FACTORS INFLUENCING ADOPTION OF CONSERVATION AGRICULTURE BY SMALL HOLDER FARMERS IN KENYA A CASE OF LAIKIPIA EAST SUB-COUNTY: KENYA

BY

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DECLARATION

This research project report is my original work and has not been submitted for any degree award in any other university.

Signature…… Date……..

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(L50/61884/2013)

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

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DEDICATION

This research project is dedicated to my late father, Mr. Justin Njeru and my dear mother Mrs. Mary Njeru, who both constantly looked at me as a star. To my husband Sammy and son Tati, for their presence and prayers; And to all my family members for their encouragement and support.

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LIST OF ABBREVIATIONS AND ACRONYMS

ACT-N	African Conservation Tillage Network
AGRA	Alliance for a Green Revolution in Africa
CA	Conservation Agriculture
CA4FS	Conservation Agriculture for Food Security and Profitability
CAADP	Comprehensive African Agriculture Development Programme
CAWT	Conservation Agriculture with Trees
CIMMYT	International Maize and Wheat Improvement Center
COMESA	Common Market for Eastern and Southern Africa
CO^2	Carbon Dioxide
FAO	Food and Agriculture Organization of the United Nations
FFSs	Farmer Field Schools
FDGs	Focus Group Discussions
GDP	Gross Domestic Product
ICRAF	International Centre for Research in Agroforestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IITA	International Institute for Tropical Agriculture
KALRO	Kenya Agricultural and Livestock Research Organization
KNBS	Kenya National Bureau of Statistics
MDG1	Millennium Development Goal 1
MoALF	Ministry of Agriculture, Livestock and Fisheries
NACOSTI	National Commission of Science, Technology and Innovation
NEPAD	New Partnership for African Development
NGOs	Non-Governmental Organizations
SADC	Southern African Development Community
SPSS	Statistical Package for Social Sciences
SRA	Strategy for Revitalizing Agriculture
SSA	Sub Saharan Africa
UNEP	United Nations Environmental Program

ABSTRACT

The purpose of this study was to investigate factors influencing adoption of conservation agriculture by small holder farmers in Laikipia East Sub County, in Laikipia County. The study was conducted in three wards of Mukogondo East, Tigithi and Umande. The study was guided by four specific objectives, which were: To determine how demographic factors influences adoption of Conservation Agriculture; assess how land tenure system influences adoption of Conservation Agriculture; determine how household income influences adoption of Conservation Agriculture and to establish how access to credit influences adoption of Conservation Agriculture in Laikipia East Sub County. The study was guided by the Diffusion of Innovation theory and the Adopter Perception model. The research design was a descriptive cross-sectional research design with a sample size of 291 farmers sampled from a target population of 1,200 farmers using the Fisher's model of sampling. Stratified random sampling technique was used to select respondents from the three wards. The data collection tools were a structured questionnaire, focus group discussion and key informant interviews. Descriptive statistics (frequencies, percentages) and inferential statistical analysis (correlation and multiple regression) was done, using Statistical Package for Social Sciences Version 21. Qualitative data obtained from the focus group discussions and the key informants was used to complement the quantitative data and was presented in verbatim. The correlation shows that all the variables have a positive relationship with Conservation Agriculture (CA) practice except for education. The results show positive relationships between gender and CA adoption, age, household income, credit access and land tenure. The results showed that age was the most prominent in influencing CA adoption. The results also showed that household income had the most influence on CA adoption followed by access to credit and land tenure system. The study therefore concluded that age, access to credit, land tenure system and household income were factors influencing adoption of CA practices. The study recommends that education and extension training on CA practices should be targeted towards older farmers as majority of the farmers were above 40 years of age. Further training and support for CA adoption to be targeted towards farmers who own their land either through purchase or inheritance and that opportunities for access to credit to be enhanced for CA adoption among households. This could be achieved through financial support by Non-Governmental Organisation's (NGOs), private sector, County Government and the National Government. In conclusion, the study was conducted among smallholder farmers in Laikipia East Sub-County only. There is need to conduct further study on other conservation agriculture projects and the effects and impacts of CA adoption among CA adopters in all the 47 counties in the country.

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

The aim of harnessing agricultural output has acquired renewed emphasis in developing countries since the 2007/08 food crisis. Even though Africa initially produced a surplus of food to make ends meet, the rapid population growth has greatly lowered the surplus over the last century (Todaro & Smith, 2009).

Taking into account the specific context of the research, the study took place in Laikipia East Sub County, targeting farmers who are part of the Conservation Agriculture for Food Security and Profitability (CA4FS) project. The project, "CA4FS'', is funded by the Alliance for a Green Revolution in Africa (AGRA), and is implemented by staff from African Conservation Tillage-Network (ACT-N), in collaboration with Kenya Agricultural and Livestock Research Organization (KALRO). This project is ongoing in two counties of Laikipia and Machakos; however, this study focused only on Laikipia County. The project proposes the enhanced adoption of Conservation Agriculture (CA) as a sustainable farming option for meeting the rising food demands in the country, and especially with effects of climate changes. The specific objectives of the CA4FS project are to evaluate and identify cover crop options for CA, increase the awareness of CA among small holder farmers and extension staff through wide scale field demonstrations, to improve access to information and communication products on CA for all practitioners including policy makers; and to improve smallholder access to input and output markets.

Conservation Agriculture (CA) is a technique for coordinating agro-systems for enhanced output, raised revenues and food security while conserving and improving the resource base and the surrounding (FAO 2006). CA, which consists of three principles (i) minimal soil disturbance which is also referred to as zero tillage, (ii) crop residues covering the soil surface, and (iii) crop rotations, is now termed as a uniting label for a number of integrated soil and managing agricultural resources (Knowler & Bradshaw, 2007; Kaumbutho & Kienzle, 2007). It entails sowing of seeds and using fertilizer on initially unprepared soils by developing a narrow bend or using directly onto the stubble of the past crop (Bollinger et al., 2004; Dumanski et

al., 2006). Zero-tillage slowly rises organic matter composition of the soil as a result of reduced erosion of the soil which leads to high output both in the short and long run (Bollinger et al., 2004).

The conservation of a non-interim or partially permanent organic soil cover in the manner of dry mulching or green crop cover in the entire cropping cycle assists prevent degradation of the soil. Various ways of attaining this is by letting previous crop anchored or loose after harvesting, growing a cover crop, for instance, Lablab that may be cut to give mulch and by using external mulch from manures and composts (Hobbs et al., 2007; Nhamo, 2007). It leads to enhanced water infiltration, lowered loss of water from the soil, reduced loss of the soil via erosion and enhanced soil health via improved nitrogen mineralization, lower weed infestation and improved nutrients of the soil (Hobbs, 2007). Crop rotation according to Chomba (2004) entails changing crops of diverse families such as legumes and cereals each season or annually. It helps disintegrate weed and the life cycle of pests and promotes fertility of the soil by giving complementary fertilization to crops sequentially (ACT 2005).

1.2 Statement of the Problem

Greater risks to agricultural businesses are expected due to climate changes as identified in Kenya's National Climate Change Action Plan (NCCAP, 2011). Less days for crop growth are expected. Both gradual climate change and more frequent extreme events such as flooding and prolonged drought will create decrease in reliable cropping days making crop failure more likely. The increased frequency of droughts causes water shortages for domestic use, crops and livestock. The unpredictable climate patterns disrupt agricultural planning in most counties in Kenya especially in arid and semi-arid lands of Laikipia. These challenges include reducing yields due to climate change, lack of access to credit and financial services, increasing demands for food supply, low profits from farming activities and dry land rain-fed farming (Huho & Kosonei, 2013). There is evidence to show that these challenges have been facing smallholder farmers in Laikipia County. Kaumbutho and Kienzle (2007) reported that conventional methods that farmers were using in Laikipia were running at losses because of high cost of production. Kinyumu (2012) conducted a study in Laikipia and found that farmers perceived several benefits associated with CA adoption, and

despite the fact that deliberate efforts have been made to promote and disseminate the CA approach in Laikipia, the adoption rate of this approach is still low. Cox and Sseguya (2015) study also reported that Conservation Agriculture has been practiced in Laikipia County for more than twenty years, but uptake has been generally slow. As far as the researcher's knowledge is concerned, there is no evidence of a study that has been conducted to investigate the factors influencing adoption of Conservation Agriculture by small holder farmers in Laikipia East Sub County, a gap that this study intends to fill.

1.3 Purpose of the Study

The purpose of this study was to investigate factors influencing adoption of Conservation Agriculture by small holder farmers in Laikipia East sub County.

