand with the Navakholo sub-county agricultural officers and Education officers to ensure accurate results at the end of the study.

3.8 Assumptions

The following assumptions were made regarding the study:

i. That the female farmers selected for the study consisted of both former secondary school agriculture subject women and non-agriculture subject women.

ii. That maize and beans are the main staple foodstuffs and was therefore cultivated by nearly all households.

iii. That during the study, all the respondents gave correct information and variables not captured in the current study and in the conceptual framework remained constant.

3.9 Data Analysis and Presentation

Data collected by questionnaires on proportion of women farmers practicing agriculture are coded, analysed and presented using descriptive statistical where frequencies and percentages were applied. Data collected on impact to agricultural productivity were coded and analysed through descriptive statistics (frequencies and percentages) then subjected to cross tabulation to show relationships by statistical package for social sciences (SSPS) software version 20.

Table 3. 6: Summary of data analysis and presentation as per the specific objectives for the study of former women agriculture subject students in Navakholo Sub-County, Kakamega County, Kenya

Specific objectives	Measurable variables/indicators	Data analysis method
i.) Establish the proportion of women graduates of agriculture subject at secondary school level practising agriculture in Navakholo sub county, Kakamega County, Kenya.	• Years of experience • Marital status • Occupation • KCSE Agriculture graduates • Non-agriculture graduates of KCSE	Chi square, inferential and descriptive statistics
ii.) Evaluate the impact to agricultural productivity of women graduates of secondary school agriculture subject in Navakholo sub-county, Kakamega County, Kenya.	• Crop planted • Components of diet • Size of farm. • Inputs acquisition. • Marketing of products. • Field management practices • Practice of production	Chi square, correlation analysis and descriptive statistics
iii.) To evaluate strategies to enhance agricultural productivity through female agricultural education training at secondary school level Navakholo Sub-County, Kakamega County, Kenya.	• Government policies in education and agriculture • Challenges experienced by farmers and learners • Strategies to improve teaching of agriculture	Chi square, descriptive statistics and spearman rank order correlation analysis

Inferential statistics were obtained using chi-square at 5% level of significance to determine the contributions of women graduates of agriculture subject to agricultural productivity.

It was also analysed using Chi-square test and correlations (cross tabulation) carried out to determine the relationship between learning agriculture at secondary school level and participation in farming by women who were agriculture students. The same procedure was also used to determine the relationship between agricultural productivity and learned agriculture at secondary school level. This was done using the Statistical Package for the Social Sciences (SPSS Version 20).

3.9.1 Methods of analysis

Chi-square test equation.

$$X^2 = \Sigma \frac{\text{observed} \times \text{frequency} - \text{expected} \times \text{frequency})}{(expected \times frequency)} \cdots\cdots\cdots\cdots \textbf{Equation…3.3}$$

$$X^2 = \Sigma^n \frac{(0_i - F_i)^2}{E_i}$$

$$i\text{-}1$$

Where

X^2 = Pearson's cumulative test statistics.

O_i = an observed frequency in the class.

E_i = an expected theoretical frequency asserted by the full hypothesis of the class.

n = the number of lass in the contingency table.

Spearman's Rank order correlation will be calculated between variables to establish similarities or differences between various rankings.

The correlation will be obtained using the formula.

$$r = 1 - \frac{6\sum D^2}{N\sqrt{N^2-1}} \quad \text{..... Equation 3.4}$$

Where r- Coefficient of correlation

N- The number of pairs or rankings used in deviations of r.

D- The difference in a pair of rankings

Standard error of the correlation was obtained using the formulae.

$$S.E_r = \frac{1 - r^{2\,u}}{\sqrt{N}} \text{.....Equation 3.5}$$

The correlation coefficient was computed between variable and its magnitude compared with its probable error.

The probable error ($P.E_r$)

$$P.E_r = 0.6745 \left(\frac{1-r^2}{\sqrt{N}}\right)$$

Where $P.E_r$ - Probable Error

r- Coefficient of correlation.

N- The number of pairs or rankings used in deviations of r.

Thus;

When r= P. E_r There is no evidence of correlation. This means statistically P>0.05 value of r is not significant,

But When r > 6, P.E_r, the coefficient of correlation is statistically significant (P<0.05) **(Gupta, 2008)**

3.10 Ethical Consideration

Privacy of research was observed. Consent was sought at all stages. This was done to maintain confidentiality and anonymity. The researcher requested for a letter of approval from the dean of the department and School of Graduate Studies (Appendix VIII), a permit from NACOSTI (Appendix IX and X) that gives authority to carry out research and a letter of introduction to respondents to elaborate the purpose of the study (Appendix I). The researcher then visited the county offices inform them of the study and seek consent. Data were collected according to objectives to avoid bias and omission.

CHAPTER FOUR

PROPORTION OF WOMEN PARTICIPATING IN AGRICULTURE IN NAVAKHOLO, KAKAMEGA COUNTY, KENYA.

4.1 Introduction

The chapter presents the Socio-Economic and demographic characteristics of household respondents and the results of the proportion of graduates of KCSE agriculture subject female farmers participating in agriculture in Navakholo sub-county, Kakamega County, Kenya

4.2 Socio – Demographic Characteristics of Household Respondents

The study sought to find out the background information of the respondents such as gender, marital status, crop planted, years of farming, occupation level of education and proportion of graduates of KCSE agriculture subject participating ain farming.

4.2.1 Gender

Female respondents were purposively selected as gender for the current study. Previous researchers cited women as providers of labour force to smallholder producers IMF, (2012), AGRA, (2014), World Bank, (2015). In SSA, 80% of all farms are small smallholder employing about 175 million people directly (AGRA, 2014), with women comprising half of the labour force (FAO, *et al.*, 2015). A key crop production informant pointed out that women were the actual participants in farming in the sub county.

Some of the women farmers in a self-help group meeting in Navakholo Central ward are shown in **Plate 4.1**. Previous researchers indicated that women comprise the main global agricultural labour force as it was stated by AEO (2016) and 86% of farmers in Kenya are women (World Bank, 2015). Similarly, women's roles are diverse across regions (FAO, 2011) and according to MOSAVI *et al*., (2011), women's attitude and participation in agriculture is positive. For these reasons, women who were by then practicing agriculture were selected to be the main respondents to this study in Navakholo sub-County.

Plate 4. 1: Women farmers of Navakholo central self-help group in Kakamega County, Kenya

4.2.2 Marital Status

The study sought to find out the marital status of the selected respondents in Navakholo sub County, Kakamega County, Kenya

The results were summarised as shown in **Figure 4.1**. From the results, 379 (89.6%) of respondents were married while 44 (10.4%) were single or widowed. A Chi Square test ($\chi^2_{1,0.01} = 265.31$) conducted on the results indicates that there was a significant ($p<0.01$) variation in the responses on marital status of women farmers. This implies that thee was variation in participation in farming in Navakholo of Kakamega County, Kenya between the married and single women. From the Focus Group Discussion it come out clearly that married women receive a lot of moral and material support from men but they are the actual participants in farming.

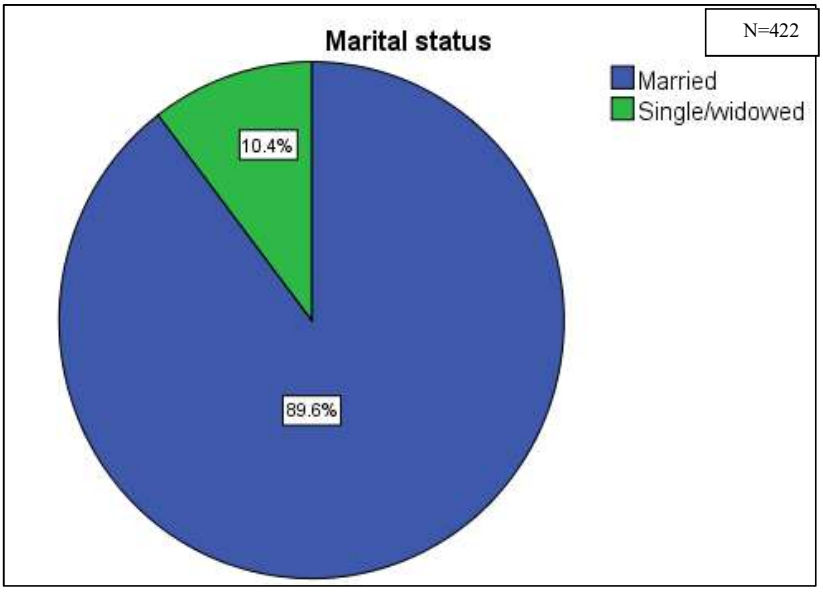

Figure 4. 1: Marital status of women respondent in Navakholo sub –County, Kakamega County, Kenya (Source: field data).

From the received support, they gained the confidence to participate in either agriculture as personal financial project or as representatives of their husbands. According to World Bank (2015), 86% of farmers in Kenya are women, 44% of whom work in their own right while 42% represent their husbands. It's true that a woman can afford to participate in farming whether is married or not married. According to MOSAVI *et al*., (2011), women's attitude and participation in agriculture is positive.

4.2.3 Crops planted

The main crops focused on for this study were the subsistence crops of the community which are maize and beans. From the research, 83 (19.6%) women farmers planted only maize, 1 (0.2%) planted only beans while 339 (80.1%) planted both maize and beans. A Chi Square test, ($\chi^2_{2,0.01} = 440.91$) conducted on the results indicated that crops planted varied and had significant ($p<0.01$) association with participation of women farmers in farming in Navakholo sub County of Kakamega County, Kenya. Discussions with key informants revealed that women with secondary school agriculture subject knowledge planted both maize and beans, hence providing enough food for the household families in the sub-county. Since the staple subsistence foodstuff is maize and beans, it was expected that for the community to be food secure, most respondents should produce both as compared to either those who produce maize or beans only**. Figure 4.2** shows the types of crops planted by household respondents.

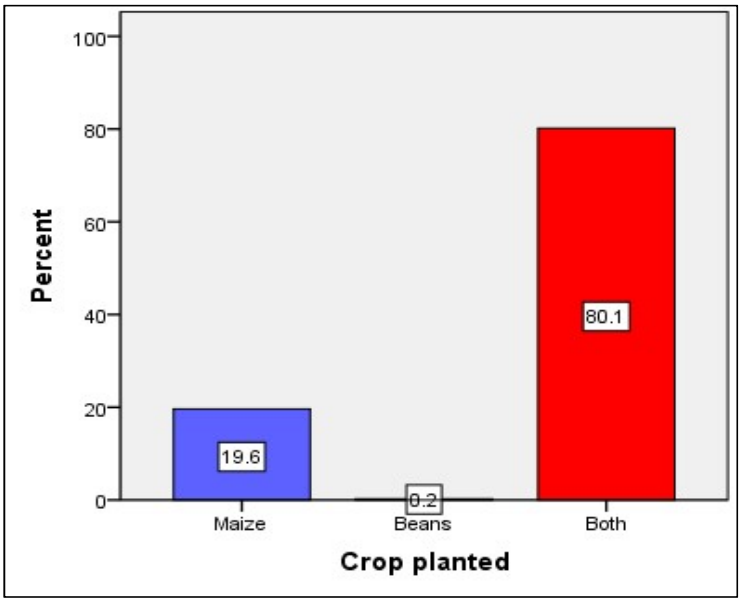

Figure 4. 2: Crops planted by women farmers in Navakholo sub county Kakamega County, Kenya

These results contradict with those of Ajani and Chianu, (2008) who posted that in western Kenya, people are food insecure since sugarcane production has depleted soils. Currently most farmers are uprooting sugarcane to plant their subsistence crops (maize and beans). The results agree with the role that agriculture plays in meeting national goals such as providing food and rural incomes to its people.

4.2.4 Years of farming

The study sought to find out the farming experience of respondents and the results were recorded in **Figure 4.3**. 8 (1.9%) of the respondents indicated that they had been farmers for five years or less while 415 (98.1%) had been farmers for over five years. Years of farming of women farmers of Navakholo sub-county, Kakamega County highly significantly (P<0.01) varied and had a significant relationship to their participation in farming as indicated by Chi square test, ($\boldsymbol{\chi^2_{(1,0.01)} = 391.61}$, p=0.01). This implies that there was variation in participation between female farmers with less years of experience and those with more than 5years A greater proportion of the respondents had been farmers for over 5 years. Focus Group Discussions indicated that farmers with longer experience made reliable decision and had confidence to participate in agricultural activities.

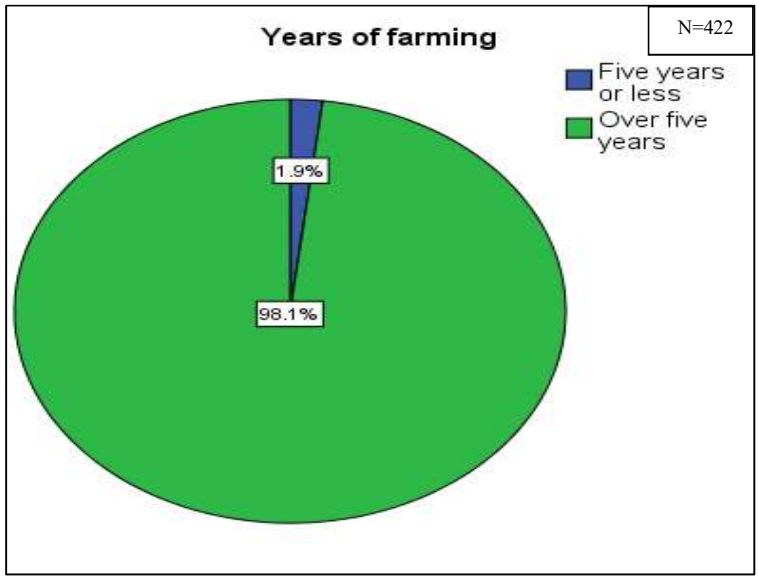

Figure 4. 3: Farming experience of women respondents for Navakholo sub County, Kakamega County, Kenya.

The current results contradict with Hansen *et al.,* (2012) who reported a negative relationship between female labour participation and years of agricultural activities in Kenya. Similarly, IMF, (2012), AGRA (2014), and World Bank (2015) cited women as providers of labour force to smallholder producers.

4.2.5 Occupation

Women farmers stated their main occupation and the results were recorded in Figure 4.4 below. The research indicated that, 211 (49.9%) were farmers, 200 (47.3%) were civil servants and 12 (2.8%) were business women.

A Chi- Square test, ($\chi^2_{2,0.01} = 177.46$) conducted on the results indicates that there was significant ($p<0.01$) variation in the occupation of respondents. These implies that Occupation of respondents had variation on participation in farming in Navakholo sub-county of Kakamega County, Kenya. Focus Group Discussions indicated that, civil servants and business women generated income which they invest in production of

maize and beans and employed other women to manage their crops in their absence hence increasing women participation in agriculture.