1.4 Research Objectives

The objectives of this study were:

i. To determine how demographic factors influences adoption of Conservation Agriculture in Laikipia East Sub County.
ii. To assess how land tenure system influences adoption of Conservation Agriculture in Laikipia East Sub County.
iii. To determine how household income influences adoption of Conservation Agriculture in Laikipia East Sub County
iv. To establish how access to credit influences adoption of Conservation Agriculture in Laikipia East Sub County

1.5 Research Questions

This study aimed at the following research questions:

i. How do demographic factors influence adoption of Conservation Agriculture in Laikipia East Sub County?
ii. How does land tenure system influence adoption of Conservation Agriculture in Laikipia East Sub County?
iii. How does household income influence adoption of Conservation Agriculture in Laikipia East Sub County?
iv. How does access to credit influence adoption of Conservation Agriculture in Laikipia East Sub County?

1.6 Significant of the Study

The information obtained from this study will be useful to government ministries and departments and other stakeholders in various ways. The private sector, the donor community, farming community, non-governmental organizations (NGO's) and other players will be at an informed position and can use this information to support financially the concept of conservation agriculture. Further, the agricultural extension agents both in national and county governments will be empowered to train and educate farmers on how to understand conservation agriculture better, its three underlying principles and their impacts, which when practiced will improve food security among households. The study will also be important for policy makers and extension officers to formulate effective intervention practices that will assist in accelerating rates of adopting conservation agriculture advancements in Africa. In addition, it bears a direct relevance to the United Nations Millennium Development Goal 1 (MDG 1) that aims to get rid of absolute poverty and hunger.

1.7 Basic assumptions of the Study

The study assumed that farmers will cooperate in answering all the research questions, and that the answers to the research questions will be understood and relevant. It was also assumed that after data is collected and analyzed, the final report will show the relevance of this study, and that the information obtained will be useful for further research of CA in future.

1.8 Limitations of the Study

In conducting this study there are some critical limitations that were expected. First, not all respondents were willing to share information during the interview and therefore this forced the researcher and the research assistants to cover long distances in order to interview a significant number of respondents. Second, since the CA4FS project is the one funding current CA activities in Laikipia County, farmers were expecting to be paid something for participating and this weakened the results of the study. The researcher even after briefing the enumerators and farmers that the study was for purposes of research only, it was still difficult to convince the farmers to cooperate in answering the questions.

1.9 Delimitations of the Study

The research objectives, research questions and the locations identified for the study were towards the achievement of the deliverables expected in the outcomes of the CA4FS project. The sample size and sampling frame were determined by funds available for the study and mainly targeted small holder farmers in Laikipia East Sub County. Three wards namely Mukogondo East, Tigithi and Umande were selected for the study. These were the wards where training of Conservation Agriculture had taken place. Questionnaire was used as the main research instrument as it had the potential to obtain a lot of information required. Both closed-ended Likert scale responses and open-ended responses were included in the survey.

1.10 Definitions of Significant Terms used in the Study

Access to credit – It is the capability of consumers and entities to access financial help and repay with interest within a stated period for agricultural purposes. Repayment terms are usually agreed upon between the two parties involved; The lender and the lendee.

Adoption of Conservation Agriculture - Is the decision made by a farmer to use the agricultural technology which consists of a set of three principles in order to increase crop productivity, while at the same time conserving the environment. The combination of zero tillage or minimum tillage, soil cover and crop rotation, makes the combined set of conservation agricultural principles which when practiced increases food productivity.

Conservation Agriculture – regarded as the set of soil preservation activities that lower the interference of the structure of the soil, composition and natural biodiversity to improve yields.

Demographic factors: considered as private attributes utilized to describe people and gather and assess data on individuals in a certain population. Some of the variables include education, age, race, marital status, occupation, income, and gender.

Household Income - Is the combined amount of money of individuals sharing a certain residential place. It incorporates each type of income, for instance, salaries and wages, agricultural earnings among others.

Land tenure system - Is the regime in which land is owned by an individual or a group of persons who are said to hold the land. This system can either be private or communal depending on the land rights bestowed to the owners.

1.11 Organization of the Study

This research proposal is organized into five chapters. Chapter One dealt with the background of the study, purpose of the study, research objectives and research questions. Further, the chapter dwelt on relevance of the study, assumptions and the descriptions of essential terminologies. Chapter Two looked into the previous literature in the area of study which is, 'Adoption of Conservation Agriculture by small holder farmers'. Further, Chapter Two covers the explanation on the themes of the study objectives, as well as the conceptual framework, the theoretical framework and the knowledge gaps

Chapter Three looked into the research design, the target population, sample size that was used in the study, sampling techniques, data collection instruments, reliability and validity of data collection instrument, data collection procedures, methods of data analysis, operational definition of variables and finally the ethical issues in the study. Chapter Four tackled data analysis, presentation and interpretation. Chapter Five which is the last chapter, gave a summary of the research findings, discussions of key findings, conclusion and recommendations and finally suggestions for further research.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter looks at other literature that is related to the study and the themes of the four objectives. There will be four subheadings namely; the origin of Conservation Agriculture, demographic factors and adoption of conservation agriculture, land tenure system and adoption of conservation agriculture, household income and adoption of conservation agriculture and access to credit and adoption of conservation agriculture. The chapter will also cover the theoretical framework and the conceptual framework of the study and also look at the gaps in the literature reviewed.

2.2 Origin of Conservation Agriculture

The problem of soil erosion was basically intense in the Midwest, where a significant amount of topsoil was eroded by various agents (Hobbs, 2006, Berger et al., 2008). Farmers began sowed cover crops to safeguard the soil and did crop rotation to conserve the fertility of the soil. Knowledge was diffused rapidly such that by 2000, CA was done on approximately 60 million hectares of land globally (FAO, 2006). As a concept, Conservation Agriculture (CA) depends on 3 crucial pillars: 1) reduced disturbance of the soil; 2) complete soil cover 3) different rotation of crops (Giller et al., 2009). CA began in Kenya in the 50s where emphasis was on sustaining and maintaining water reservoirs and preventing erosion of the soil (Kassam et al., 2009). Facts from the past activities indicate that agriculture conservation is among the most rigid and promising means of implementing sustainable agriculture in the country (Shetto et al., 2007).

Conservation Agriculture in Africa has continuously been promoted by the Food and Agriculture Organization of the United Nations (FAO), the African Conservation Tillage Network (ACT-N), International Centre for Research in Agroforestry (ICRAF), the International Maize and Wheat Improvement Center (CIMMYT), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), and the International Institute for Tropical Agriculture (IITA); (Baudron et al. 2007; Boshen et al., 2007; Kaumbutho & Kienzle, 2007).

2.3 Demographic Factors and Adoption of Conservation Agriculture

Age is an important factor that influences the probability of adoption of new technologies because it is said to be a primary latent characteristic in adoption decisions (Akudugu et al., 2012). The age of the farmer has the anticipated essential impact on the probabilities of farmers taking part in embracing innovation (Amir, 2006). The adverse sign for the age factor may be comprehended rom the obviously observed adverse relationship between adoption of technologies and age. That is, younger planters have a tendency of being willing to embrace technology unlike their aged colleagues (Amir, 2006). In addition, aged farmers have a probability of being risk averse and could avoid creativity in a bid to avert risks linked with the initiative and therefore resistance to transformations (Mazvimavi et al., 2009).

This study therefore hypothesizes that the number of farming years' experience of a farmer does affect CA adoption. The length of time that farmers have practiced CA in their district had a positive and significant (5%) effect on land under CA (Ngwira et al., 2014). Through education, Norman (2005) claims that farmers may know the rationale for managing land through better farming practices and other social economic factors. The farmer's education background is an important factor that determines the readiness to accept and properly apply technologies (Ngwira et al., 2014). In general, education has been observed to have positive effects on conservation agriculture. In Kenya, most farmers have low formal education and therefore, mostly they use traditional farming practices. This leads to reduced productivity and repeated farming mistakes. The more complex the technology to be utilized is, the more likely it is that education will play a major role in its adoption. Therefore, it is hypothesized that the ability to acquire information and knowledge and understand the applications of conservation agriculture is highly dependent on the education background of the farmer.

Gender is also hypothesized to influence adoption of CA. It is often that women are ignored when it comes to the adoption and transfer of technology. It is further supported by the cultural systems that calls for women to stay at home and fend for the family while men search for means of making ends meet. Moreover, Women lack immediate access to the crucial factors of production (Mazvimavi et al., 2009). Therefore this study will look into the relationship of gender and adoption of conservation agriculture.

2.4 Land Tenure System and Adoption of Conservation Agriculture

Land tenure is another important factor influencing the conservation practice adoption decision-making process. In the current conventional agricultural industry, many farmers have had to increase production and farm more land in order to remain profitable, which has resulted in many farmers renting more land than they own. Land tenants are generally less willing and or able to implement conservation practices due to lease terms and arrangements and the timing of practice results or benefits. The effects of tenure security on conservation measures adoption and investment have been investigated by various studies.