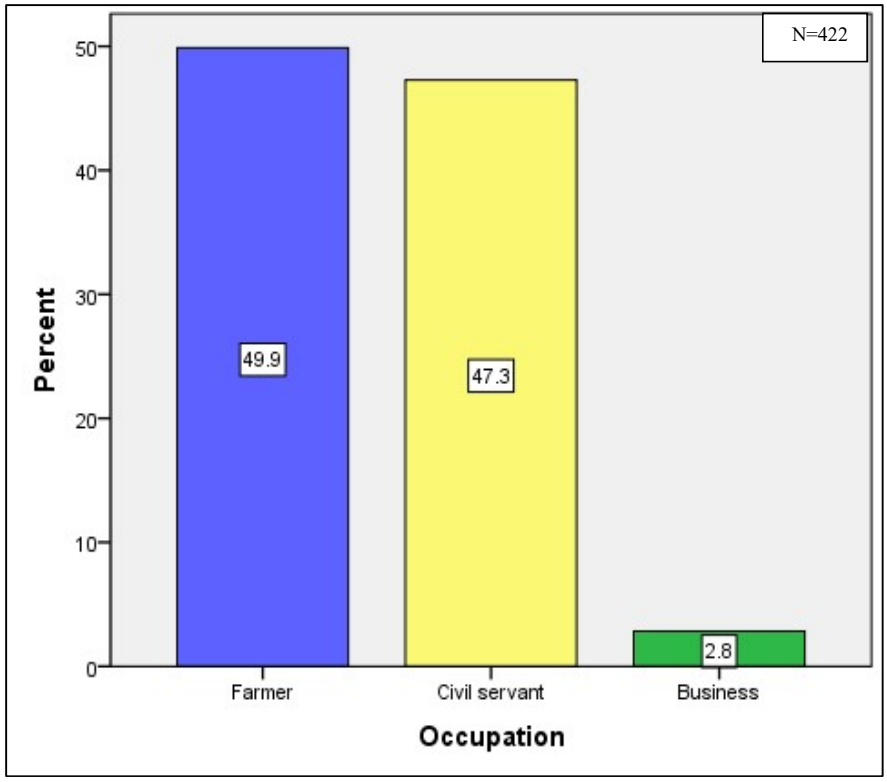

Figure 4. 4: Occupation of women respondents in Navakholo sub County, Kakamega County, Kenya.

According to gender statistical profile in Uganda (2012), from the total number of women engaged in crop production, more than half were unpaid household workers (mainly farmers). The current results are in line to those of Grace (2004) who reported that women's participation in agriculture is determined by socio-cultural factors and involvement in income generating activities and (ILO, 2015) who posted that working women in Africa are in low productive agriculture. The results also agree with Abdulhamid *at el.*, (2016) who indicated that both employed and unemployed women provided labour force.

4.2.7 Proportion of KCSE/KCE graduates among secondary school graduate women farmers in Navakholo sub-county

Secondary school women graduates stated whether they learned agriculture and sat for KCE/ KCSE and the responses were summarised in **Figure 4.6**. The results revealed that out of 422 secondary graduate farmers, 107 (25.4%) had learned agriculture and sat it at KCE/KCSE while 315 (74.6%) had not learned Agriculture subject at KCSE. A Chi Square test, ($\chi^2_{1,0.05} = 0.021$) conducted on the results showed that there was a significant ($p<0.05$) variation in responses implying that the proportion of KCSE graduates of agriculture subject to non-KCSE graduates had significant variation in participation in farming and agricultural productivity.

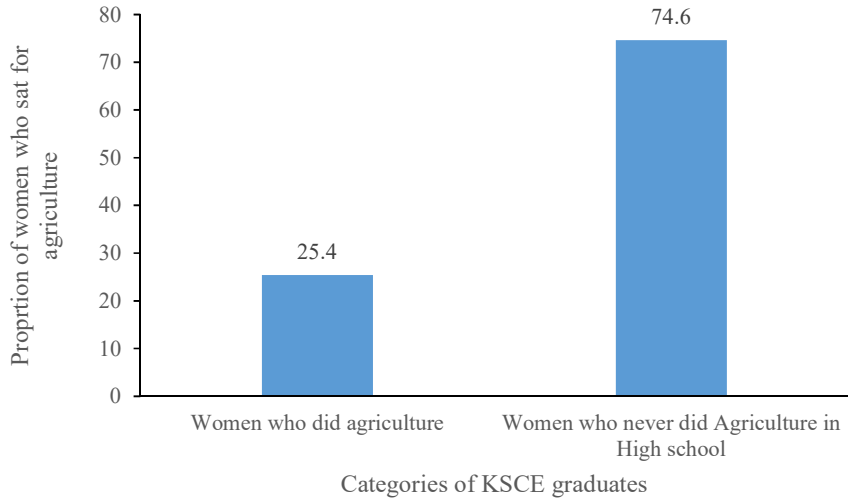

Figure 4. 5: Proportion of women graduates of KCSE agriculture subject in Navakholo sub County

The results agree with Egun and Egun (2015) who reported that enrolment of girls in Agriculture Science in secondary is not encouraging. This has reduced the number of girls entering agriculture sector) and disagree with Stouracova, (2016) who reported increase in the number of girls who access secondary schools, and most of them complete their courses by undertaking KCSE agriculture.

CHAPTER FIVE

IMPACT TO AGRICULTURAL PRODUCTIVITY OF WOMEN GRADUATES OF AGRICULTURE SUBJECT STUDENTS IN NAVAKHOLO SUB-COUNTY, KAKAMEGA COUNTY, KENYA

5.1 Introduction

The section presents result on the second objective of the study which was to determine the impact of former women secondary school agriculture subject students to agricultural productivity.

5.2 Components of Diets

All respondents indicated that maize and beans were the main component of their diet. This agrees with data from key official informant from the Ministries of agriculture which indicated that maize, particularly, was the main component of the diet for households.

Data collected on maize production for the previous 5 years before the current study, shows continuous increase in the production of maize in Navakholo sub-county. Households have maintained high productivity of maize to offer food security in the sub-county. Focus Group Discussions indicated that households must plant maize every year because it's the main food component for the community. They indicated that its' known that every household must take a meal with maize or products processed from maize such as porridge, beans or ugali.

5.2.1 Number of bags of maize consumed per household

Respondents stated the number of bags of maize they used yearly for household consumption. The results were summarised in **Table 5.1**

Table 5. 1: Number of bags of maize used for household consumption in Navakholo Sub-County, Kenya.

Number of bags	Household size	Frequency	Percent
1	3	28	6.7
2	5	71	16.7
3	5	84	20.0
4	7	56	13.3
5	8	84	20.0
6	10	56	13.3
7	12	43	10.0
Total		**422**	**100.0**

From the results, 2 (6.7%) used 1 bag of maize, 5 (16.7%) used 2 bags, 6 (20.0%) used 3 bags, 4 (13.3%) 4 bags, 6 (20.0%) 5 bags, 4 (13.3%) 6 bags while 3 (10.0%) used 7 bags. Most respondent households used 3 or 5 bags of maize while some households indicated that they only needed 1bag yearly. A key informant indicated that most households have fewer members of the family and they need 3 bags or at most 5 bags of maize to consume yearly. The key informant reported;

> "Unless we are visited by relatives frequently, most families need 3 bags of maize to consume yearly. Slightly larger families consume 5 bags at most per year."

From the Focused Group Discussion, it came out clearly that it's rare to find households using more than 6 bags of maize per year. It was observed that most households kept 3 to 5 bags of maize for consumption. The extra amount of maize was sold to earn income.

5.2.2 Number of bags of beans used per household

Respondents stated that the number of bags of beans they used yearly for household consumption. The results were summarised in **Table 5.2**

Table 5. 2: Number of bags of beans used for household consumption by women farmers in Navakholo Sub-County, Kakamega County, Kenya.

Number of bags	Household size	Frequency	Percent
0	2	2	0.5
0.25	2	2	0.5
0.50	4	5	1.2
1.00	5	14	3.3
2.00	7	399	94.3
3.00	10	1	0.2
Total		**422**	**100.0**

From the results, 2 (0.5%) never used, 2 (0.5%) used quarter a bag, 5 (1.2%) used half a bag, 14 (3.3%) used 1 bag, 399 (94.3%) used 2 bags while 1 (0.2%) used 3 bags. Majority (399) of the respondents indicated that they used 2 bags of beans yearly especially when cooked in mixture with maize.

During the Focused Group Discussion, one of the members indicated that most households used 2 bags of beans per year. He also indicated that farmers planted beans in mixture with maize while others had not. A key crop officer informant from the Navakholo sub-county agricultural office stated that the records of productivity showed low consumption of beans as compared to maize

5.2.3 Adequacy of the bags of maize and beans for household diet

Respondents indicated that the bags were enough and the results were summarised in **Figure 5.1**. Results indicated that 402 (95.0% of the respondents) indicated that the bags were enough while 21 (5.0%) indicated that the bags were not enough. A Chi

Square test, $\left(\chi^2_{1,0.01} = 343.17\right)$ conducted on the results indicated that there was a highly significant (P<0.01) variation responses on adequacy of bags of maize and beans produced. This factor had significant relationship to agricultural productivity of former women Agriculture subject students in secondary schools in Navakholo sub-county, Kakamega County, Kenya

During the Focus Group Discussion, a member indicated that women farmers produced bags of maize and beans which are enough for their households to survive on for a period lasting 10-12 months. He also stated that a few could not provide for their families due to less or lack of skills required for farming.

He also indicated that there were stakeholders in agriculture operating in the sub-county and with great interest in maize production. Such stakeholders included NGOs such as One Acre Fund. Women farmers therefore had a wide choice of sources of inputs. Some obtained inputs from NGOs while others received from sub-county agriculture offices. Nambiro (2007) posted that land in Navakholo Sub-County had been depleted of the soil nutrients thus it produced little amount of subsistence crops. The current situation might not be the same since most women farmers are planting maize and producing enough for household consumption due to availability of fertilisers.

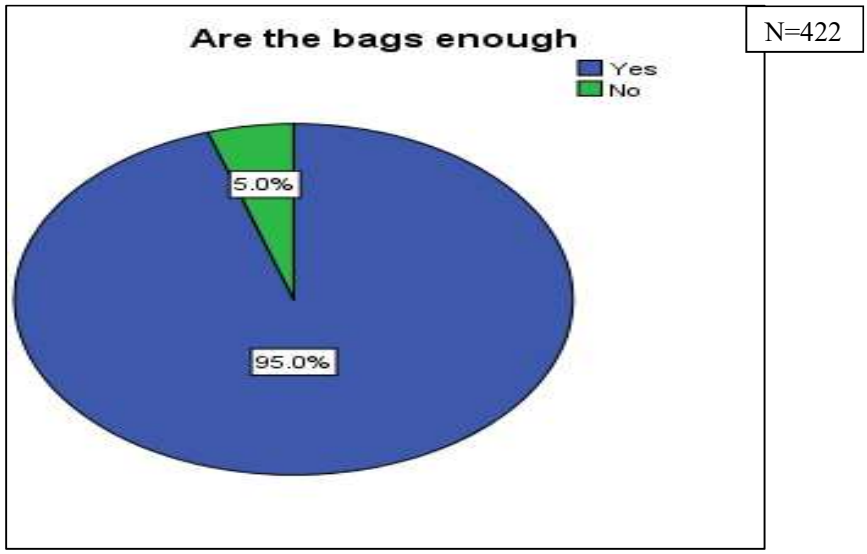

Figure 5. 1: Bags used enough for food by women farmers in Navakholo Sub County, Kakamega County, Kenya

5.2.4 Income earned from maize farmings

Respondents indicated whether they earned income from maize and the results were summarised in **Figure 5.2**. From the results, 269 (63.6%) earned income from the maize while 154 (36.4%) did not earn income from maize.

A Chi Square test, ($\chi^2_{1,0.01} = 31.27$) conducted on the results indicated that there was a significant ($p<0.01$) variation in responses on income earned from maize farming.

A key informant from the Navakholo sub-county indicated that most women farmers produced extra bags of maize which they sold to the local traders and neighbours. A few managed to sell to NCPB (National Cereals and Produce Board) within the county. During the Focus Group Discussion, a member from the agriculture office indicate that most of the maize produced in the sub-county was by the women farmers and sold the extra to other households and traders in the local market. This earned them income used to sustain them as stated by Wabwoba *et al.,* (2013).

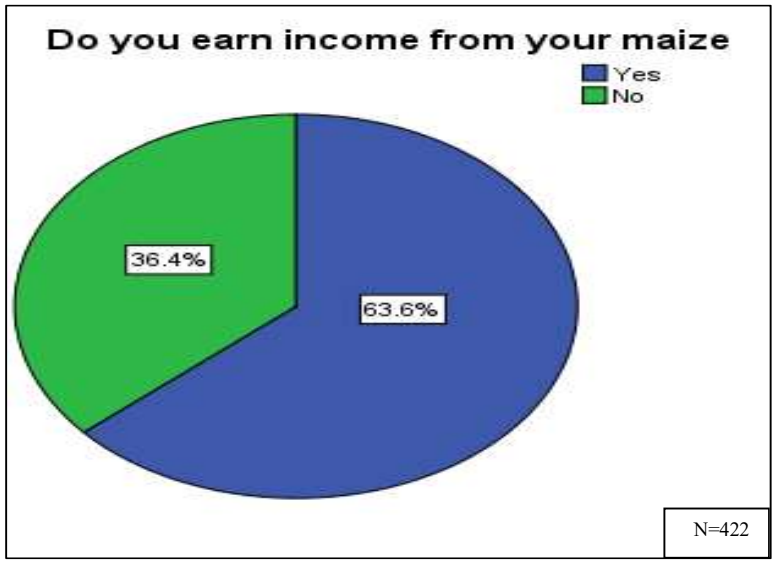

Figure 5. 2: Earn income from maize produced by women farmers in Navakholo Sub County, Kakamega County, Kenya

5.2.5 Income earned from beans produced

Respondents were further asked to indicate whether they earned income from beans. The results were recorded in **Figure 5.3**. This study revealed that 212 (50.4%) earned income from the beans while 211 (49.6%) did not earn income from beans. A Chi Square test ($\chi^2_{1,0.05} = 0.021$) conducted on the results indicated that there was no significant ($p>0.05$) variation in the responses on income earned from beans produced. During the Focus Group Discussion, a member from agriculture office indicated that women farmers produced beans and sold the extra beans to other households and small scale traders on the local market. The money is then invested in farming. Wabwoba *et al.,* (2013) also posted that income is necessary since it sustains food productivity and hence food availability.

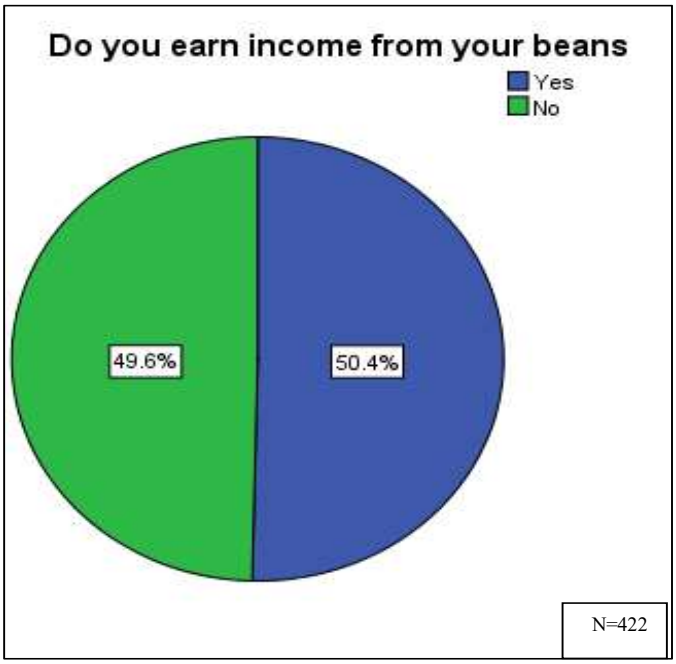

Figure 5. 3: Income earned from beans by women farmers Navakholo sub County, Kakamega County, Kenya

5.3 Size of Land Acreage per Farmer

Respondents indicated their land acreage their results were summarised in **Figure 5.4**. The current research results (Figure 5.6) indicated that the majority 395 (93.4%) had less than an acre, 13 (3.1%) had 1-3 acres, 11 (2.6%) had 4-6 acres while 1 (0.2%) had over 6 acres for farming. A Chi Square test $(\chi^2_{3,0.01} = 1055.99)$, p=0.01) indicated that land acreage per farmer had significant ($p<0.01$) relationship to agricultural productivity of former women agriculture subject students in secondary schools in Navakholo Sub County, Kakamega County, Kenya. During the Focus Group Discussion, an extension officer from the agriculture office Navakholo sub county indicated that most women farmers own small pieces of land, a factor that limits productivity. Some of them have high level of knowledge and skills. A key informant stated that even with small pieces of land women farmers practice high level of Agricultural, and their productivity is high. These results are in line with those of (Wabwoba *et al.,* 2013) who posted that land tenure affect food security and

sustainability. The chi square test investigation revealed that the size of land had significant variation on the level of production.