According to FAO (2006), the settlement of farmers at one place has an important implication on access or control of resources and long term investment on the farm. A migrant with short stay on the land will be unwilling to invest capital and labour in practices of which the effects can only be realized after a long period of time. Farmers are not likely to invest on a land which long term access is not secured. The hired land especially when it is rented for 2-3 years can be a constraining factor for adoption of CA practices, because the land owner might need the land back when the soil fertility has distinctly improved and crop production has increased (Ngendo et al., 2013). A study by ICRAF Kenya in 2005 on the policy environment of Conservation Agriculture with Trees (CAWT) in Eastern Kenya, found that security of land tenure offered the best motivation for them to adopt CAWT.

Embracing conservation agriculture is impacted by the tenure ship of the land of the household (Kassie et al., 2012). The research attributed to the impact of land tenure condition of household on acquisition of conservation agriculture activities to the fact that the gains from the long run conservation practices add up with time. Kassie and Holden (2006) revealed that small scale farmers have a higher chance of practicing CA on leased lands than theirs, may be as a result of insufficient land tenure security (Ng'ombe, 2014). In Ghana, (Nkegbe, Shankar & Graziano; 2012) found that the effects of tenure security on the soil and water conservation practices adoption decisions of households in northern Ghana tend to be mixed and there is no conclusive evidence of the effect of land tenure on conservation agriculture practices.

2.5 Household Income and Adoption of Conservation Agriculture

Income plays an important role of financing the uptake of new innovations. High family income enhances the ability to embrace technology due to the presence of fundamental capital to begin the innovation. In Mozambique, Nkala et al., (2011) and Amsalu and De Jan (2007) pointed out that inadequate access to loans and other means of generating income impacts the small scale farmer which has a negative effect on the adoption of technology.

High income has a positive influence on the initial stages of trial of innovations as the wealth allows the farmer to invest a relative small proportion of their income into an uncertain enterprise (FAO, 2007a). Wealthier farmers may be the first to try new technology especially if it involves purchased inputs because they are more able to take risk. That is farmers who do not utilize new technology may complain the lack of cash as the principle factor limiting their utilization.

In Malawi, Nyambose & Jumber (2013) found that households that depend heavily on farming as a means of livelihood are ready to embrace the CA. In Zambia, Ng'ombe (2014) discovered that accessibility to income plays a role in the acquisition of CF. Findings show that off-farm returns lower the odds of acquiring CF by small scale farmers, ceteris peribus.

2.6 Access to Credit and Adoption of Conservation Agriculture

In India, Bhan & Behera (2014) conducted a study on conservation agriculture problems. The role of credit in the uptake of farming technologies, as observed by Yirga (2007) found relationship between degree of adoption and access to credit; because loans makes it simpler to purchase farm inputs. For instance, the Chinese administration recently embraced various policies to catalyse CA strategies in the Yellow River Basin which positively affected agricultural output (Yan et al., 2009).

Access to credit is an important factor in acquiring basic inputs required for adoption of conservation farming. Credit was identified as a major factor affecting adoption for new hybrid rice technologies in Thailand. The CA techniques involve purchase of equipment necessary for farming which involve direct planting and ploughing such as jab planters, agrochemicals and fertilizers. The high cost of farming inputs has a significant impact on cash demand for farmers during the farming season and thus the need to seek financial support. In Mexico, Van de Broeck et al., (2013) study on

adoption of CA found that there were important differences between farmers with respect to institutional factors. CA-full time and CA-part time farmers have better access to information, technical support and other services. CA farmers receive significantly more services from the organisations they are member of, including better access to credit, agricultural insurance and subsidies. Credit constraint negatively influences investment in modern crop varieties and commercial fertilizers, and this suggests that liquidity-constrained households (those who need credit but are unable to find it) are less likely to adopt CA that requires cash outlay.

2.7 Theoretical Framework

The study alludes to the adoption theory to describe variables impacting the decision of farmers to adopt CA. Two main paradigms may be differentiated in the postulate of adoption of agricultural advancements by small scale farmers: The Diffusion of Innovation Theory and the Adopter Perception Model.

2.7.1 Diffusion of Innovation Theory

It is termed as the valuable transition model for directing technological creativity where innovation is altered and illustrated in a manner that achieves the demands of all the applicants. That is, diffusion of innovation is considered as the procedure that takes place when consumers embrace a recent idea, commodity, activity among others. Rogers (2003) described this procedure, emphasizing that in many cases, few accept the latest idea and adopt its application. With time, the innovative concept became diffused by farmers till they attained a saturation level. Rogers (2003) differentiated five groups of adopters: early adopters, laggards, early majority, and late majority. At times, a sixth category is incorporated: non-adopters. They are illustrated in figure 2.

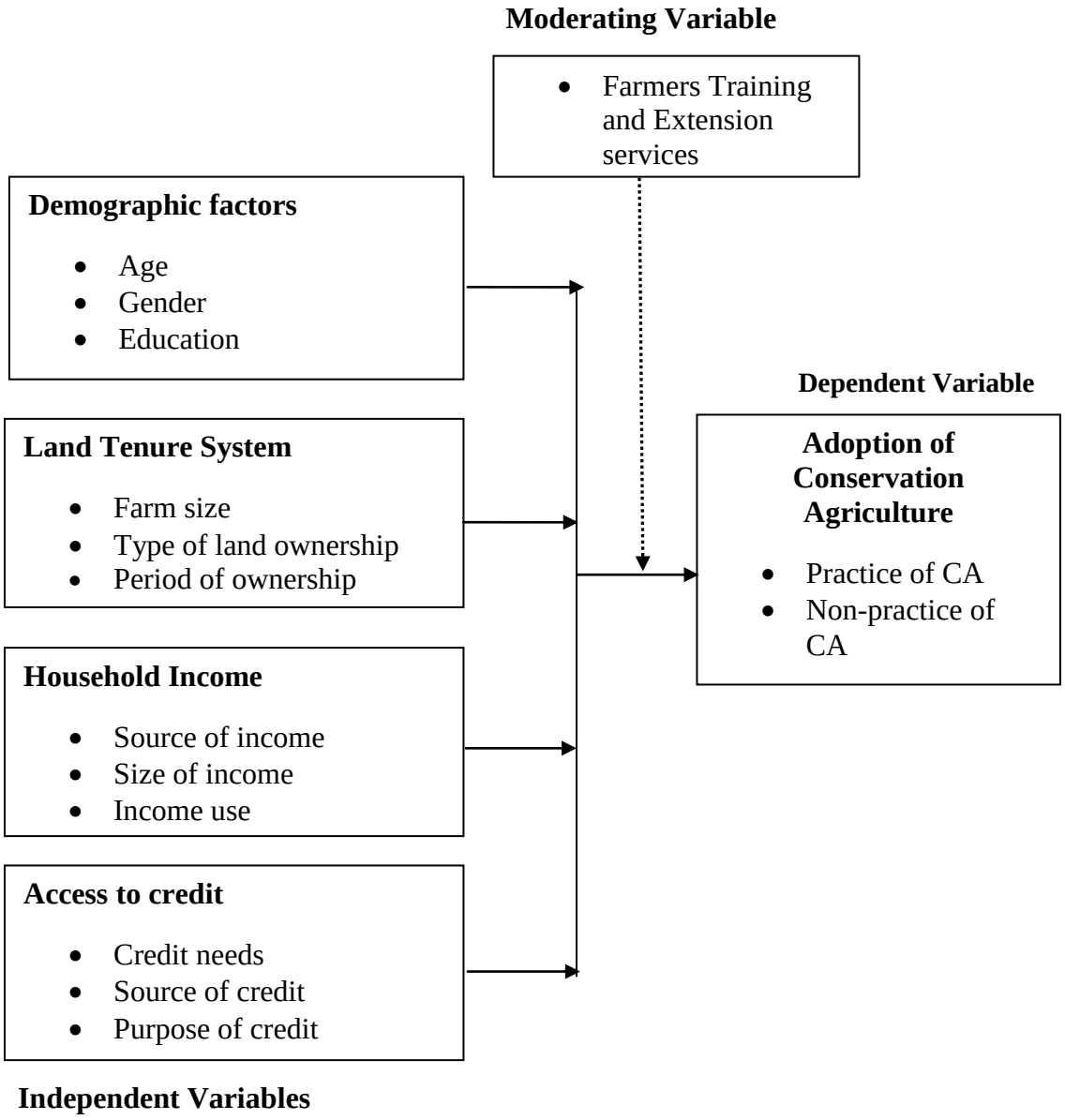
Rogers (2003) described that diffusion of innovation was the procedure through which an innovation is disseminated via particular networks with time. It is essential to study why various innovations are effective, whereas others are not. Various innovation have been noted by Rogers to define this mystery. They include observability, trialability, relative advantage, complexity compatibility. They offer a basic assessment list for technical project leaders to use when factoring innovative transformation.