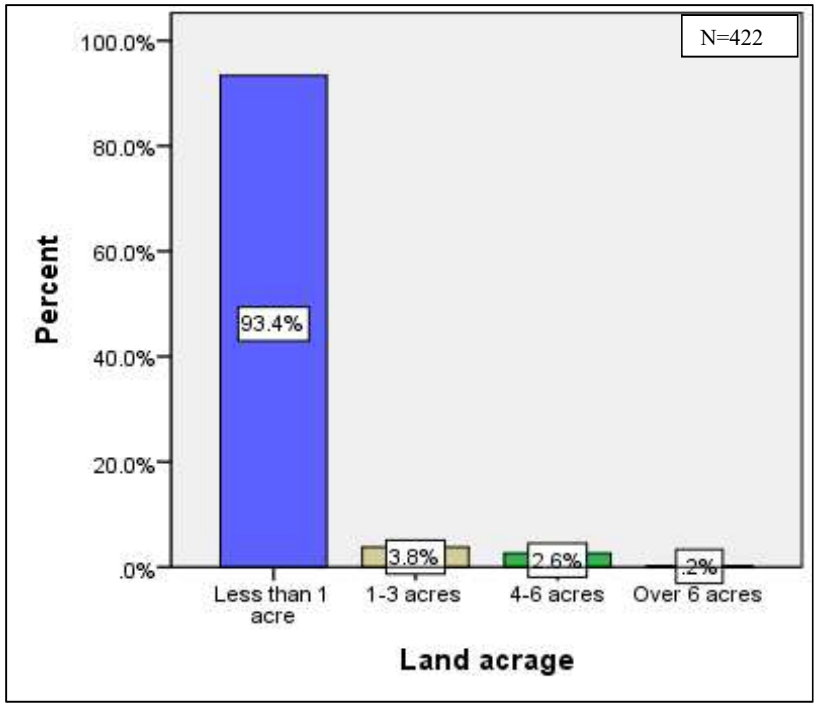

Figure 5. 4: Land acreage for the women farmers in Navakholo sub county, Kakamega County, Kenya.

5.4 Diseases Attack on Maize and Beans Plants Produced by Women Farmers.

All respondents indicated that their maize was affected by diseases. Maize is grown widely by nearly all the households of Navakholo sub-County because it's their main stable foodstuff. Maize plants are affected by a number of diseases that seriously lower production level.

The ministry of agriculture indicated that the most stubborn and serious diseases were maize smut and MLND related diseases. A key informant claimed that the diseases caused serious destruction and therefore lowering yields. During a Focus Group Discussion, most members indicated that change in climatic conditions made maize plants vulnerable to the disease attack. Extension officers pointed out that women

farmers with KCSE agriculture knowledge had the knowledge about the diseases and had the ability and skills control the disease although as compared to non-KCSE agriculture subject women who purely relayed on extension officers for disease control.

Similarly, women farmers indicated that their maize and beans were infested by diseases and results summarised in **Figure 5.5**. The results indicated that, 10 (20.5%) indicated that their maize and beans were not affected by diseases while the majority 412 (79.5%) indicated that their beans were affected by diseases especially bean rust. Further investigation using a chi-square revealed that diseases had a significant ($p<0.01$) variation on productivity in maize and beans production with ($\chi^2_{1,0.01} = 415.04$ at $p=0.01$).These implies that there was a variation in attack of diseases on maize and bean plants. Most households planted beans intercropped with maize since they are the major staple foodstuff for the community.

Focus Group Discussions and key informant interviews reveal that most farmers need direction on disease management in the event of attack although the former KCSE agriculture learners took instructions faster than the non-agriculture students. Hence disease management had a significant variation in participation in maize and beans in Navakholo sub-County.

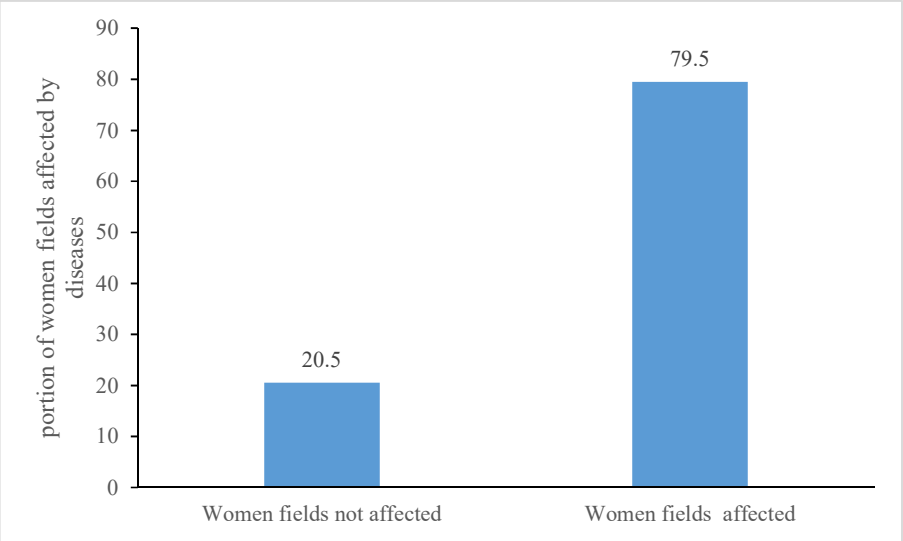

Figure 5. 5: Diseases Attack on Maize and Beans Plants Produced by Women Farmers in Navakholo Sub-County

5.6 Pests Attack on Maize and bean Produced by Women Farmers in Navakholo Sub County.

All respondents indicated that their maize was affected by pests. Currently, the most serious pest affecting maize plants is Fall Army Worm. In the previous year it had affected up to (25-50) % proportion of the sub-county's maize plants. With knowledge and skills applied, the women farmers had controlled the effects of the pest by applying chemicals such as Duduthrin, Thunder, Bolt and Tremor.

The respondents pointed out that the most effective pesticide is tremor since it was applied directly to the point of pest inhabitation. They also received direction on pest control from KALRO, MOALF/PPSD, Radio Farmer programs and TV Farmer programs. Fall Army worm incidences had also been controlled by holding demonstrations and field days to train farmers. There had been continuous creation of awareness among farmers through Baraza where farmers have been asked to avoid planting maize during off sessions. A key extension agent informant stated;

> "It is difficult when you have to serve all farmers in the same ward at the same time. All maize plants are infested by fall army worm same day, same hour. They all ask for assistance at the same time, same hour, same day."

Another pest that commonly affected maize in Navakholo sub-county was maize stock borer that damaged the pollen grains before pollination was complete.

Similarly, women farmers stated whether their maize and beans were affected by pests and the results were summarised in **Figure 5.6**. A key informant revealed that few farmers planted beans while marketers stocked less bags of beans for sale as compared to maize. The prices of beans were fairly higher than for maize. Hence very few farmers claimed freedom from pests. For the plants affected, the farmers managed to control the pests before they reached the threshold level to damage the crop. From the results, 21 (5%) indicated that were not affected by pests while the majority 401 (95%) indicated that their crops were affected by pests. Further investigation using Chi-square gave significant ($\chi^2_{1,0.01} = 415.04$, p=0.01) variation in responses. These implied variation in pest attack on maize and bean plants and productivity.

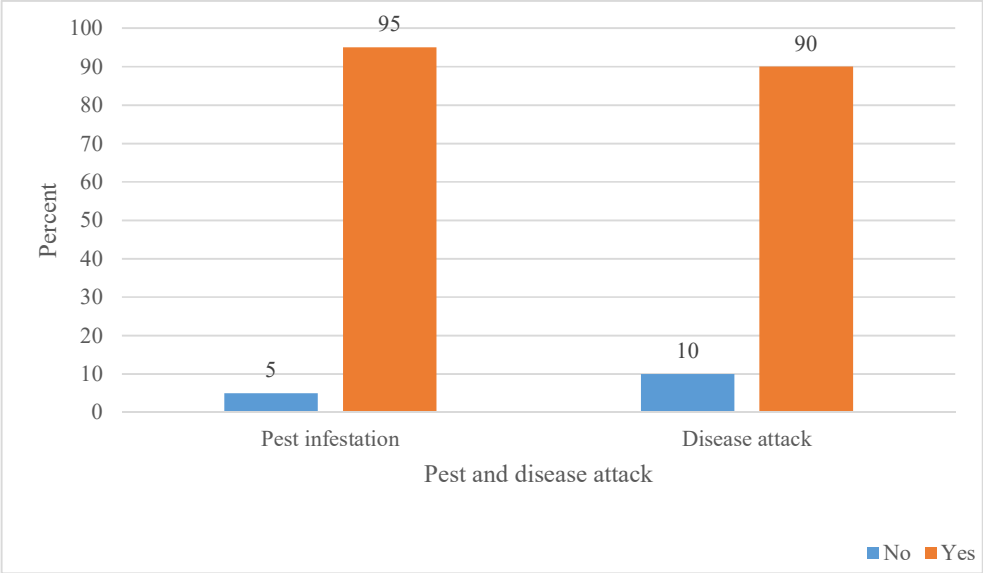

Figure 5. 6: Pests and Disease attack to maize and beans of women farmers

5.8 Ownership of Livestock and Other Crops

The study sought to establish the livestock and other crops owned by respondents so as to understand the extent to which women farmers practise agricultural principles learned in secondary school. Secondary school teachers of Agriculture subjects of Navakholo sub-county stated that the syllabus content does not only train crop production principles but it also trains livestock production principles. Well trained woman farmer and economically empowered would engage in livestock production to earn more income and the results were summarized in **Figure 5.7**

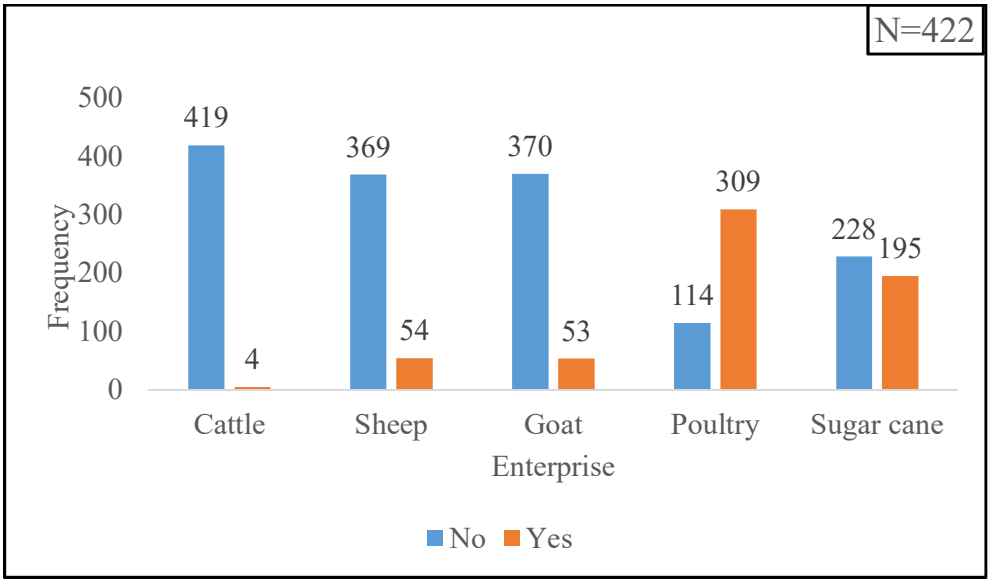

Figure 5. 7: Ownership of livestock and other crops by women farmers

A key ward agricultural officer informant reported that farmers kept one or two cows for subsistence milk production. He also indicated that most women farmers had insufficient knowledge and skills in livestock keeping.A key ward agricultural officer informant indicated that most women farmers lacked knowledge and skills in production of sheep and hence had no interest in rearing. He also added that some did not have resources such as land to combine subsistence food production with sheep rearing. A key sub-county agricultural informant reported that farmers reared goats for selling to earn income so that they can invest in farming. Observations made from farmers homesteads revealed one or two goats reared by a few women farmers.

.A key sub-county agricultural informant reported that most women farmers preferred rearing poultry to any other livestock since it required less labour, used as a protein in the household diet and can be sold to earn income Focus Group Discussions and key agricultural informants, indicated that maize was by then profitable compared to sugarcane production. A key informant reported that women farmers were by then

uprooting sugarcane to plant maize though few farmers planted both with the aim of earning extra income.

5.9 Form of Land ownership

The form of ownership of land by women farmers results indicates that majority, 379 (89.8%) cultivated private land, 42(10%) cultivated hired land and 1 (0.2%) cultivated communal land as summarised in **Figure 5.8**. A Chi Square test, ($\chi^2_{1,0.01} = 419.01, p = 0.01$) conducted on the results indicates that there was a significant ($p<0.01$) variation in responses on land ownership among women farmers of Navakholo Sub County, Kakamega County, Kenya. These implied that there was variation in land ownership. A key informant extension officer from the Ministries of agriculture pointed out that most farmers owned farm land privately except a few who owned inherited land awaiting subdivision while others hired. The results does agree with findings from Wabwoba et al., (2013) who asserts that one of the factors that affect food sustainability and productivity is land tenure.

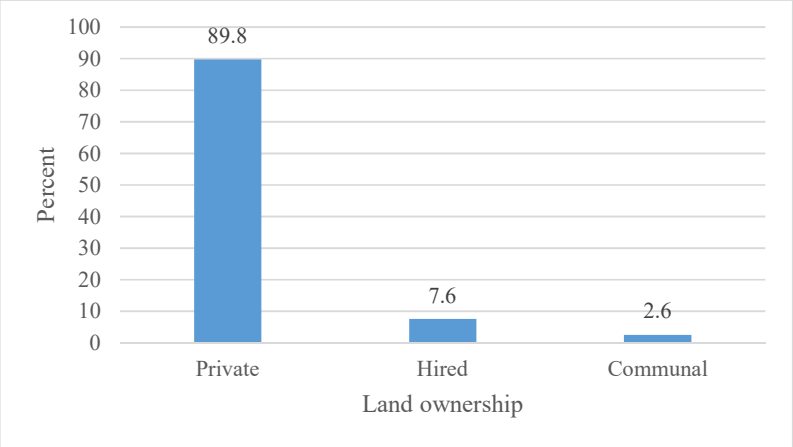

Figure 5. 8: Form of land ownership by women farmers of Navakholo sub-County.

5.10 Suitability of Soil for Crops

Women farmers stated the type of crops which their soils were suitable for and results were summarised in **Figure 5.9**. From the results, 1 (0.2%) indicated none, 3 (0.7%) beans, 270 (63.8%) indicated that it was suitable for maize while 149 (35.2%) indicated that it was suited for both maize and beans. A Chi- Square test, ($\chi^2_{3,0.01} = 476.40, p = 0.01$)conducted on the results indicated that there was a h significant ($p<0.01$) variation in responses on suitability of soil for crops grown and has significant relationship to agricultural productivity of women farmers in Navakholo sub County. These implied that there was variation in suitability of soils used and hence the type of crop planted. During the Focus Group Discussion, extension officers from the wards indicated that farmers use fertiliser to improve on the level of soil fertility because it's generally low. Land is a central resource and its fertility should be high for farmers to realise high yields. Nambiro (2007) reported that, in Navakholo sub-county agriculture is done on low resource base yet it's the main source of livelihood for majority of the population.