The Diffusion of Innovation theory is essential as it helps administrators, IT specialists among other experts (Kaminski, 2011). The model states that information accessibility is the crucial variable ascertaining adoption decisions (Rogers, 2003). According to the theory, there are various phases: knowledge, persuasion, decision, implementation, and lastly confirmation. The application of agricultural creativity among planters and the emanating social change in the developed nations has widely been fathomed from the diffusion of innovations viewpoint. Therefore, according to the model, agricultural research is the source of innovation, extension agents play the role of communication and farmers are the recipients of the creativity (Mwaseba et al., 2006).

2.7.2 The Adopter Perception Model

It postulates that the perception of adopters is essential in impacting adoption choices (Prager & Posthumus, 2010). The model encompasses the viewpoints of consumers in implementing a particular innovation. It affected by private attributes; physical elements of the land and institutional variables. Therefore, in regard to the individualistic perspectives, the embracing of innovations is depicted as associating to a person without paying attention to management between interdependent players. Nonetheless, such schools of thought based on personal perspectives do not sufficiently deal with the role of the social learning in the utilization of innovations. The model has been embraced by different researchers (Nyanga, Johnsen & Aune, 2011; Ngwira et al., 2014) in describing the variables affecting the utilisation of technology in agriculture. The model is relevant in the study as it emphasizes on the private perspectives towards creativity. In this scenario, the research aims to comprehend the impact of farmer attributes such as gender, education, and age towards the implementation of CA among smallholders' farmers in Laikipia East Sub County.

Figure 1: Conceptual Framework



2.8 Conceptual Framework

Figure 1 shows the conceptual framework, where the independent variables which are the demographic factors, land tenure systems, household income and access to credit show their effect on the dependent variable which is CA practice. The moderating variable for the study is farmers' training in CA and access to extension services. Access to extension services and farmer training can affect the relationship between the independent and dependent variables as these factors affect the decision of farmers to adopt CA.

Table 2.1 Gaps in Literature Review

Objective	Past studies	Authors	Literature gap
To determine how demographic factors influences adoption of Conservation Agriculture	These studies covered various aspects of social economic indicators and how they affected CA adoption.	Akudugu et al., 2012; Amir 2006; Giller et al., 2009; Mazvimavi et al. 2009; Ngwira et al., 2014	None of these studies was conducted in Kenya and also did not include a model of demographic factors that may directly affect CA adoption as undertaken by this research.
To assess how land tenure system influences adoption of Conservation Agriculture	These studies measured CA adoption using several models of CA adoption.	FAO 2007a; Giller et al., 2009; Kassie et al., 2012;Ngendo et al., 2013; Ngombe 2014	These studies did not clearly cover land tenure as an indicator for CA adoption as will be undertaken by this research.
To determine how household income influences adoption of Conservation Agriculture	These studies revolved around how income influenced the adoption of CA but looked at different indicators.	Amsalu & De Jan 2007; Chiputwa et al., 2011; Marenya & Barett 2007; Nkala et al., 2011	This study will focus on the major sources of income and the size of income and how this influences CA adoption which did not come out clearly in the literature reviewed.
To establish how access to credit influences adoption of Conservation Agriculture	These studies focused mainly on credit barriers among farmers and how they affect CA adoption.	Bhan & Behera 2014; Kassie et al., 2012; Yan et al., 2009; Yirga 2007;	This study will focus on sources of income, income size and credit needs of farmers for CA adoption which did not come out clearly in other studies.

2.9 Summary of Literature Review

The literature review for this study looked at the empirical review of the literature on conservation agriculture available from various sources. Not so much has been done in the area of adoption as most literature looked at the economics of adoption and the benefits of adoption. Across Africa many studies have been conducted especially in Zimbabwe and Zambia where Conservation Agriculture was first introduced in Africa. However, there was not so much information on factors affecting adoption of Conservation Agriculture. Therefore it is my hope that my report will be quite informative and can be used as a reference for future work on CA. The literature review also analyses the themes for all the objectives of this study. The theoretical framework which gives two theories under which this research is underpinned is covered in this chapter as well. A lot of literature on adoption of conservation agriculture was reviewed as seen in the gaps in literature reviewed table. However, this study will look into the similarities and differences of the results of the research and the conclusions contained in the literature reviewed.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter contains information on the type of the research design adopted for the study. It gives information on the target population and its characteristics as well as the sampling size and sampling procedures used to identify participants from the target population. The type of instruments that were used for data collection, the piloting of that instrument, its validity and reliability are also described in this chapter. The chapter also tackles the information on methods and procedures of data collection and the data analysis techniques, as well as the ethical considerations for the study. Finally, the chapter looks at the operational definition of the variables used in the study.

3.2 Research Design

Describes the procedure that a researcher selects to adhere to when conducting a study. In other words, it can be explained as the format of the research according to Cooper and Schindler (2003). It helps stick all factors together in a research project. The study adopted a descriptive design. Descriptive survey is defined as the manner of gathering information from respondents to find out the existing status of the subject under scrutiny with respect to a single or more variables. The primary focus of the design is to find out the rate of occurrence or the degree to which factors are linked (Mugenda & Mugenda, 1999). The design was considered effective because it responds to questions such as 'how' and 'why.' Mualako et al, (2009) recommends a descriptive survey design where a study involves stating conditions or relationships that exist. Qualitative information was also collected from farmers' group discussions and key informants during the study.

3.3 Target Population

Statistically, it is regarded as the particular group from which information will or should be obtained. Ngechu (2004) pointed out that a population is a properly described or set of individuals, elements, services or households under investigation. The research was carried out in Laikipia East Sub County and is targeting 1,200 CA farmers cited as the target population from three wards namely Mukogondo East, Tigithi and Umande as shown in Table 3.1 (CA4FS Field Office Statistics).

Table 3.1: Target Population

Strata/Ward	Population Representation
Mukogondo East	300
Tigithi	600
Umande	300
Total	**1,200**

3.4 Sample Size and Sampling Procedures

The sample size was drawn from the CA group's register in each ward which forms the sampling frame. The farmers were stratified according to the farmer groups in which the CA4FS project is being implemented. A sample size of 291 farmers was targeted in the study out of a selected population of 1200 farmers. This data was found at Laikipia East Sub County CA4FS project field office. The sampling approach employed was the stratified technique as it is capable of generating estimates of the entire population parameters with high precision and makes sure that a more representative sample is obtained from a similar population.

The research categorized the respondents into 3 strata or layers: Mukogondo East, Tigithi, and Umande wards. Every stratum applied simple random sampling technique to choose participants.

3.4.1 Sampling Procedure

To ensure a good representation among Laikipia County residents, stratification of the target population was done with the assistance of the County Assembly Administrative Wards using probability proportional to size. To arrive at the desired sample, Fisher's model was used. In this case, the target population is less than 10,000, the formulae is given as

$$n_f = \frac{n}{1 + n/N}$$

Where: n_f is the required sample size;

n is the sample size when population is more than 10,000; and

N is the observed target population

$$n_f = \frac{384}{1 + 384/1,200} = 291$$

The research made use of the probability proportion sampling size. The probability proportion to sampling size (PPS) was adopted. The process entails dividing the size of the final unit and giving bigger clusters a bigger chance of selection and smaller ones lower chances (Abdulla et al., 2014). It is factored whenever the sampling units differ in size by making sure that those in bigger sites have similar likelihoods of getting into the sample like those in smaller sites. This was calculated as the population of individual category of staff divided by the total population of all categories (target population) multiplied by the sample size of 291.

$$\frac{\text{Population of the Ward} \times 291}{\text{Total Target Population}}$$

Stratified random sampling gave all the individuals in the defined sample an equal chance of being picked as a respondent for the study, (Orodho & Saleemi, 2009). A representative sample was selected according to the 3 Wards as shown in Table 3.2. In each stratum, a listing of farmers was made and samples selected at random.

Table 3.2: Sample Size Distribution

Strata/Ward	Sample size
Mukogondo East	73
Tigithi	145
Umande	73
Total	**291**

3.5 Data Collection Instrument

A questionnaire containing closed and open ended questions was utilized to gather data from adopters and non-adopters of CA. Kothari (2004) pointed out that the questionnaire approach has been widely applied in a wide range of business and economic surveys as a result of its unbiased attribute and capacity to catch bigger samples. In addition, focus group discussion using a FGD guide was used. Observation was also employed to collect general data on the system of tilling, type of CA and crops. Discussions and consultations with key informants was carried out using a questionnaire. The questionnaire was formulated in a way to make sure that all factors essential to the study were considered.

3.5.1 Pilot Testing of the Instrument

Simon (2011) recommends that pilot studies should be conducted among 10 % of the sample population from Tigithi Ward. Therefore, the research instrument was administered to 29 CA trained farmers in Laikipia East Sub County who were selected randomly before the main study was done. This allowed for fine-tuning of the research instrument before the actual study was carried out. After piloting any corrections suggested was done to the research instrument. The researcher was keen to ensure that the farmers interviewed during the piloting of the research instrument were not included in the main study.