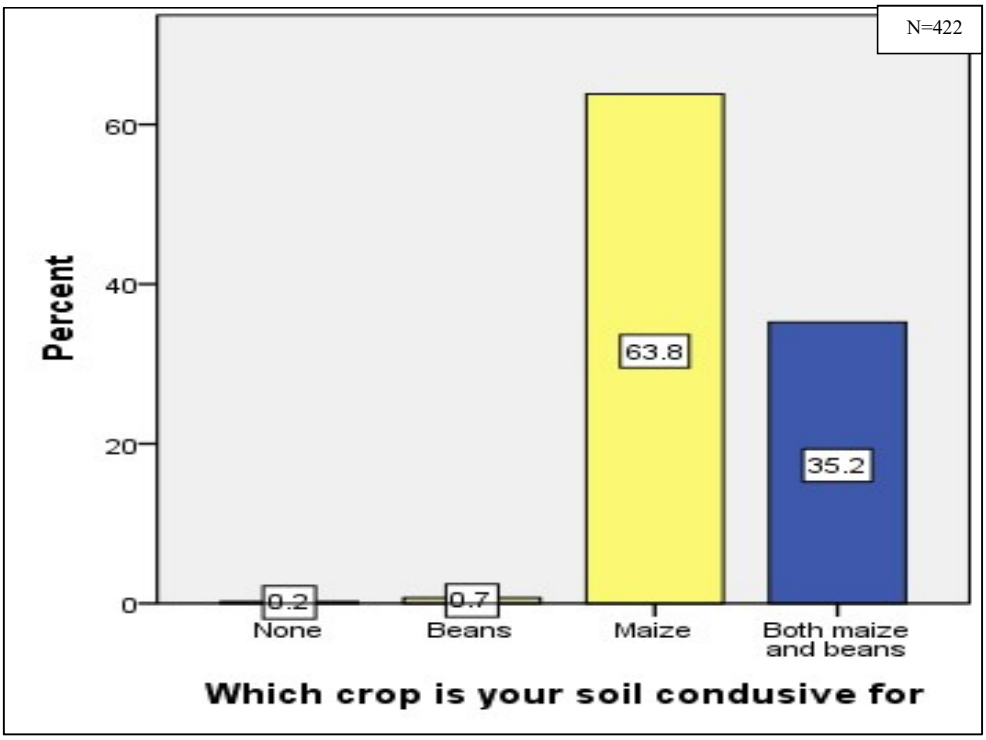

Figure 5. 9: Shows suitability of soils to maize and beans planted by women farmers in Navakholo sub-county.

Table 5. 3 Type of fertilisers used by women farmers in Navakholo sub-county and their sources

Fertilisers	Price (Ksh)	Source
DAP(50kg)	3500-4000	Agrovet
DAP		
23-23(50kg bag)	1800	NCPB
CAN/urea/mavuno planting	1500-1800	NCPB/NGO

Source: Field data

5.11 Factors Influencing Productivity of Maize and Beans in Navakholo sub County

The factors affecting productivity of maize and beans produced by women farmers were summarised in **Figure 5.10**. The majority 334 (79.2%) pointed out fertility, 87 (20.6%) land preparation while 1 (0.2%) mentioned farm and crop security. A Chi Square test, $(\chi^2_{2,0.01} = 426.61, p = 0.01)$ conducted on the results indicated that there

was significant ($p<0.01$) relationship between the factors influencing productivity of maize and beans and agricultural productivity of former women Agriculture subject students in Navakholo sub-county, Kakamega County, Kenya. These implied that there was variation in factors and therefore productivity.

During Focus Group Discussion, the Navakholo sub-county crops officer pointed out that most farmers demanded for fertiliser on credit before primary cultivation. A key ward agricultural informant pointed out that fertility was a major factor affecting productivity of maize and beans.

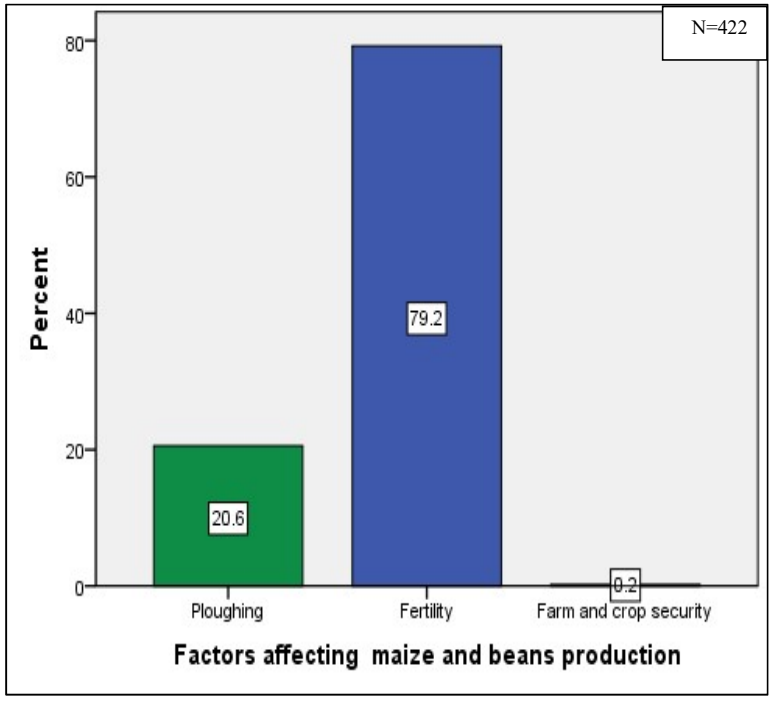

Figure 5. 10: Factors influencing productivity of women practising agriculture in Navakholo Sub County, Kakamega County, Kenya Source: field data

These results agree with those of Wakhungu (2012) who observed that fertility is a factor that affect productivity of subsistence crops.

5.12 Availability of Ready Market for Maize and Beans Produced by Women Farmers in Navakholo Sub County

The study sought to gauge if there was a ready market for beans and maize harvested.

Most women farmers indicated that there was ready market for maize and beans the results were summarised in **Figure 5.11** From the current research, results showed that majority 411 (97.4%) indicated that there was a ready market while 11 (2.6%) indicated that there was no ready market for maize. Responses showed that, 400 (94.8%) ready market beans while 22 (5.2%) indicated that there was no ready market for beans.

A Chi Square test, $(\chi^2_{1,0.01} = 380.14, p = 0.01)$ conducted on the results to further investigate the influence of availability of market to the productivity of maize and beans indicated that there was a significant ($p<0.01$) variation in responses on the availability of market for maize and beans. Focus Group Discussions indicated that, most farmers were seen selling their maize beans at the Navakholo and Nambacha local markets while some farmers were not aware of the availability of market due to lack of agricultural marketing information. These implies variation in productivity of maize and beans and markets.

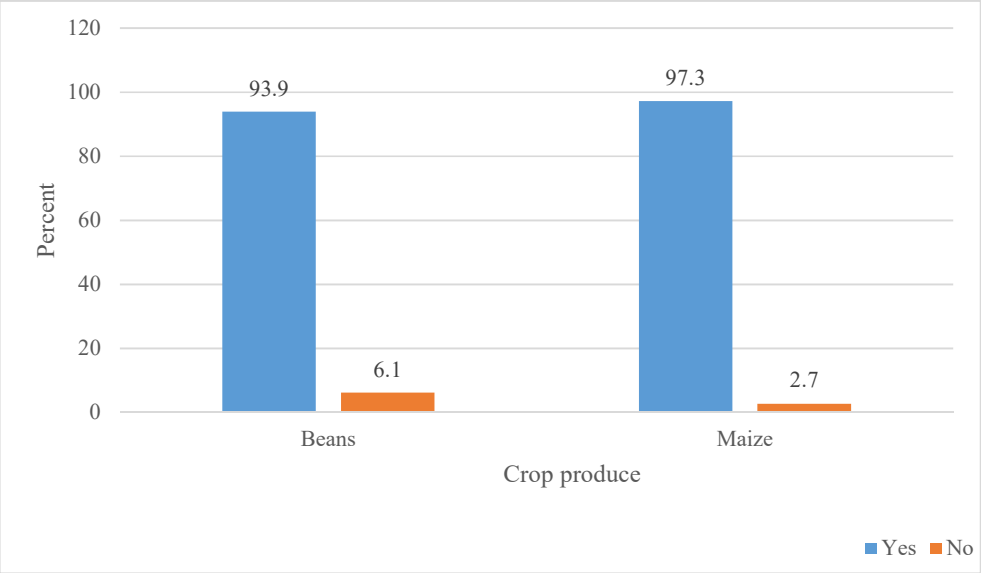

Figure 5. 11: Availability of ready market for crops produced by women farmers

5.13 Benefit from Credit Facilities

Women farmers indicated that they had benefited from credit facilities. The results were summarised in **Figure 5.12**. From the results, 397 (93.9%) indicated that they had ever benefited from credit facilities while 26 (6.1%) indicated otherwise. A Chi Square test, ($\chi^2_{1,0.01} = 325.39, p = 0.01$) conducted on the results indicated that there was a significant ($p<0.01$) variation in responses. Benefit from credit facilities had influence on productivity of women graduates of Agriculture subject students in Navakholo sub-county, Kakamega County, Kenya.

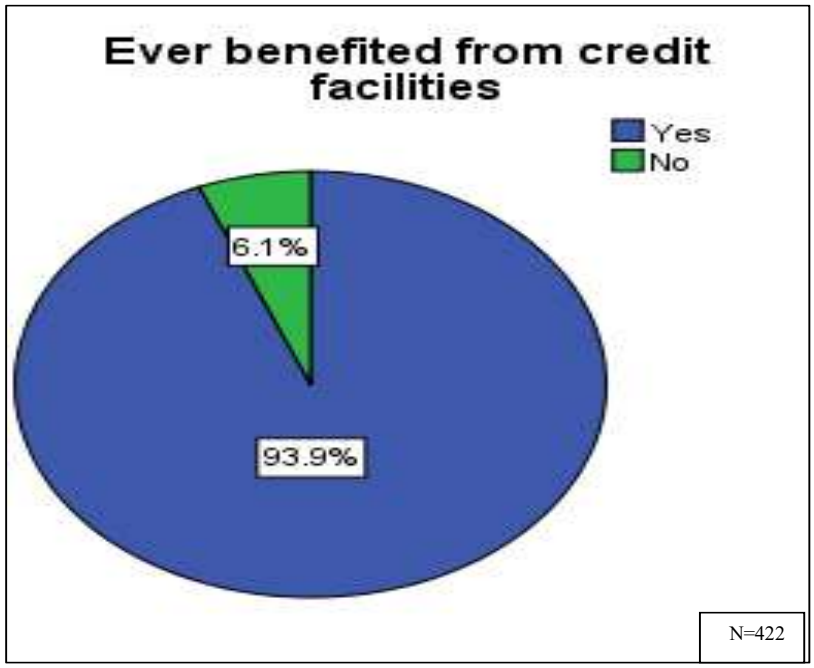

Figure 5. 12: Benefit from credit facilities by women practicing farming in Navakholo Sub County

5.14 Availability, Access and effectiveness of Extension Services

Women farmers indicated availability of extension officers both from the sub-county and county governments. Extension services were provided by several stakeholders who were by then operating in the region and engaged in food production **Table 5.4.**

Table 5. 4: Stakeholders in agriculture and their livelihood activities

Stakeholders in Agriculture	Their livelihood activities
One acre fund	• Maize production • Extension services to their customers
ICS	• Give inputs to farmers on loans.
Sub-county Agricultural office	• Ploughing at affordable rates • Extension services to farmers • Inputs e.g. fertilizers to farmers
NCPB	• Offer inputs such as fertilisers on credit.

Source: Field data

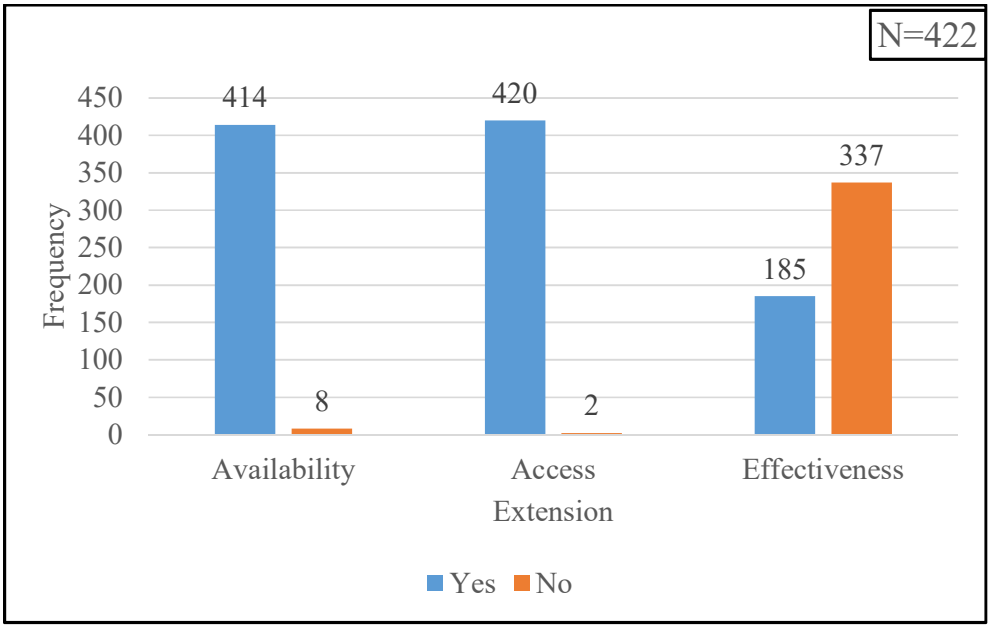

Figure 5. 13: Availability, access and effectiveness of extension services

The results agree with those posted by Wabwoba *et al*., (2013) that extension activities are vital in sustaining food production.

Plate 5. 1: Extension officers on the farm in Navakholo west, Navakholo sub-county, Kakamega County, Kenya.

A key ward agricultural informant indicated clearly that regular field days were organized by the crops agricultural officer to educate farmers on crop management principles although extension staff workers were few and could not reach all the farmers to provide extension services as frequently as expected hence not effective. Achienno (2014) also reported that effective extension services were highly needed for high productivity to be realised among farmers. She affirmed that the more the extension agents communicated with farmers, the more the adoption rates.

5.15 Source of Inputs and Type of Support Received

Women farmers indicated their source of inputs for farming and the results were summarised in **Figure 5.14** and **Figure 5.15** From the results, 191(45.2%) sourced inputs from NGOs, 8 (1.9%) privately, 173 (40.9%) from government while 51 (12.1%) were self-sponsored. A Chi Square test, ($\chi^2_{3,0.01} = 230.19$) conducted on the results indicated that there was a highly significant ($p<0.01$) variation in responses. These implied that there was variation in sources of inputs and other types of support received and agricultural productivity.

A key agricultural officer, as well as members of the Focus Group Discussion indicated that most women farmers received the inputs such as maize seeds and fertiliser on credit from NGO's who were by then stakeholders in maize production in the sub County. Others received inputs such as maize seeds, fertiliser and ploughing services from the sub County agriculture office on credit. Other women farmers had formed self-help groups which offered inputs to members on credit, while farmers with business and those who are civil servants sponsored their farming activities. These results agree with FAO (2011) and Wabwoba *et al.,* (2013) who posted that access to inputs as resources in farming increases productivity.