3.5.2 Validity of the Instrument

According to Somekh and Cathy (2005), it is extent by which the test components being sampled depict the content the study is made to measure. Content validity was used for the study since it measures the extent to which information obtained using certain instruments depicts a particular domain of a certain concept. For validity of instruments, the researcher had a comprehensive discussion with the tutor.

3.5.3 Reliability of the Instrument

It describes to credibility of scores or responses from a single administration of a tool to another and from an itemized sets to another (Tavakol & Dennik, 2011). The closer the value is to + 1.00, the stronger the congruence measure (Mugenda & Mugenda, 2003). The study used Cronbach's Alpha to establish the reliability of the questionnaire. A Cronbach Alpha level of above 0.7 is deemed acceptable in research. The researcher established the reliability of the instrument at 0.72. The researcher used qualitative and quantitative methods of data collection and analysis which is referred to as triangulation to enhance the validity and reliability of the study findings (Diaz-Jose et al., 2016).

3.6 Data Collection Procedures

A research permit from the National Commission of Science, Technology and Innovation (NACOSTI) to conduct research was sought, after which data collection began. The questionnaires were administered individually to all the sampled CA farmers in the study area. Data collection was done by reading out the questions and helping the respondent to understand and then respond. Caution was exercised in order to ensure all questionnaires issued to the respondents are received back and

numbered for reference. A register of all questionnaires was adhered to, and each questionnaire was given a reference for tracking purposes. The data to be collected was quantitative and qualitative in nature comprising of numeric and non-numeric types. Before analysis, data was checked for accuracy and then entered into a computer. The raw data was properly coded to prepare for analysis to coordinate it and offer a way of interpreting to quantitative techniques. This involved the reading of the data and demarcating segments within it. Every segment was identified by a code that suggested how the linked data relate with the research aims. Moreover, Statistical Package for Social Scientists (SPSS), excel and word computer packages played a crucial role in analyzing data.

3.7 Data Analysis Techniques

Data analysis entailed separation of data into constituent parts of the elements separately, or in relation to the whole. Quantitative data was analyzed using descriptive statistics (Kombo & Tromp, 2006). Information gathered through the questionnaires was coded and analysed using SPSS 21 software. The data was illustrated in tabular and prose format and was implemented by tabulating the responses and interpreting the data. The researcher used descriptive statistics, correlation and regression analysis. The researcher used a multiple regression model which explained factors that influence adoption of CA. Dependent variable is the adoption of CA. The independent variables are considered to influence adoption of CA represented as follows:

$$Y=\alpha+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\varepsilon_i$$

Where Y= if a farmer has adopted CA or otherwise

α =Constant

β =Coefficient of independent variable X_1.....X_6 are independent variables

X_1 = Age

X_2 = Gender

X_3 = Education Level

X_4 = Land Tenure System

X_5 = Household Income

X_6 = Access to Credit

εi =Random error term

3.8 Ethical Considerations

Confidentiality and privacy of information collected was communicated to the respondents before the start of the interviewing process. The questionnaires did not indicate the identity of interviewees, because the disclosure of confidential information might stigmatize the respondent. The other ethical issue to be considered is the physical and psychological harm ethics. This was achieved through designing the questionnaire in a user friendly manner in order to ensure that there was no physical or psychological harm caused.

Interviewers were trained and sensitized on need to avoid physical and psychological harm to the respondents and even to oneself. To ensure informed consent, the questionnaires were only administered to respondents who gave their consent and were willing to participate in the interview. The purpose of the study was clearly explained to the interviewees. The enumerators' ensured permission sought as per the cultural values and practices of the target population. It was also the duty of the enumerators to ensure that the respondents are protected from harm and discomfort during the entire interview process.

3.9 Operational Definition of Variables

It explains the exact way of measuring a variable. Table 3.2 shows the kinds of variables and their signs, and manner of measuring in the study course.

Table 3.3: Operationalization of Variables

Objective	Variable	Indicators	Measurements	Measurement Scales	Type of Analysis
To determine how demographic factors influences adoption of Conservation Agriculture in Laikipia County	Demographic factors	• Gender • Age • Education level	• Either male or female • No. of years since birth • Level of education attained	Interval Nominal Interval	Descriptive Correlation Regression
To assess how land tenure system influences adoption of Conservation Agriculture in Laikipia County	Land tenure systems	• Farm size under CA • Farm land • Land acquisition	• Purchased • Leased • Inherited • Communal land • Hired	Nominal	Descriptive Correlation Regression
To determine how household income influences adoption of Conservation Agriculture in Laikipia County	Household income	• Major source of income • Size of income • Use of income	• Farming/business/employment • Amount in Kshs.	Nominal Interval	Descriptive Correlation Regression
To establish how access to credit influences adoption of Conservation Agriculture in Laikipia County	Access to credit	• Credit needs • Source of credit • Purpose for credit	• Buying inputs • Banks/SACCOs/Self savings • Purchase of inputs/pay for farm/ Other needs	Nominal	Descriptive Correlation Regression
	Dependent Variable CA Adoption	• CA practice • Non-practice of CA	• Conservation agriculture practice in farms	Ordinal	Descriptive Correlation Regression

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter presents the results from the data collection which is presented in line with the study objectives. The data is presented in tables and also by the researcher's own interpretation.

4.2 Questionnaire Return Rate

29 questionnaires were used to conduct the pilot test among respondents and were not included in the final study. 87 questionnaires were incomplete as the data collection was done during farming hours and interviews were often interrupted, while 55 questionnaires were not retrieved from respondents who were busy to respond at the time of the field interviews. The researcher was able to collect and analyse 120 questionnaires which met the criteria for analysis. This represented a response rate of 52 % which is acceptable, as Mugenda and Mugenda (2003) recommend a response rate of 50 % as adequate.

4.3 Demographic Characteristics of the Respondents

This section discusses the respondent's gender, age, level of education, marital status, family size and land size. These attributes were relevant to the study since they have a bearing on the respondent to provide information that is valid, reliable and relevant to the study.

4.3.1 Gender of Respondents

In terms of gender, the majority of farmers were female respondents (61.7 %) and 38.3 % were male respondents. These findings were attributed to the fact that majority of farm activities are performed by women and as such most of the respondents were women.

Table 4.1: Gender of Respondents

Gender	Frequency	Percent
Male	46	38.3
Female	74	61.7
Total	**120**	**100.0**

4.3.2 Age of Respondents

The results show that 55.0 % were aged 46-60, 25.8 % were 31-45, 18.3 % were over 60 years and 0.8 % were 18-30 years. The majority of land owners were the study participants. This is the common age for individuals who have acquired land and also this finding is attributed to the average of household heads in Kenya.

Table 4.2: Age of Respondents

Age brackets (years)	Frequency	Percent
18-30	1	0.8
31-45	31	25.8
46-60	66	55.0
Over 60	22	18.3
Total	**120**	**100.0**

4.3.3 Education Level of Respondents

In terms of level of education, 45.8 % of the respondents have a secondary school education, 40.0 % have gone up to primary level, 7.5 % have a college/university education, 4.2 % never went to school and 2.5 % have gone to a polytechnic. The findings show that majority of the respondents had attained basic education levels. Secondary school is the highest level of basic education in Kenya.

Table 4.3: Education Level of Respondents

Education level	Frequency	Percent
No education	5	4.2
Primary	48	40.0
Secondary	55	45.8
Polytechnic	3	2.5
College/University	9	7.5
Total	**120**	**100.0**

4.4 Land Tenure systems and Adoption of Conservation Agriculture

Land tenure was looked into as part of the factors influencing adoption of Conservation Agriculture in Laikipia East Sub County.

4.4.1 Farm Size

In terms of the farm size of sampled farmers', majority had 2-5 acres of land and accounted for 62.5 %, 20.0 % had 0.5-1 acre, 8.2 % had 5-10 acres, 5.8 % had below 0.5 acreage and 3.5 % had over 10 acres of land as shown in Table 4.4. The majority of farmers' had access to between 2 and 5 acres of land. This is attributed to the target population of the study who were smallholder farmers.

Table 4.4: Size of Farm among Respondents

Farm size (Acres)	Frequency	Percent
Below 0.5	7	5.8
0.5-1	24	20.0
2-5	75	62.5
5-10	11	8.2
Over 10	3	3.5
Total	**120**	**100.0**

4.4.2 Land size

The findings revealed that 49.9 % used 0.5-1 acres for farming, 41.6 % used 2-5 acres, 5.0 % used 5-10 acres for farming and those who used more than 10 acres were 3.5% as presented in Table 4.5. The findings show that majority of the study participants were farming on 0.5- 1 acre of land. This is attributed to the fact that most of the farmers' land was also used for keeping livestock and growing livestock feeds.