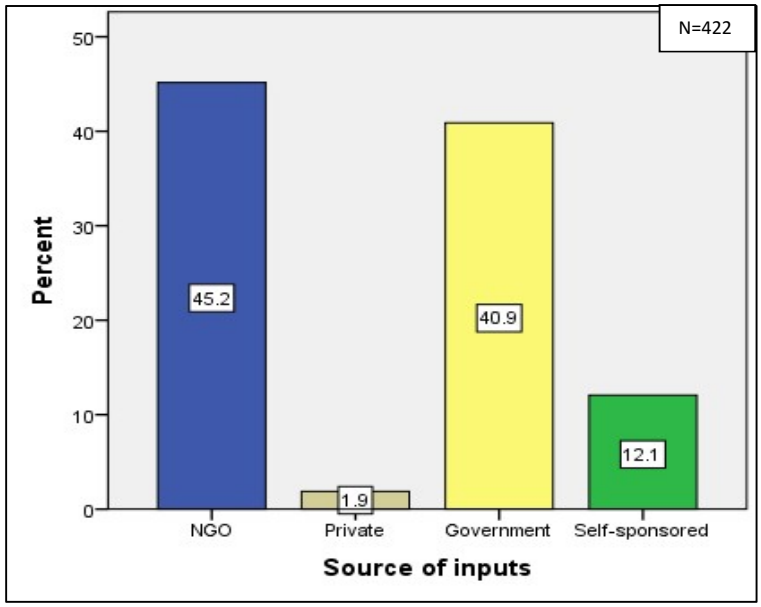

Figure 5. 14: Source of inputs for women farmers in Navakholo Sub County, Kakamega County, Kenya

This agree with Focus Group Discussions which indicated that NGOs were actively involved in supporting farmers. These included One Acre Fund, ICS and ministries of agriculture both at county and sub-county levels. A key informant ward officer reported that most farmers' economic status could not allow them to fully finance their farming activities.

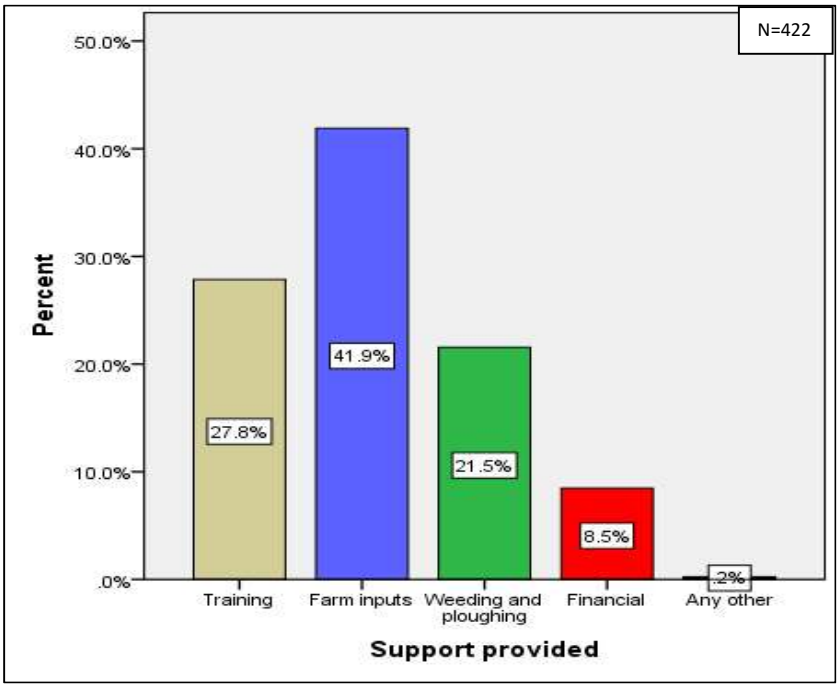

Figure 5. 15: Support provided by external sources for women farmers in Navakholo sub County, Kakamega County, Kenya

Farmers ranked the support they received in order of preference as farm inputs, training, weeding and ploughing, finance and lastly any other. Most women farmers receive inputs from the NGOs and sub-county agricultural offices as stated by sub-county crops officer during the Focus Group Discussion.

5.16 Period Taken by Maize and Beans to Mature

Households indicated that the average period of maturity for maize is 4.3 months while for beans is 2.5 months as shown by Figure **5.16**. From the Focus Group Discussion differences in duration before harvesting was due to different varieties of maize planted while in some cases it's due to the field management practices given to crops by different women farmers with of different levels of skills and competencies developed. Hence, goals such as food security, job opportunity for the people, poverty eradication and rural income generation will be met (ECA, 2005. MoA, 2016).

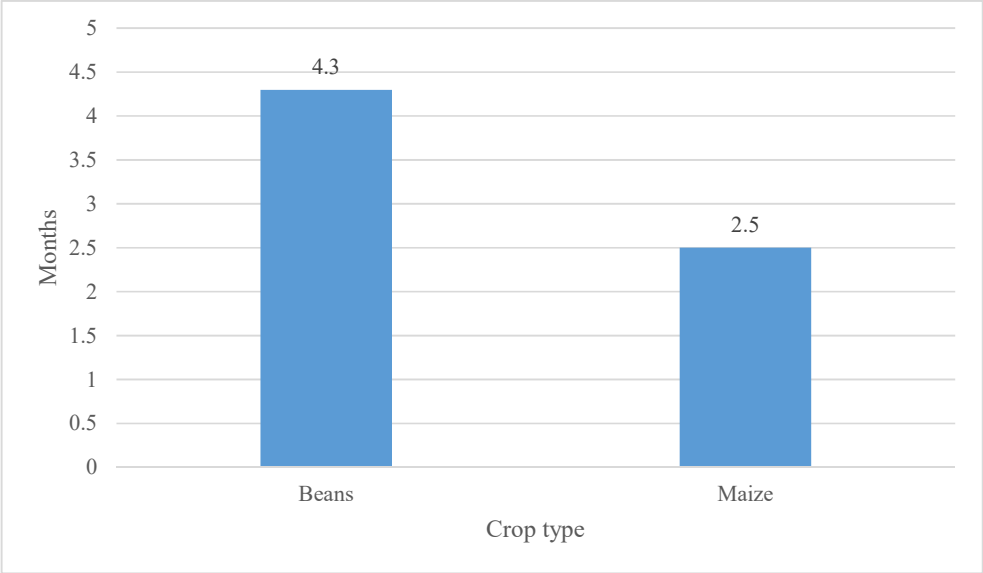

Figure 5. 16: Average period of time taken to mature for maize and beans produced by women farmers.

5.17 Number of Bags of Maize and Beans Harvested per Acre by Women Farmers in Navakholo sub County

Respondents were further asked to indicate the number of bags of maize and beans they harvested per acre in the previous season. The responses were summarized in **Figure 5.17**. From the results, 14 (3.3%) harvested less than 5 bags of maize, 65 (15.4%) harvested 5-10 bags, 176 (41.8%) harvested 11-15 bags while 167 (39.5%) harvested over 15 bags. A Chi Square test, ($\chi^2_{3,0.01} = 178.79$) conducted on the results indicated that there was significant ($p<0.01$) variation in the number of bags of maize harvested per acre by women farmers Navakholo of Kakamega County, Kenya.

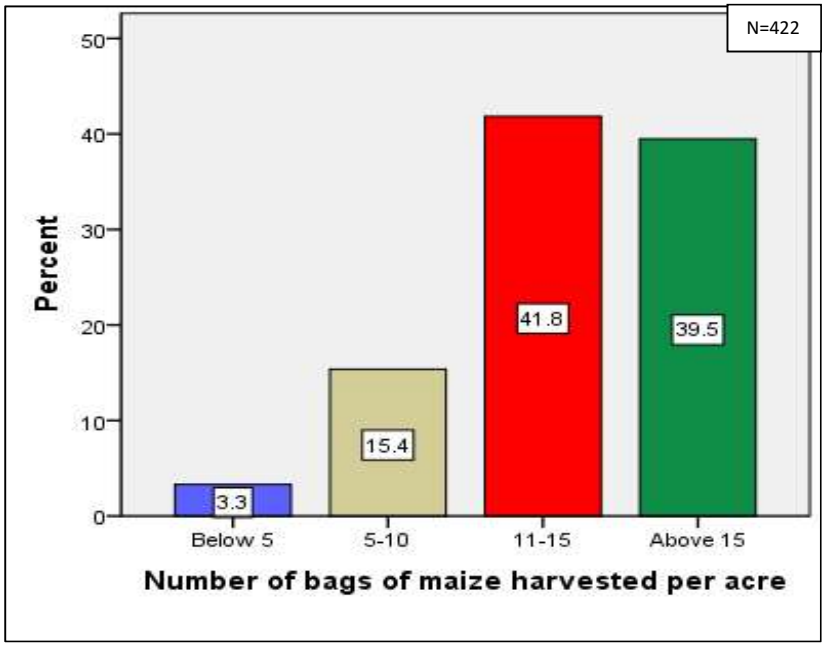

Figure 5. 17: Number of maize bags harvested per acre for women farmers in Navakholo sub County, Kakamega County, Kenya (Source: field data)

A key extension officer informant stated that the expected number of bags of maize from a properly managed piece of land in Navakholo were 20 bags per acre. Therefore, results from the current study indicate underperformance for nearly all the women respondents.

The Focus Group Discussions indicated that low productivity was attributed to factors such as: lack of finance as well as lack of knowledge and skills. If farmers had information on how much fertilisers to incorporate in the soils to give the highest yield then they would have obtained maximum yields The results are in agreement with that posted by (Wabwoba and Wakhungu, 2013) that knowledge and skills are important in sustaining food security while (Tino *et al.,* 2015) asserts that knowledge plays a greater role in agricultural productivity.

5.18 Number of Bags of Beans Harvested by Women Farmers in Navakholo Sub County.

Similarly, women farmers further stated the number of bags of beans they harvested annually and the results were presented in **Table 5.5.** The highest population of respondents (325) harvested 2bags of beans. Most respondents related the level of the yields they obtained to factors such as field management practises offered to the plants during the growth and development. Focus Group Discussions pointed out that correct field management practices increased productivity.

Table 5. 5: Number of Bags of Beans Harvested by Women Farmers in Navakholo Sub County

Number of bags	Frequency	Percent
Less than 1	5	1.7
1.0	43	10.2
1.5	1	0.2
2.0	325	76.8
2.5	11	2.6
3.0	28	6.9
3.5	2	0.5
4.0	1	0.2
4.5	1	0.2
5.0	2	0.5
7.0	1	0.2
Total	**422**	**100.0**

A key ward extension informant reported the following:

> "Most NGOs stakeholders operating in the area and interested in food production did not allow farmers to intercrop maize and beans to stop depletion of fertilisers placed in the holes where maize seeds had been planted".

5.19 Marketing Channels for Maize and Beans Produced by Women Farmers in Navakholo sub-County Kakamega County

Women farmers indicated the marketing channel which they used to sell their maize and beans and the results were summarised in **Figure 5.18**. Results indicated that 350 (82.6%) used the local market, 10 (2.4%) employed the farm gate while 62(14.7%) sold to neighbours. A Chi -Square test, $(\chi^2_{1,0.01} = 419.01, p = 0.01)$ conducted on the results indicated that there was significant ($p<0.01$) variation in the marketing channels for maize and beans produced by women farmers. These implies that there was a variation in markets and hence productivity of maize and beans.

Maize and beans are the main subsistence crops for residents. The surplus of the produced is sold to the residents at the local markets. Some women farmers who could not take the products to the market sold to neighbours from farm gates. A key crops informant reported the following;

> "Women farmers are aware of how much food stuff is used by their households hence sell any surplus at local markets and neighbours who may not have harvested enough for their subsistence use".

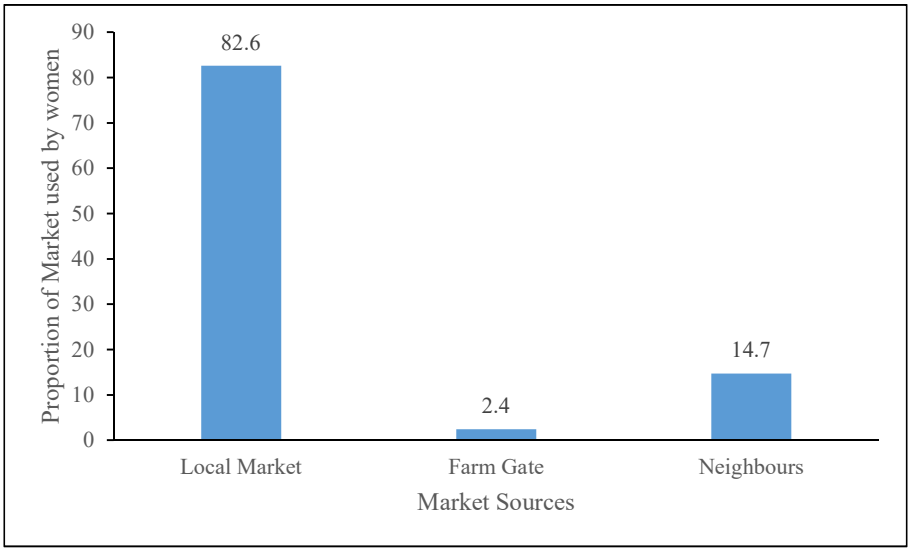

Figure 5. 18: Marketing channel for the products produced by women farmers in Navakholo sub County Kakamega County, Kenya Source: field data

The amount considered as surplus of produce is of small quantity and can be purchased locally. The results concur with a previous researcher who posted that agriculture remains unattractive if women lack knowledge in farming and marketing (Grace, 2004). Income from produce motivates them to increase productivity.

Plate 5. 2: A trader at the local market (Nambacha) selling maize together with other cereals in small quantities affordable by locals in Navakholo Sub County, Kakamega County, Kenya (Source: field data)

5.20 Learning of Agriculture and Sitting for KCSE/KCE

Women farmers stated whether they learned agriculture and sat for KCE/ KCSE. The results revealed that out of 422 secondary school graduates ,107 (25.4%) had learned agriculture and sat it at KCE/KCSE while 315 (74.6%) had not learned Agriculture subject at secondary school level.

A key crops officer informant claimed that quick and wise decisions are made by women farmers with agricultural knowledge and skills. He also stated that their farms were well managed than those of the non-KCSE women farmers. High productivity was seen among the KCSE women farmers. The non-KCSE women farmers could only manage their crops with the help of extension officers. These results of the current study agree with Robinson-Pant (2001) who posted that skill development can take place through formal education.

According to Robinson-Pant (2016) “skill development” should take place through formal, informal and non-formal education system simultaneously during the learning period of a student. Hence, goals such as food security, job opportunity for the people, poverty eradication and rural income generation will be met (ECA, 2005. MoA, 2016).

5.21 Learned Agriculture and Practice of Production for Women Farmers in Navakholo sub County Kakamega County

To establish the impact of learning agriculture, cross tabulation was carried out between learning Agriculture and the practice of production between women farmers with KCSE agriculture subject knowledge those without and the results were described in **Table 5.6.**

Table 5. 6: Learned agriculture and Practice of production Cross-tabulation for women farmers in Navakholo sub-county, Kakamega County, Kenya

Learned agriculture and sat for KCE/KCSE		**Practice of production**	
		Mono culture	**Mixed culture**
Yes	Frequency	21	79
	%	19.5%	80.5%
No	Frequency	121	194
	%	38.5%	61.5%

From the results, majority of those who learned agriculture (80.5%) practiced mixed culture (mixed farming) but only 61.5% of non-KCSE Agriculture subject women farmers practiced mixed culture. This shows that learning of agriculture had impacted them positively. Mixed culture (farming) has a lot of advantages and increases productivity as compared to mono culture.

5.22 Learned Agriculture and Number of Bags Harvested Cross-Tabulation for Women Farmers of Navakholo sub-county, Kakamega County, Kenya.

To further understand how the studying of agriculture impacted on productivity, cross-tabulation was carried out to establish the relationship. This was as described in **Table 5.7**. From the analysis, 66.7% of those who had learned agriculture and sat for KCSE produced over 15 bags while only 12.7% of those that had not learned agriculture harvested over 15 bags.

Focus Group Discussions attributed this performance to knowledge gained and management skills developed during learning agriculture subject at secondary school level. For the respondents who didn't learn agriculture and sit for KCSE, there productivity is lower and attributed to lack of management skills. A key crops officer informant asserted that to the non-KCSE subject women, extension services were offered informally in the process of crop management.

The results agree with that of (Tino *et al.,* 2015) who posted that knowledge plays a greater role in agricultural productivity and those posted by (Wabwoba and Wakhungu, 2013) that, knowledge and skills are important in sustaining food security.

Table 5. 7: Learned agriculture and Number of bags harvested Cross-tabulation for women farmers in Navakholo sub-county, Kakamega County, Kenya

			Number of bags of maize harvested per acre				Chi-square	P value
			Below 5	**5-10**	**11-15**	**Above 15**		
Learned agriculture and sat for KCE/KCSE	Yes	F	0	5	31	71	357.7	0.000
		%	0.0%	4.3%	29.0%	66.7%		
	No	F	21	83	172	39		
		%	6.6%	26.3%	54.5%	12.7%		

Source: Researcher (2019)

5.23 Impact of Studying Agriculture on Productivity of Women Farmers in Navakholo sub-county, Kakamega County, Kenya

Spearman rank order correlation was carried out to establish the relationship between studying agriculture and productivity as shown in **Table.5.8** The results showed that there was a significant (P<0.01) relationship between studying agriculture and agricultural productivity. Looking at the tabulation, the correlation is positive and significant at **the 0.01 level**; that is, it's two-tailed i.e**. r = 0.55 ± 0.034, (p < 0.01).**

Table 5. 8: Correlation between studying agriculture and productivity

		Learned agriculture and sat for KCE/KCSE	**Number of bags of maize harvested per acre**
Learned agriculture and sat for KCE/KCSE	Pearson Correlation	1	0.55±0.034**
	Sig. (2-tailed)		0.000
	N	422	422

**** Correlation is significant at 0.01 level (2-tailed)**

Source: field data

A key agricultural officer from Navakholo sub-county reported that if all farmers had learnt agriculture subject, then supervision of subsistence crops production would be easy since, the Agriculture subject KCSE women farmers followed management practices keenly and produced highest amount of products yearly as compared to non-KCSE Agriculture subject women farmers. Hence, the study of agriculture subject had a positive impact on respondent's agricultural productivity.

CHAPTER SIX

STRATEGIES TO ENHANCE AGRICULTURAL PRODUCTIVITY THROUGH FEMALE AGRICULTURAL EDUCTION TRAINING AT SECONDARY SCHOOL LEVEL NAVAKHOLO SUB-COUNTY, KAKAMEGA COUNTY, KENYA

6.1 Introduction

This chapter gives results and discussions on the necessity for teaching agriculture subject to girls at secondary school level, challenges faced by learners and women farmers and finally the strategies that can be put in place to re-orient agriculture training at secondary school level to respond better to the demands of the women farmers in Navakholo sub-county, to answer the third objective of the study.

6.2 Necessity for Teaching Agriculture Subject to Girls at Secondary School Level in Navakholo sub-county.

Women farmers indicated whether agriculture should be taught to girls at secondary school level or not and the results were summarised in **Figure 6.1**. 256 (60.5%) said yes while 167 (39.5%) were of the view that it should not be taught to girls.

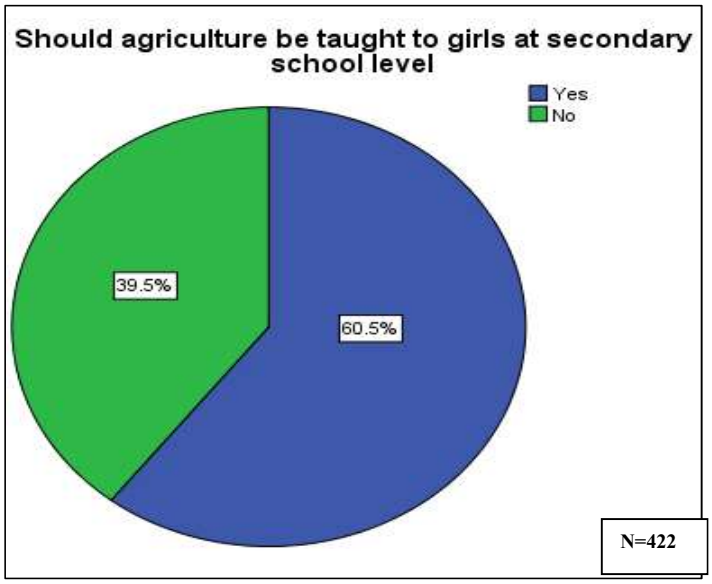

Figure 6. 1: Teaching of agriculture to girls in Secondary schools in Navakholo sub-county, Kakamega County, Kenya.

From key informant interviews and Focus Group Discussions, it was evident that there was need to teach agriculture to girls at secondary school level since they are the main participants in major agricultural activities carried out in the sub -County either to produce food or to generate income. The result agree with Tandi, (2011), who posted that relevant information and knowledge for women farmers improved the agricultural performances and livelihoods. Women farmers should be taught relevant information to the farming activities that they must undertake to improve on productivity. FAO (2011) also affirmed that change in attitude, self-perception and productivity are of conceptual significance for education offered to women.

6.3 Reasons for Teaching Agriculture to Girls in Navakholo sub County, Kakamega County, Kenya

Women farmers who gave a appositive response for teaching agriculture to girls supported their response with the following reasons: economic empowerment, for household food security, it gives basic farming skills, teaches correct management

practices; imparts knowledge and skills on farming, they have the right skills for farming, and that they are economical on inputs. The responses were summarized in **Table 6.1**.

Table 6. 1: Why agriculture should be taught to girls in Navakholo sub county, Kakamega County, Kenya

Reason	Frequency	Percent
Economic empowerment	85	33.3
For household food security	64	25.1
Gives basic farming skills	38	14.9
Teaches correct management practices	24	9.4
Imparts knowledge and skills	17	6.7
They have the right skills for farming	15	5.9
They are economical on inputs	13	4.7
Total	**256**	**100.0**

Source: field data

A Chi Square test, $\chi^2_{(6,0.05)} = 50.52$ conducted on the results indicated that there was no significant ($p>0.05$) variation in the reasons for teaching agriculture to girls and its impact to agricultural producti vity of former women agriculture subject students in Navakholo sub-county, Kakamega County, Kenya. Focus Group Discussions indicated that women are at the core of food security in their households, hence there is need for learning application of agriculture knowledge. Keen analysis of the reasons given shows lack of application of knowledge and skills learned in secondary school.

Focus Group Discussions indicated that women are at the core of food security in their households, hence there is need for learning application of agriculture knowledge. Keen analysis of the reasons given shows lack of application of knowledge and skills learned in secondary school.

These results agree with Duveskog (2013), who reported that change in productivity need skill application. The current Agriculture syllabus allows students to learn agriculture theoretically, but very few application skills are provided.

6.4 Problems faced by women farmers

Respondents stated whether they faced problems of transport, low prices, and lack of customers. The responses were summarized in **Table 6.2**

Table 6. 2: Challenges faced by women farmers in Navakholo sub-county, Kakamega County, Kenya

Problem faced	Frequency	Percent
Transport challenges	100	23.6
Low prices	130	30.7
Lack of customers	15	3.5
Others	177	42.1

Source: Researcher (2019)

A respondent stated that;

> "It's common to find a farmer using a lot of money on transport yet the prices of products are low. This is the greatest challenge that needs to be solved"

The respondents stated the most serious challenge faced and the results were summarised in **Figure 6.2**

From the results, the challenges faced by women farmers were: transport 100 (23.6%), low prices 130 (30.7%) and lack of customers 15 (3.5%). Other problems, which account for 42.1% included high cost of farm inputs, pests (fall army worm), storage problems and diseases and variability of climate. From key informant interview with officials from the Ministries of agriculture, the main challenges for farmers were: high

cost of farm inputs, low cost of farm outputs, lack of transport and others such as low soil fertility, lack of technical knowledge, small pieces of land due to fragmentation and reduced extension services.

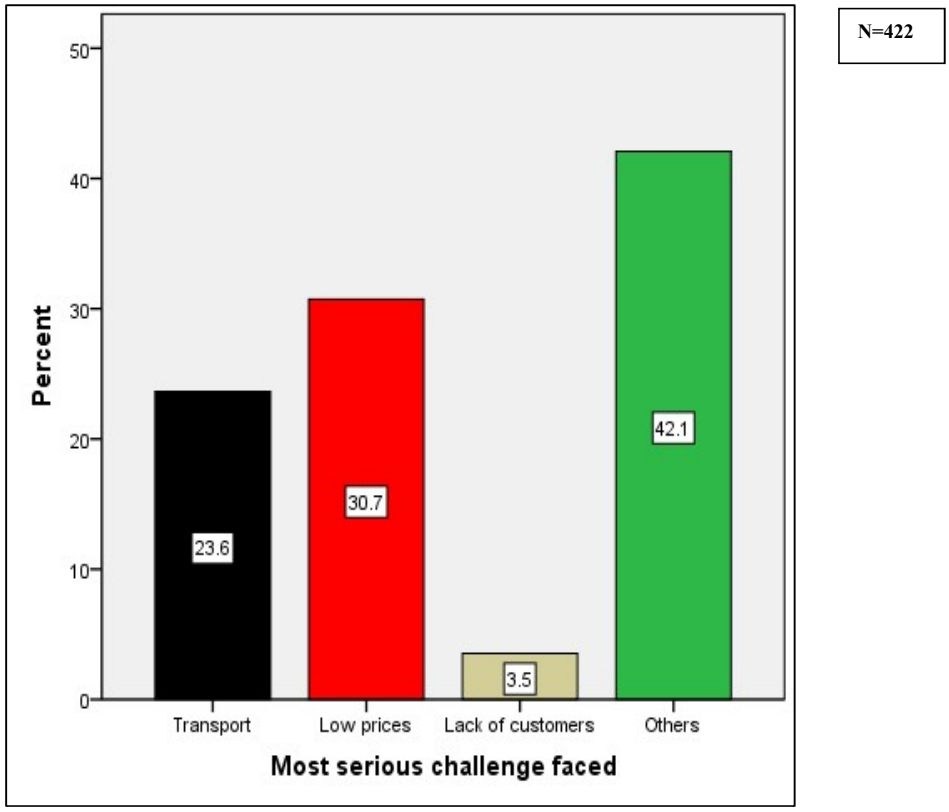

Figure 6. 2: Most serious challenges faced by women farmers in Navakholo Sub County, Kakamega county Kenya. Source: Researcher (2019).

These results are agreement with those of Squire (2003) who posted that Bias technological change and lack of information are barriers to women full participation in agriculture

6.4.1 Ways of overcoming the problems faced by women farmers in Navakholo sub County.

Women farmers indicated the ways in which they overcame the challenges as summarized in **Table 6.3** Transport challenge was overcome by hiring lorries and motorcycles, using human transport while others sold part of the produce to hire

transport. Low price of produce was solved by selling the produce when prices increase**.**

Table 6. 3 Ways of overcoming problems faced by women farmers in Navakholo Sub County Kakamega County, Kenya

Ways of overcoming	Frequency	Percent
Use of pesticides	128	30.4
Timely planting	106	25.0
Hire lorries/ motorcycle	53	12.5
Selling immediately to avoid storage problems	42	9.8
Human transport (self)	26	6.3
sell produce to hire transport	18	4.5
sell when prices are high	49	11.6
Total	**442**	**100.0**

Respondents were further asked to state ways of improving maize and beans farming in the area. The responses were summarized in **Table 6.4**. According to respondents, maize and beans production could be improved by using the right fertilizer, application of manure to improve soil fertility, timely planting, land fallowing, government to provide fertilizers to farmers, use of lime, crop rotation, planting using right procedures and avoiding planting fertility lowering crops which are field management practiced and the government to provide market support to motive them.

Table 6. 4: Ways of improving maize and bean farming in Navakholo Sub county Kakamega County, Kenya

Way of improving	Frequency	Percent
Using the right fertilizer	68	24.4
Application of manure to improve soil fertility	56	20.1
Timely planting	46	16.5
Land fallowing	25	9.0
Government to provide fertilizers to farmers	24	8.6
Government to provide market support	17	6.1
Use of lime	15	5.4
Crop rotation	14	5.0
plant using right procedures	9	3.2
Avoid planting fertility lowering crops	5	1.8
Total	**279**	**100.0**

Source: field data

6.5 Problems faced by learners in the teaching of agriculture

The former KCSE agriculture subject women farmers indicated by ranking the challenges faced by learners during the implementation of agriculture subject. This was summarized in **Table 6.5**

Table 6. 5: Problems faced by learners in the teaching of agriculture for Navakholo sub County Kakamega County, Kenya

Challenges	Rank
Lack of modern equipment/ technology	1
Less practical lessons	2
Lack of knowledge in operating machines	3
Few qualified teachers	4
Reduced content taught	5

The indicated challenges can be summarised into one main challenge which is lack of knowledge and competence in skills required for improved productivity. During the household interview, a former KCSE Agriculture subject women farmer stated the following;

> "I wonder when the education system will change their way of teaching agriculture in secondary school. The only tool I touched practically was the *jembe*. Up to date, my daughter still uses the same *jembe* to do the practicals. How I wish they would teach the new ways like use of machines".

This means that the respondent had challenges in the way they were taught and they wished that the methods of teaching agriculture were better.

6.6 Strategies for improving teaching of agriculture subject

Officers from the ministry of Agriculture were asked to rank the following strategies to be put in place by education policy makers to improve on the implementation of agriculture syllabus as a practical subject. This was summarized in **Table 6.6.**

Table 6. 6: Strategies for improving teaching of agriculture subject in Navakholo sub County, Kakamega County, Kenya

Strategy	Rank 1	Rank 2	Rank 3
Teach more practicals than theory	1	1	1
Practicals should involve attending extension training sessions on adoption of new innovation	3	2	2
Learners be taught application of new technology	4	4	4

Source: field data

According to Robinson-Pant (2016) "skill development" should take place through formal, informal and non-formal education system simultaneously during the learning period of a student. The reinforcement of the (MDGs) through Universal Primary Education is vital as it emphasizes access to lifelong learning opportunities for skills and competencies development. Hence, goals such as food security, job opportunity for the people, poverty eradication and rural income generation will be met (ECA, 2005. MoA, 2016)). Spearman rank order correlation was carried out to establish whether the ranks (Rank 1 and 2) were similar. The following was obtained: $r = 0.993 \pm 0.065^{**}$

The very high correlation shows that the rankings were very similar. Hence the strategies can be implemented in either way.

The results are in agreement with that of Ogbonna and Okoroafor (2004) who posted that food development and extension strategies should be reviewed, re-designed and

packaged to reach women farmers to increase output through technology. Squire (2003) stated that Agriculture education training and employment policies should put in consideration the rural women participation and productivity as well as employment in the formal agricultural industry.

CHAPTER SEVEN

SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.1 Introduction

This chapter presents the discussion of the study findings, conclusions drawn and recommendations based on the findings. Suggestions for further research are in this chapter.

7.2 Summary of the Findings

The study sought to find the proportion of former women graduates of KCSE agriculture subject at secondary school level practicing agriculture among the maize women farmers in Navakholo of Kakamega County, Kenya. It was found out that, only 107(25.4%) were graduates of KCSE agriculture subject while the remaining 315 (74.6%) were non-KCSE agriculture subject. This proportion is low.