Table 4.5: Farming Land among Respondents

Land size (Acres)	Frequency	Percent
0.5-1	61	49.9
2-5	50	41.6
5-10	6	5.0
More than 10	3	3.5
Total	**120**	**100.0**

4.4.3 Land Acquisition

The study sought to establish how farmers acquired their land. The results found that majority had purchased and were 66.7 % of the sample, 25.0 % had inherited, 4.2 % had communal land, 3.3 % had leased the land and 0.8 % had hired land as shown in Table 4.6. Majority of the farmers had purchased their farmland. This is attributed to the culture of land ownership in Kenya where everyone strives to own their piece of land, which has also been fueled by emerging real estate agents.

Table 4.6: Land Acquisition

Land type	Frequency	Percent
Inherited	30	25.0
Communal	5	4.2
Hired for short period	1	0.8
Leased for long period	4	3.3
Purchased	80	66.7
Total	**120**	**100.0**

4.5 Household Income and Adoption of Conservation Agriculture

Source of household income was researched upon as part of the factors hypothesized to influence adoption of Conservation agriculture in Laikipia East Sub County.

4.5.1 Major Source of Income

Table 4.7 shows the major sources of income among respondents was through farming (86.6 %), Business/Farming (6.7%), Employment/Farming (3.3%), Employment alone (2.5%) and Business alone (0.9 %). Majority of the study participants cited farming as their main source of income, which is attributed to the rural setup of Laikipia County as an agricultural zone.

Table 4.7: Major Source of Income among Respondents

Source of Income	Frequency	Percent
Business	1	0.9
Business/Farming	8	6.7
Employment	3	2.5
Employment/Farming	4	3.3
Farming	104	86.6
Total	**120**	**100.0**

4.5.2 Monthly Income

The respondents were requested to indicate their monthly income where the findings showed that 85.8 % earned less than 10,000 Kshs, 9.2 % earned 10,001-40,000 Kshs, 3.3 % earned 40,001-100,000 Kshs and 1.7 % earned more than 100,000 Kshs as shown in Table 4.8. Majority of the farmers were small scale farmers and this explains the amount of their monthly income being less than 10,000 as their income depends or fluctuates in each planting and harvesting seasons.

Table 4.8: Monthly Income

Kshs	Frequency	Percent
Less than 10,000	103	85.8
10,001-40,000	11	9.2
40,001-100,000	4	3.3
More than 100,000	2	1.7
Total	**120**	**100.0**

4.6 Access to Credit and Adoption of Conservation Agriculture

Access to credit to finance conservation agriculture practices was looked into as one of the factors influencing adoption of conservation agriculture among the smallholder farmers.

4.6.1 Access to Credit Finance

The study sought to ascertain respondents' access to credit and found that majority of respondents had no access to credit for agricultural use and accounted for 88.4 % compared to 11.6 % who had access as presented in Table 4.9. The major obstacle to farmers in Kenya has been access to credit and therefore these study findings confirm farmers' challenges.

Table 4.9: Access to Credit

Access to Credit	Frequency	Percent
Yes	14	11.6
No	106	88.4
Total	**120**	**100.0**

4.6.2 Source of Credit

The findings revealed that 84.2 % had no access to any source of credit, 4.2 % source of money was from both *M-Shwari* and SACCO's, 2.5 % got their credit from banks and *Gumbato,* other sources of income were Merry Go Round. Table Banking and Women Group accounted for 0.8 % respectively as shown in table 4.10. *M-Shwari* and Sacco's were the major sources of income among the study participants. This was attributed to the few credit facilities in the rural areas. *M-Shwari* is a convenient way to access credit because it's based on the individuals' access to income and saving capabilities through a mobile phone application. SACCO's are a popular means for accessing small credit for farmers' in rural settings.

Table 4.10: Source of Credit

Sources of Credit	Frequency	Percent
Bank	3	2.5
Gumbato	3	2.5
Merry Go Round	1	0.8
M-Shwari	5	4.2
Sacco's	5	4.2
Table Banking	1	0.8
Women Groups	1	0.8
No access	101	84.2
Total	**120**	**100.0**

4.6.3 Purpose of Credit

The purpose of credit included to Buy Seeds and Agrochemicals (10.8 %), Buy farm Machinery (2.5 %) and School Fees (0.8 %) as shown in Table 4.11. Majority of the repsonses were not applicable because majority of the study participants had not borrowed any cash or credit facilities which was attributed to lack of opportunities to access credit. Buying seeds for planting season and agrochemicals were the main reasons for borrowing. This is attributed to low incomes that are derived from farming according to respondents.

Table 4.11: Purpose of Credit

Purpose of Credit	Frequency	Percent
Buy Seeds and Agrochemicals	13	10.8
School Fees	1	0.8
Buy farm Machinery	3	2.5
Not Applicable	103	85.9
Total	**120**	**100.0**

4.7 Adoption of Conservation Agriculture

Adoption of Conservation Agriculture was the dependent variable and results revealed that majority of the respondents had adopted Conservation Agriculture (CA). The results show that 50.0 % were practicing CA, while 31.7 % were not and 18.3 % were yet to practice CA. this finding is attributed to the training that farmers had from the CA initiatives in Laikipia East Sub County.

Table 4.12: Adoption of Conservation Agriculture by Respondents

Adoption of CA Practices	Frequency	Percent
Yes	60	50.0
No	38	31.7
Yet To	22	18.3
Total	**120**	**100.0**

4.8 Inferential Statistics

Correlation Analysis and Regression Analysis were looked into under Inferential Statistics.

4.8.1 Correlation Analysis

Correlation analysis examines the strength of the correlation between two test variables. Correlation coefficients (r) measure the strength of association and can have values between –1 and +1. The closer they are to 1, the stronger is the association. A test variable and a statistical test can be constructed from the correlation coefficient. The null hypothesis to be tested is then that there is no linear (or monotonous) correlation (Du Prel, Röhrig, Hommel & Blettner, 2010).

The correlation shows that all the variables have a positive relationship with Conservation Agriculture practice, except for education. The results show positive relationships between gender and CA adoption ($r = 0.100$; $p = 0.032$), age ($r = 0.028$; $p = 0.087$), household income ($r = 0.061$; $p = 0.043$), credit access ($r = 0.063$; $p = 0.008$) and land tenure ($r = 0.340$; $p = 0.001$). The results however revealed a negative association between education level and CA adoption (r = -0.161; p = 0.014).

Table 4.13: Correlation Coefficients

	Gender	Age	Education Level	Household Income	Credit Access	Land Tenure	CA Practice
Gender	1						
Age	-.286	1					
Education	-.129	.286	1				
Household Income	-.074	.031	-.056	1			
Credit Access	.025	-.127	-.172	.274	1		
Land Tenure	.265	-.036	-.218	.080	.032	1	
CA Adoption	.100	.028	-.161	.061	.063	.340	1
Sig. (2-tailed)	.032	.087	.014	.043	.008	.001	.332

4.8.2 Regression Analysis

Regression analysis is a statistical tool for the investigation of relationships between variables. Regression analysis is useful to ascertain the causal effect of one variable upon another. The researcher undertook a multiple regression analysis to ascertain the influence of the independent variables on the dependent variable. Multiple regression is a technique that allows additional factors to enter the analysis separately so that the effect of each can be estimated. It is valuable for quantifying the impact of various simultaneous influences upon a single dependent variable.

Table 4.14 shows the model summary which shows that the independent variables explain 34.6 % variation in the dependent variable. Table 4.15 shows the ANOVA results. The Sig. column is important for interpretation and it shows that the p value is less than 0.05 which means that our model is statistically significant to explain the influence of our independent variables (Gender, Age, Education, Household Income, Credit Access, and Land Tenure) on Conservation Agriculture practice in Laikipia County.

Table 4.14: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.346(a)	.120	.048	.444

a Predictors: (Constant), (Constant), Age, Education, Gender, Household Income, Credit Access, Land Tenure

Table 4.15: ANOVA [(b)]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.965	6	.328	1.658	.044(a)
	Residual	14.422	73	.198		
	Total	16.388	79			

a Predictors: (Constant), Age, Education, Gender, Household Income, Credit Access, Land Tenure
b Dependent Variable: CA Adoption

Table 4.16 shows our coefficient results of the independent variables on the dependent variable. Therefore our proposed model: $Y=\alpha+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+\beta_5X_5+\beta_6X_6+\varepsilon i$ becomes;

$$\mathbf{Y=0.444+0.128X_1+0.050X_2+-0.333X_3+0.065X_4+0.243X_5+0.128X_6}$$

The regression results show that taking all factors into account (Gender, Age, Education, Household Income, Credit Access and Land Tenure) constant at zero, conservation agriculture adoption was 0.444. The findings also showed that taking all other independent variables at zero, a unit increase in gender led to a 0.050 increase in CA adoption; a unit increase in age led to a 0.128 increase in CA adoption; a unit increase in education level led to a -0.333 increase in CA adoption; a unit increase in land tenure system led to a 0.065 increase in CA adoption; a unit increase in household income leads to a 0.243 increase in CA adoption and a unit increase in credit access led to a 0.128 increase in CA adoption.

Table 4.16: Coefficients [(a)]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	.444	.323		1.376	.173
	Gender	.050	.122	.054	.410	.683
	Age	.128	.082	.186	1.557	.124
	Education	-.333	.183	-.208	-1.815	.074
	Household Income	.243	.085	-.017	-.149	.882
	Credit Access	.128	.147	.101	.868	.388
	Land Tenure	.065	.043	.188	1.507	.136

a Dependent Variable: CA Adoption

CHAPTER FIVE
SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of findings, discussion, conclusion and recommendations of the study based on the study findings. The summary of findings summarizes the findings of the study and the relationship of each indicators on the objectives of the study. The conclusion presents the conclusions made by the researcher in terms of the research objectives and recommendations of the study as per the research objectives.

5.2 Summary of Findings

The purpose of this study was to investigate factors influencing adoption of conservation agriculture by small holder farmers in Laikipia East Sub County, Laikipia County. The study was conducted in three wards of Mukogondo East, Tigithi and Umande. The study was guided by four specific objectives.

In terms of demographic information, majority were female (61.7 %) and 38.3 % were male. In terms of gender, there is no conclusive evidence of differences in Conservation Agriculture (CA) adoption between male and female headed households in Laikipia East Sub County. Different studies have shown different results in regard to influence of gender on CA practice. Mazvimavi et al. (2010) study results indicated that male-headed households take up conservation agriculture technology at a larger scale than female-headed households. The findings showed that male headed households have a larger conservation agriculture plot area than their female counterparts. In contrast, Chompolola and Kaonga (2016) hypothesised that female-headed households were expected to adopt technologies more easily than their male counterparts due to less labour demands of conservation farming. This is because most of the labour in farms is undertaken by women.

In terms of age, findings showed that 55.0 % were aged 46-60, 25.8 % were 31-45, 18.3 % were over 60 and 0.8 % were aged 18-30. There has been mixed findings on the effect of age on adoption of Conservation Agriculture (CA) in various countries. (Langyintuo & Mungoma, 2008; Mazvimavi & Twomlow, 2009). Conservation agriculture is a complex technology and researchers (Defrancesco et al., 2008) argued

that for successful adoption, CA should be targeted to young farmers. Mavunganidze et al. (2013) found that the farmer's decision to adopt components of CA was conditioned by age. Young farmers have been found to be more innovative and less risk averse than older farmers and are more likely to adopt CA. Fujie (2015) found that age has a negative and significant effect on the likelihood of adopting CA.

In terms of education level, 45.8 % of the respondents have a secondary school level of education, 40.0 % have gone up to primary level, 7.5 % have a college/university education, 4.2 % never went to school and 2.5 % have gone to a polytechnic. Various studies have shown the significance of higher education levels towards CA adoption. For instance, Teklewold and Köhlin (2011) found that increased access to formal education and extension services enhance farmers' understanding and technical capability for CA practices. Mavunganidze et al. (2013) concluded that CA adoption is positively influenced by farmer's formal education.

In regards to land size, majority had 2-5 acres land size and accounted for 62.5 %, 20.0 % had 0.5-1 acre, 8.2 % had 5-10 acres, 5.8 % had below 0.5 acreage and 3.5 % had over 10 acres. Fifty percent used 0.5-1 acres for farming, 41.7 % used 2-5 acres, 5.0 % used 5-10 acres for farming and those who used more than 10 acres accounted for 3.5 %. 67% had purchased their land, 25.0 % had inherited, 4.2 % had communal land, 3.3 % had leased their land and 0.8 % had hired their land.

Major source of income was from farming (86.6 %), Business/Farming (6.7 %), Employment/Farming (3.3 %), Employment (2.5 %) and Business (0.8 %). Eighty six percent earned less than 10,000 Kshs, 9.2 % earned 10,001-40,000 Kshs, 3.3 % earned 40,001-100,000 Kshs and 1.7 % earned more than 100,000 Kshs. In regard to access to credit, the findings showed that 88.4 % had no access compared to 11.6 % who had access. 4.2% source of credit was from *M-Shwari* and SACCOs, 2.5 % got their credit from banks and *Gumbato*, other sources of credit were Merry Go Round, Table Banking and Women Group and accounted for 0.8 % respectively. Purpose of credit included buying seeds and agrochemicals (10.8 %), buying machinery (2.5 %) and school fees (0.8 %).

5.3 Discussions of Findings

A discussion of findings of the study is presented based on the four objectives of the study.

5.3.1 Demographic Factors Influences Adoption of Conservation Agriculture

The results revealed that among the demographic factors affecting CA adoption, age was the most prominent. Mlenga and Maseko (2015) found that age of the household head did not influence the adoption decision, though there was a positive relationship with the adoption CA status of the households. The study confirmed that education level had no influence on farmers' decision to adopt CA practices. This finding disagree with Mangisoni et al., (2011) who asserted that choice of CA components is positively influenced by farmer's formal education level. This finding can be attributed to the fact that most CA adoption undertaken by smallholder farmers has been influenced by NGOs and extension services that provide training to farmers in order to adopt CA practices in their farms. Farmer training and extension services was the mediating variable in this study as the selected farmers' who participated in the study were assumed to have undergone CA practices' training.

5.3.2 Land Tenure System Influences Adoption of Conservation Agriculture

The study found that land tenure was a factor that influenced adoption of conservation agriculture. This finding supports earlier studies that have found similar relationships between land tenure system and CA practice. Ngendo et al., (2013) found that farmers are not likely to invest on a land which long term access is not secured. The hired land especially when it is rented for 2-3 years can be a constraining factor for adoption of CA practices, because the land owner might need the land back when the soil fertility has distinctly improved and crop production has increased. Kassie et al. (2012) noted that farmers who own their land will have a higher probability of adopting conservation agriculture practices in the long term as opposed to those that hire/lease land. The findings of the study showed that majority of the farmers owned their land through purchase and also through inheritance. A small number of farmers indicated that they were renting/leasing the land. According to past research (Parks et al., 2015), short-term land management arrangements such as renting or mortgaging could be a constraint since there are limited benefits in the first 4 years of adoption and farmers want to maximize their profits during their tenancy. In the beginning, CA increases weeds and requires increased inputs, while not necessarily increasing yields. Farmers

who are renting a plot of land say for 5 years may be hesitant to adopt CA because they are more concerned about production and short-term profits than increasing the quality of a soil that is only temporarily for their use. This means that the farmers in Laikipia County are more likely to adopt conservation agriculture with efficient support**.**

5.3.3 Household Income Influences Adoption of Conservation Agriculture

The results showed that the household income had the most influence on CA adoption. The findings revealed that majority of the farmers were earning less than Kshs 10,000 per month. Chiputwa et al. (2011) found that there is an inverse relationship between level of disposable income and adoption of CA, implying that households with higher disposable income are less likely to adopt and intensify the use of zero-tillage than those with lower income. This means that farmers sampled in this study were more likely to adopt CA. Moreover, the study found that the major source of income among sampled farmers in Laikipia County was farming. In Malawi, Nyambose and Jumber (2013) found that families with high reliance on agricultural production as source of income to be more willing to adopt CA. This means that the study participants were more likely to adopt CA in order to increase their earnings from farming activities. Ng'ombe (2014) explained that off-farm incomes reduce the odds of adopting CA among smallholder farmers, holding other things constant. A more plausible explanation would be that households' major sources of income are off-farm activities and that these households would less likely invest in agricultural technologies. The study findings support Ng'ombe as majority of the households income was from farming activities.

5.3.4 Access to Credit Influences Adoption of Conservation Agriculture

Studies (Bhan & Behera 2014; Kassie et al., 2012; Yan et al., 2009; Yirga 2007) have revealed that access to credit is an important factor in acquiring basic inputs required for adoption of conservation farming. This fact was supported by earlier findings by Kaumbutho and Kienzle (2007), which showed that majority of the farmers sampled in the study were earning less than 10,000 Kshs from their farms. Mlenga and Maseko (2015) study on factors influencing adoption of conservation agriculture in Swaziland showed that 92.3 % non-adopters did not have access to credit for agricultural production. This means that all production inputs were derived from internal

household income. Therefore, lack of access to cash or credit may constrain farmers from using technologies that require initial investments.

5.4 Conclusion

The study sought to determine the influence of demographic factors which influenced CA adoption in Laikipia East Sub County. The demographic characteristics under investigation were age, gender and education level. The research findings showed that among these characteristics, farmers' age had the most influence on CA adoption. The study confirmed that education level did not have any influence on CA adoption. The researcher therefore concluded that age was the most determining demographic factor influencing CA adoption.

The study sought to determine the influence of land tenure system on CA adoption in Laikipia East Sub County. The study found that land tenure system has an influence on CA adoption. The study measured the influence of land tenure system by using land ownership differences. The study compared whether farmers owned their land or otherwise. Past studies suggested that farm ownership has a significant influence on CA adoption. Majority of the respondents in the study owned their land which suggests that they are more likely to adopt CA practices. The study therefore concludes that land tenure system affects farmers' decision for CA adoption.