Pertaining the impact of secondary school Agriculture subject to agricultural productivity, a cross-tabulation between learning of agriculture and productivity results revealed that there was a significant ($P<0.01$) relationship between studying Agriculture subject and agricultural productivity. Agriculture subject had a positive impact on productivity. Highest productivity of >15 bags of maize were realized from 66.7% of the women graduates of KCSE agriculture subject compared to 12.7% of the non-KCSE agriculture subject graduates.

Spearman rank order correlation was significant at 0.01 level ($P<0.01$) relationship between studying agriculture and agricultural productivity (number of bags. harvested

per acre). Hence, the study of agriculture subject had a positive impact on respondents' agricultural productivity.

In this study higher productivity means more bags of the products. Extra bags beyond the consumption level of households were sold to earn income. Income earned was there a factor motivating women farmers to increase their productivity.

A number of reasons as to why girls should be taught agriculture were cited by women farmers as well as challenges faced by students of agriculture subject in secondary schools. Women graduates of KCSE stated the strategies that could be employed to improve agricultural productivity as adoption of new innovations, teaching more practicals than theories, employing experienced teachers who are qualified to teach agriculture and attending extension training sessions.

7.3 Conclusions

Girls should be encouraged to enrol for secondary school Agriculture subject and persist to completion because the skills gained have influence on agricultural productivity. From the information gathered during the research, the current study made the following conclusions:

i.) The proportion of women graduates of KCSE agriculture subject farmers was lower than the proportion of the non-KCSE agriculture subject farmers. Only 107 (25.4%) had learnt agriculture and sat for KCSE while 315(74.6) had not.

ii.) The study established that learning of agriculture had influence on farmer productivity. Those that had learned agriculture portrayed better farming methods and had higher productivity.

iii.) The proportion of women graduates of KCSE agriculture subject participating in farming is low as ascertained above. The strategies proposed for enhancing agricultural productivity through restructuring agriculture training as secondary school level were teaching more practicals than theory; practicals to involve attending extension training sessions on adoption of new innovation; and learners to be taught application of new technology.

7.4 Recommendations

The following recommendations were made based on the findings and the conclusions of the study:

(i) Secondary school Agriculture subject is needed as a tool in practising agriculture. Most women farmers in Navakholo sub-county practising agriculture are underperforming in crop management practices due to inadequate knowledge and skills. More girls should be encouraged to enrol for agriculture subject at secondary school level.

(ii) There is need for the government to increase the funds to be used in teaching applied technology and innovations during the implementation of secondary school Agriculture subject syllabus.

(iii) There is need for the Ministries of Agriculture and Education to jointly develop a curriculum that fully implements a practical approach to the teaching and learning of agriculture as a subject in secondary schools so as to improve on food productivity, economy and implementation of agriculture subject education.

7.5 Suggestions for Further Research

Following the results of this study, there is need for more research to be done in the following areas;

i.) There is need for similar studies to be done in other sub-counties to validate the findings of this study carried out in Navakholo sub-county.

ii.) There is need for a similar study to be conducted considering men farmers.

iii.) There is need for another study to be conducted in another community where residents use a different staple foodstuff.

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APPENDICES

APPENDIX I

INTRODUCTION LETTER FOR MANYASI ANNAH NAWAMBISA

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY

Date 6th December, 2018

Dear (respondent),

I am a postgraduate student at **Masinde Muliro University of Science and Technology** and currently undertaking a research study on **Secondary school Agriculture in shaping women's participation to agricultural productivity in Navakholo sub-county, Kakamega County, Kenya" in partial fulfilment of the requirement for the Degree of Master of Science in Agricultural Education and Extension.** You have been selected upon to take part in this study. Kindly respond to the questions attached on the letter of introduction. The information provided by you is for academic purpose and will not affect you in any way. Your participation and information will be held confidential, voluntary and highly appreciated.

Thanks in advance for cooperating.

Best regards,

MANYASI ANNAH NAWAMBISA.

Signature_____ Date_____

APPENDIX II

CHI SQUARE VALUES

Test Statistics 1

	Marital status	Level of education	Crop planted	Years of farming	Occupation	Average household income
Chi-Square	265.307[a]	214.400[b]	440.908[c]	391.605[a]	177.461[c]	1.251[a]
Df	1	3	2	1	2	1
Asymp. Sig.	.000	.000	.000	.000	.000	.263

Test Statistics 2

	Are your beans affected by diseases	Are your beans affected by pests	Which crop is your soil conducive for	Factors affecting maize and beans production	There is a ready market for your maize	There is a ready market for your beans
Chi-Square	415.038[a]	415.038[a]	476.395[b]	426.610[c]	380.144[a]	376.362[a]
Df	1	1	3	2	1	1
Asymp. Sig.	.000	.000	.000	.000	.000	.000

Test Statistics 3

	Ever benefited from credit facilities	Extension services are available	How often do you receive extension service	Extension officers are effective in their work	How many bags of maize is used for household consumption	How many bags of beans is used for household consumption	Are the bags enough	Do you earn income from your maize
Chi-Square	325.39[a]	391.61[a]	308.27[b]	6.149[a]	3.133[c]	1838.43[d]	343.17[a]	31.27[a]
Df	1	1	2	1	6	5	1	1
Asymp. Sig.	.000	.000	.000	.013	.792	.000	.000	.000

Test Statistics 4

	Do you earn income from your beans	Is the income worth investment	Land acreage	Do you own cattle	Do you own sheep	Do you own Goats	Do you own poultry
Chi-Square	.021[a]	2.574[a]	1055.988[b]	407.151[a]	234.574[a]	237.563[a]	89.894[a]
Df	1	1	3	1	1	1	1
Asymp. Sig.	.884	.109	.000	.000	.000	.000	.000

Test Statistics 5

	Do you own sugarcane	Ownership of land used for farming	Production level	Your practice in production	Source of inputs	Any other support from external sources	If yes, who supports you	Support provided
Chi-Square	2.574[a]	419.009[a]	357.733[a]	156.144[a]	230.191[b]	383.946[a]	352.710[c]	220.184[d]
Df	1	1	1	1	3	1	2	4
Asymp. Sig.	.109	.000	.000	.000	.000	.000	.000	.000

Test Statistics 6

	After planting, how long do you take to harvest your maize	After planting, how long do you take to harvest your beans	Bags of maize harvested	Bags of beans harvested	Marketing channels employed
Chi-Square	333.844[a]	1237.208[b]	1055.307[b]	2910.440[d]	419.009[c]
Df	2	3	3	12	1
Asymp. Sig.	.000	.000	.000	.000	.000

Test Statistics 7

	Most serious challenge faced	Learned agriculture and sat for KCE/KCSE	Number of bags of maize harvested per acre	Practice of production	How agriculture subject at KCSE assist you in relation to current farming practice	Should agriculture be taught to girls at secondary school level
Chi-Square	133.113[a]	.021[b]	178.787[a]	74.064[b]	.021[b]	18.726[b]
Df	3	1	3	1	1	1
Asymp. Sig.	.000	.884	.000	.000	.884	.000

APPENDIX III

HOUSEHOLDS' QUESTIONNAIRE FOR FORMER WOMEN AGRICULTURE SUIBJECT IN NAVAKHOLO SUB-COUNTY, KAKAMEGA COUNTY, KENYA

Introductions

This questionnaire is aimed at collecting data that will form part of the study on "secondary school agriculture subject in shaping women's contribution to agricultural productivity in Navakholo sub county, Kakamega county, Kenya ," by Manyasi Annah Nawambisa, a masters student in the school of SAVET, MMUST during 2017/2018 academic year.. The information will be used to understand the impact of agriculture subject to former agriculture students Women at secondary school level. Your co-operation in the study will be highly be appreciated.

Thank you,

Yours sincerely,

Manyasi Annah Nawambisa.

A. Social-economic characteristics of household heads (Please Tick or fill in where applicable)

1.Name…….

2.Gender…….

3.Marital status 1. (Yes) 2. (No).

4. Which crop do you plant . 1. (maize) 2. (beans) 3. (both).

5.Years of farming. 1. (<5) 2. (>5).

6.Occupation. 1. (Farmer) 2. (Civil servant) 3. (Business) 4. (Others).

B. Proportion of KCSE graduates practising agriculture in Navakholo sub-county

7.What is your level of education? (Informal) (Primary) (Secondary)

8.Is your soil suitable for bean or maize production? (Maize) (Beans)

9. What factors affect your maize and beans production?

(Ploughing) (Fertility) (Farm and crop security)

10.Is there ready market for your

Maize. 1. (Yes) 2. (No).

Beans 1. (Yes) 2. (No).

11.Have you ever benefited from credit facilities?

1. (Yes) 2. (No).

12.Are extension services available? 1. (Yes) 2. (No).

If yes, how often do you receive them?

1. Weekly 2.monthly. 3. Quarterly. (after 3 months).

13.Are the extension officers effective in their work (are they useful to you).

1. Yes…….. 2. No……..

C. Productivity of former women agriculture students in Navakholo sub-county, Kakamega County, Kenya

14. Are maize and beans the main food component of your diet? 1.Yes…….2.No……

15. How many gags of your harvested maize used for the HH consumption.

1( ) 2( ) 3( ) 4( ) 5( ) 6( ) 7( ).

16.How many bags of beans are used for HH consumption? None…. Quarter….

Half…. 1bag…. 2bags…. 3bag….

Is it enough 1. (Yes) 2. (No).

17. Do you earn income from your maize and beans

Maize 1. (Yes) 2. (No).

Beans 1. (Yes) 2. (No).

If yes, is this income worth the investment (please tick)? 1. Yes 2. No

18. What is your total land acrerage. 1.(< 1acre) 2.(1-3) 3.(4-6) 4.(>6)

19. Are your crops affected by diseases (please tick).

Beans 1. (yes) 2. (No) Maize 1. (yes) 2. (No)

20. Are your crops affected by pests (please tick).

Beans 1. (yes) 2. (No). Maize 1. (yes) 2. (No)

21. What other agricultural enterprises does your household own (please tick). ?

0. (None) 1. (Cattle) 2. (Sheep) 3. (Goats) 4. (Poultry) 5. (Sugarcane)

22. Which is the form of land ownership for the land you use

Private owned	1
Community Land	2
Group owned	3
Company owned	4
Government owned	5

23. Where do you get your inputs (e.g. seeds, fertiliser) (please tick)?

1. NGO …….

2. Private …….

3. Government ……..

4. Self-sponsored ……..

24.) Do you receive any other support from external sources?

1. Yes…….. 2. No…….

i.)If yes, state who supports you (Please tick).1. (NGO) 2. (Government) 3 (Selfhelp group).

ii.)State the type of support (please tick).

	Support provided	Tick where applicable	Cost of the support received
1	Training		
2	Farm inputs		
3	Weeding and ploughing.		
4	Financial		

25.) After planting how long do you take to harvest your

Maize 1. (3 months) 2. (4 months). 3. (more than 4 months)

Beans 1. (2 months) 2. (3 months) 3. (More than 3 months)

26.) How many bags do you harvest annually for;

Maize: (below 10…), (10-40…,) (41-80…) (over 80…)

Beans (less than 1), (1), (1.5), (2), (2.5) , (3) , (3.5), (4.0), (4.5) ,(5.0), (7.0).

27.) Which marketing channels do you employ?

- Export market ( )

- Local market ( )

- Farm gate ( )

x) Food diversity scores.

	Type of food	**1 or 0**
1	Ugali, maize porridge, maize, beans or mixture taken for breakfast.	
2	Ugali, maize, beans or mixed maize and beans for lunch.	
3	Ugali, maize, beans or mixed maize and beans for supper.	
4	Other foods not made from maize or beans.	

D. Strategies to enhance agricultural productivity through female agricultural education training at secondary school level in Navakholo sub-County, Kenya

a)What challenges do you experience while marketing maize and beans? (please tick)

1. (Transport) 2. (Low price) 3. (Lack customers) 4. (Many customers). Explain briefly how you overcome the challenges……

……

……..

b)In your opinion, what can be done to improve maize and beans farming in your area?

28. Did you learn agriculture and sit for KCE/KCSE. 1. (Yes) 2. (No).

29. How has the study of agriculture subject at secondary school level assist you in relation to your current farming practice. (Please Tick).

1. In management practices of crops.

2. In marketing

24.) What is your practice in production (please tick)?

1. Mono culture ……..
2. Mixed culture …….

d. Do you think Agriculture subject should be thought to girls at secondary school level? (Please tick). 1. (Yes) 2 (No.)

Explain briefly why it should be taught to girls

……

……

Thank you.

END.

APPENDIX IV

FOCUS GROUP DISCUSSION GUIDE FOR THE STUDY FOR FORMER AGRICULTURE SUBJECT WOMEN NAVAKHOLO SUB-COUNTY, KAKAMEGA COUNTY, KENYA

Introductions

The focused group discussion guide aimed at collecting data that will form part of the study on "secondary school agriculture subject in shaping women's contribution to agricultural productivity in Navakholo sub county, Kakamega county, Kenya ," by Manyasi Annah Nawambisa, a masters student in the school of SAVET, MMUST during 2017/2018 academic year.. Your co-operation in the study will be highly appreciated.

Thank you,

Yours sincerely,

Manyasi Annah Nawambisa.

AGRICULTURAL OFFICERS/WARD AGRICULTURAL OFFICERS

1. How does the community provide food for their households?
2. How do individuals meet their food needs?
3. What shocks have recently affected farming within Navakholo sub county (economic, social, political, environmental e.g. hailstorm, lack of rain) (please tick).

4. (a). What stakeholders in agriculture are currently operating in this region and engaged in food production ? e.g NGO, Company.

   (b).What are their livelihoods activities.eg maize production, beans production.[state].

   (c)Who are the beneficiaries of those activities?

5. How do you use income generated from the maize and beans farms?

6. Do maize and beans farming have a role in household food security?

7. How does maize and beans farming compare with other agricultural enterprises in this area?

   .....

8. What challenges are faced by maize and beans farmers?

   ……

AREA EDUCATION OFFICERS/TEACHERS

9. When do girls enjoy learning agriculture lessons (Tick) .

   (When taught as practicals) (When taught as theory lessons).

10. Are girls taught how to us modern agricultural technology and machines.

    (Yes) (No) If (No) Briefly explain why?

    .....

    ……

11. Should agriculture subject be taught to girls at secondary school level? Briefly explain your answer

……

……

12. State challenges faced by learners during implementation of agriculture subject syllabus

……

……

13. Rank the following strategies to be put in place by education policy makers to improve on the implementation of agriculture syllabus as a practical subject

1. Teach using more practicals than theory.
2. Include extension topics in the curriculum.
3. Practicals should involve attending extension training sessions on adoption of new innovation.
4. Learners be taught application of new technology.

14. Rank the following food security strategies in the community to ensure food availability.

1. Building community silos for food collection.
2. Access to loans.

3. Building warehouse receipt financing programs where a certain amount of produce is delivered by farmers, receipted and stored so that it can be sold, swapped or used as cred facility later by the farmer.

Thank you.

APPENDIX V

KEY INFORMANTS INTERVIEW GUIDE FOR THE STUDY FOR FORMER WOMEN AGRICULTURE SUBJECT OF NAVAKHOLO SUB-COUTNY, KAKAMEGA COUNTY, KENYA

Introductions

This key informants interview guide aimed at collecting data which will form part of the study on "secondary school agriculture subject in shaping women's contribution to agricultural productivity in Navakholo sub county, Kakamega county, Kenya ," by Manyasi Annah Nawambisa, a masters student in the school of SAVET, MMUST in the academic year 2017/2018. Your co-operation in the study will be highly appreciated.

Thank you,

Yours sincere

Manyasi Annah Nawambisa.

SUB COUNTY/WARD AGRICULTURAL OFFICERS

1. (a.)What farming systems are preferred by farmers of maize and beans?

   (b.)Do they encounter any challenges? State them

   (c) What can be done to address the stated challenges?

   (d) What other agricultural enterprises are undertaken by farmers of maize and beans?

(e) How does maize and beans farming compare to other enterprises productivity given the same area of land?

2. What are the sources of farming inputs in this sub county?

3. Where do the farmers sell their

a) maize…….b) Beans……

4. Is there ready market for the

a) maize…….b) Beans……

5. Which variety of maize and beans is mostly preferred?

6. Are all farmers KCE/KCSE holders? (Please Tick). 1. Yes 2. No.

7. If no, is there any difference in productivity between KCE/KCSE holders and non-KCSE holders.

8. Comparing the level of participation and productivity, do you think learning agriculture at secondary school makes agriculture KCSE leavers better farmers?

TEACHERS

9. (a). Why do girls choose to learn agriculture subject?

(b).Do the girls like practicals.

(c).Basing on KNEC examinations in agriculture subject in the last 5years, has the enrolment in agriculture subject been increasing or decreasing.

(d). Do you think the content in agriculture subject is sufficient enough for learners to apply in real agricultural productivity after school?

AREA EDUCATION OFFICERS

10. Basing on KNEC examinations enrolment in agriculture in the last 5years should girls be thought agriculture at secondary school level? Explain.

CREDITORS

NAME OF CREDITOR …….

How much land do most of your farmers allocate to maize and beans production?

What are some of the inputs provided to farmers?

Do you provide all their inputs?

Do their outputs match the inputs provided? Explain

Thank you.

APPENDIX VI

OBSERVATION CHECK LISTS FOR THE ACTIVITIES OF WOMEN AND MARKETERS FOR FORMER WOMEN AGRICULTURE SUBJECT NAVAKHOLO SUB-COUNTY, KAKAMEGA COUNTY, KENYA

Introductions

This observation checklist aimed at collecting data on the value chain actors in the production of maize and bean to form part of the study on "secondary school agriculture subject in shaping women's contribution to agricultural productivity in Navakholo sub county, Kakamega county, Kenya," by Manyasi Annah Nawambisa, a masters student in the school of SAVET, MMUST in the academic year 2017/2018. Your co-operation in the study will be highly appreciated.

Thank you,

Yours sincerely,

Manyasi Annah Nawambisa.

NAME OF FARMER…….

Observation	Description of the observed	Judgement
Availability of maize on farms		
Household head		
Availability of records		
Ownership of land		
Farms | land Fertility		
Time of planting		
Photographs/pictures of farms/farmers participating in maize and beans production activities.		

NAME OF THE TRADER/SELLER OF MAIZE/MAIZE FLOUR AND BEANS

……

Observation	Description of the observed	Judgement
Availability of maize on market		
Availability of maize flour on the market		
Availability of beans on the market		
Availability of records on amount purchased from local farmers		
Availability of records on the amount sold to consumers		
Level of prices of maize and beans in comparison to neighbouring sub counties		
Pictures(photographs) of farmers/sellers selling/purchasing maize /beans		

Checklist for 2012 to 2016 KNEC examination girls' enrolment in Agriculture subject

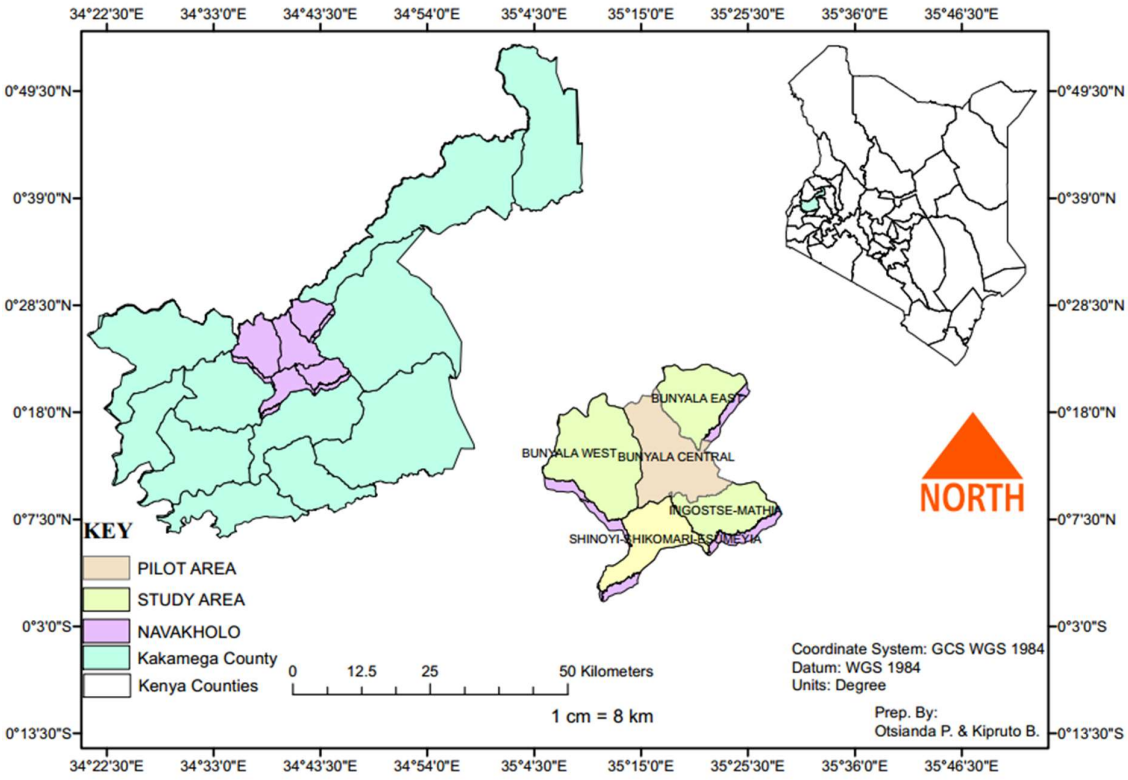
(5 years prior to the study year).

Year	KCSE enrolment
2012	
2013	
2014	
2015	
2016	

Thank You.

APPENDIX VII

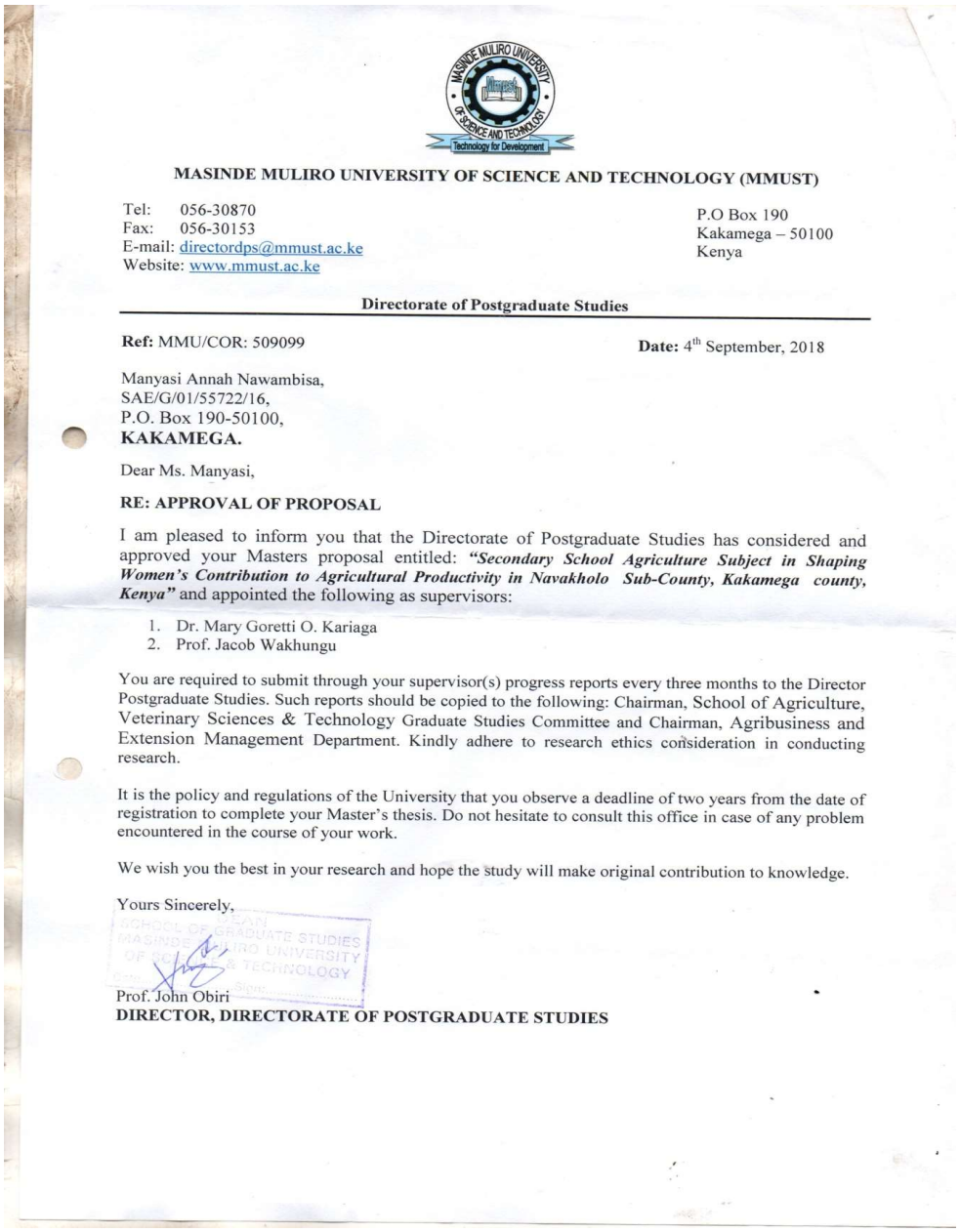
MAP OF NAVAKHOLO SUB-COUNTY, KAKAMEGA COUNTY, KENYA



APPENDIX VIII

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY

APPROVAL OF PROPOSAL



MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

Tel: 056-30870
Fax: 056-30153
E-mail: directordps@mmust.ac.ke
Website: www.mmust.ac.ke

P.O Box 190
Kakamega – 50100
Kenya

Directorate of Postgraduate Studies

Ref: MMU/COR: 509099

Date: 4th September, 2018

Manyasi Annah Nawambisa,
SAE/G/01/55722/16,
P.O. Box 190-50100,
KAKAMEGA.

Dear Ms. Manyasi,

RE: APPROVAL OF PROPOSAL

I am pleased to inform you that the Directorate of Postgraduate Studies has considered and approved your Masters proposal entitled: ***"Secondary School Agriculture Subject in Shaping Women's Contribution to Agricultural Productivity in Navakholo Sub-County, Kakamega county, Kenya"*** and appointed the following as supervisors:

1. Dr. Mary Goretti O. Kariaga
2. Prof. Jacob Wakhungu

You are required to submit through your supervisor(s) progress reports every three months to the Director Postgraduate Studies. Such reports should be copied to the following: Chairman, School of Agriculture, Veterinary Sciences & Technology Graduate Studies Committee and Chairman, Agribusiness and Extension Management Department. Kindly adhere to research ethics consideration in conducting research.

It is the policy and regulations of the University that you observe a deadline of two years from the date of registration to complete your Master's thesis. Do not hesitate to consult this office in case of any problem encountered in the course of your work.

We wish you the best in your research and hope the study will make original contribution to knowledge.

Yours Sincerely,

Prof. John Obiri
DIRECTOR, DIRECTORATE OF POSTGRADUATE STUDIES

APPENDIX IX

COPY OF NACOSTI RESEARCH AUTHORITY LETTER

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone:+254-20-2213471,
2241349,3310571,2219420
Fax:+254-20-318245,318249
Email: dg@nacosti.go.ke
Website : www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/18/36568/26801**

Date: **6th December, 2018**

Annah Nawambisa Manyasi
Masinde Muliro University of Science and Technology
P. O Box 190-50100
KAKAMEGA

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Secondary school agriculture subject in shaping women's contribution to agricultural productivity in Navakholo Sub-County, Kakamega County, Kenya"*** I am pleased to inform you that you have been authorized to undertake research in **Kakamega County** for the period ending **5th December, 2019.**

You are advised to report to **the County Commissioner and the County Director of Education, Kakamega County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

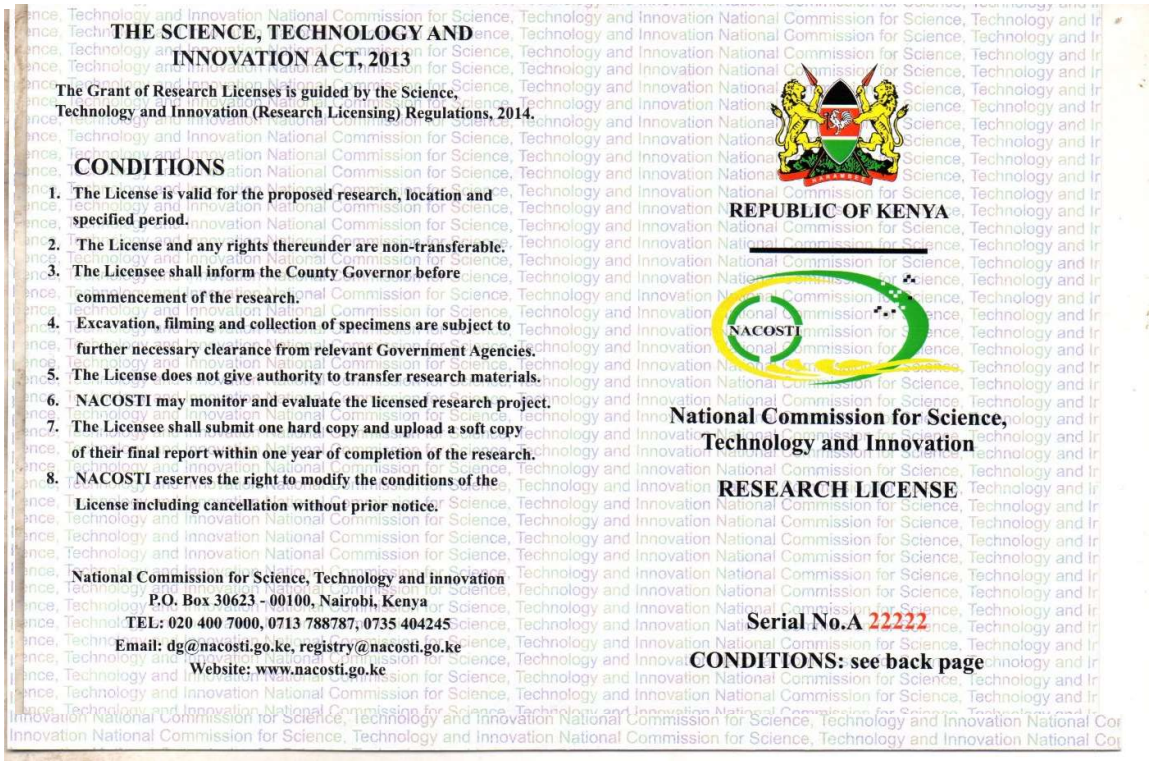
Copy to:

The County Commissioner
Kakamega County.

The County Director of Education
Kakamega County.

APPENDIX X

COPY OF NACOSTI RESEARCH PERMIT



THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013

The Grant of Research Licenses is guided by the Science, Technology and Innovation (Research Licensing) Regulations, 2014.

CONDITIONS

1. **The License is valid for the proposed research, location and specified period.**
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