The study sought to establish the influence of household income on CA adoption in Laikipia East Sub County. The study found that household income had the greatest effect on farmers' decision to adopt CA practices. The study further found that majority of the study participants' major source of income was from farming and most of the respondents earned less than 10,000 Kshs monthly from farming. The study therefore concludes that household income is a major determinant to adopt CA. This is attributed to the cost of Conservation Agriculture practices to smallholder farmers.

The study sought to establish the influence of access to credit on CA adoption in Laikipia East Sub County. The study findings found that access to credit had an influence on CA adoption among farmers. Access to credit is related to household income where majority of the farmers earned less than 10,000 Kshs in monthly income. Farmers need access to credit to purchase inputs, hire labour and maintain

CA practices in their farms. The study therefore concludes that lack of access to credit limits CA adoption among small holder farmers in Laikipia East Sub County.

5.5 Recommendations

Based on the study findings, the study makes the following recommendations;

i. The study found that age difference influences Conservation Agriculture adoption. The researcher therefore recommends that extension and training on CA practices should be targeted towards older farmers as majority of the farmers were above 40 years of age.

ii. The study found that majority of the farmers owned their farming land. The researcher therefore recommends for further training and extension support for CA adoption to be targeted towards farmers who own their own land. This was either through purchase or inheritance.

iii. The study found that household income has the greatest influence on CA adoption. The study therefore recommends more opportunities for access to credit to enhance CA adoption among households. This could be achieved by arrangements through NGOs, County Governments and National Government financial assistance to farmers willing to adopt CA practices.

iv. There is need to follow up on the trainings provided by the NGOs and extension services to establish whether farmers understand what they were taught.

5.6 Suggested Areas for Further Studies

The study was conducted among smallholder farmers in Laikipia East Sub-County. The researcher suggests further research in all the 47 counties. This way there will be good comparison and a way forward for food and nutrition security through conservation agriculture farming. The study was conducted only among farmers targeted by Conservation Agriculture for Food Security (CA4FS) project. The researcher suggests for further study on other conservation agriculture projects and effects and impacts of CA adoption among CA adopters in all the 47 counties.

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APPENDICES

APPENDIX 1: LETTER FOR TRANSMITTAL TO THE RESPONDENTS

School of Continuing and Distance Learning,
Department of Extra Mural Studies,
University of Nairobi,
Main Campus,
P. O. Box 13495-00100,
Nairobi.

Dear Participant,

RE: PARTICIPATION IN THE STUDY

I am a Master's of Arts Degree in Project Planning and Management student in the University of Nairobi, School of Continuing and Distance Learning, Department of Extra Mural Studies. I am conducting a research study on a topic entitled "Factors influencing adoption of conservation agriculture by small holder farmers in Laikipia East sub county, Laikipia County". The study is targeting small holder farmers in Mukogondo East, Tigithi and Umande Wards. You have been selected to assist in providing the required information and please note that your views are considered very important to this study.

I am kindly requesting you to fully participate in the study and your responses to the various questions in the questionnaire will be treated confidential and will not be used for any other purpose except for the intended use. I sincerely appreciate your cooperation. Thank you.

Yours Faithfully,

Esther Njeru
L50/61884/2013

APPENDIX II : RESEARCH QUESTIONNAIRE FOR HOUSEHOLDS

Guidelines:

i. The purpose of this questionnaire is to obtain information on "factors influencing adoption of conservation agriculture" in Laikipia East Sub County only.

ii. Please fill all the relevant boxes and blank spaces.

iii. The information collected will be used solely for research as intended for this study and will remain confidential.

General Information

i. Respondent Number.....

ii. Ward.....

iii. Village.....

Section I: Demographic Data

1. Please tick your Gender:

(a) Male ( )

(b) Female ( )

2. Please tick your age bracket from the choices below.

a) 16- 30 years ( )

b) 31-45 years ( )

d) 46-60 years ( )

e) Over 60 Years ( )

3. Kindly indicate your highest level of education attained.

(a) College/University education ( )

(b) Secondary education ( )

(c) Polytechnic ( )

(d) Primary education ( )

(e) Never went to school ( )

Section II: Land Tenure System

4. Please tick the total size of your land.

a) Below 0.5 acre ( )

b) 0.5-1 acre ( )

c) 2-5 acres ( )

d) 5-10 acres ( )

e) Over 10 acres ( )

5. What portion of this land do you farm?

a) 0.5-1 acre ( )

b) 2-5 acres ( )

c) 5-10 acres ( )

d) Over 10 acres ( )

6. How did you acquire the land that you have?

a) Purchased ( )

b) Communal land ( )

c) Leased/Hired ( )

d) Inherited ( )

7. For how long have you been farming on this land?

a) 1-3 years ( )

b) 4-7 years ( )

c) 7-10 years ( )

d) Over 10 years ( )

Section III: Household Income

8. Please tick the family's major source of income.

(a) Employment ( )

(b) Farming ( )

c) Business ( )

d) Emloyment/Farming ( )

e) Business/ Farming ( )

9. What is the estimated family income per month from the farm in Kshs?

(a) Less than 10,000 ( )

(b) 10,001-40,000 ( )

(c) 40,001-100,000 ( )

(d) More than 100,000 ( )

10. What do you do with the monthly income above?

a) Purchase food ( )

b) Purchase farm inputs and tools ( )

c) Pay school fees ( )

d) Use for development purposes ( )

Section IV: Access to Credit

11. Do you have any access to credit to finance your CA farming business?

a) Yes ( ) (b) No ( )

12. If ‘yes’ where did you access credit from?

a) Bank ( ) (b) Sacco ( ) (c) Cooperative society ( ) (d) Others/specify ……

13. What was the purpose of the credit acquired?

a) To buy seeds and fertilizers ( )

b) To buy agrochemicals ( )

c) To buy farm machinery ( )

d) To lease more farming land ( )

e) Others/specify……

Section V: Adoption of Conservation Agriculture (CA)

14. Are you aware of Conservation Agriculture (CA)?

a) Yes ( )

(b) No ( )

15. If ‘Yes’ do you practice it? (a) Yes ( ) (b) No ( )

16) Where do you practice your Conservation Agriculture knowledge?

a) At your farm …….

b) Other peoples’ farm…….

17. For how long have you practiced CA?

a) 1-3 years ( )

b) 3-6 years ( )

c) 7-10 years ( )

d) Over 10 years ( )

18. Do you belong to any CA farmer group? a) Yes ( ) b) No ( )

APPENDIX III: QUESTIONNAIRE FOR FOCUS GROUP DISCUSSION (CA FARMER GROUP)

1. When was this group formed? ….. ……

2. How many members formed the group? .....

3. What is the total no of farmers in the group at the moment? ……

4. Do all the members know about CA farming?

a) Yes ( ) b) No ( )

5. If 'No' what is the reason?

i. ……

ii ……

6. What are the groups' activities with regards to CA?

a). …….

b) ……..……

c) ……..

7. Are there any difficulties or problems facing you as a group?

a) ……..

b) ……..…….

c) ……..

8. Do you think CA is suitable for you as a group?

a) Yes ( ) b) No ( )

9. Have you ever been trained on CA as a group by an extension officer/s either from government, Donors or other companies (If more than one, please tick both)

a) Government (a) Yes ( ) (b) No ( )

b) ACT/Donor (a) Yes ( ) (b) No ( )

c) Other companies/Specify (a) Yes ( ) (b) No ( )……...

10. How often does extension officer pay a visit to the groups' farm?

(a) Once a week ( )

b) Twice a week ( )

(b) Once a month ( )

(c) Twice a month ( )

11. Does the extension services help you in understanding CA better?

(a) Yes ( ) (b) No ( )

12. What are the major problems hindering the implementation of CA as a team?

a) …….

b) …….

c) …….

13. What do you think could be the solutions to the above problems?

i. . ……

ii ……..

iii …….

THANK YOU FOR YOUR TIME.

APPENDIX IV: CHECKLIST FOR KEY INFORMANTS (**STAKEHOLDERS/PARTNERS**)

Please indicate your position and Office below:

……

1. For how long have you held this position? …….....

2. In your own opinion does the village/ward know about Conservation Agriculture?

(a) Satisfactorily ( ) (b) Not Satisfactorily ( )

3. If not satisfactorily, what do you think could be the problem?

a) ……

b) …….

c) ……..

4. What do you advise can be done about these problems?

a) ……..

b) …….

c) ……..

5. In your position what can you influence in order to assist in adoption and implementation of CA in the county and in the country at large?

a) ……..

b) …….

c) ……..

THANK YOU FOR YOUR TIME.

APPENDIX V: RESEARCH PERMIT

THIS IS TO CERTIFY THAT:
MS. ESTHER KAWIRA NJERU
of THE UNIVERSITY OF NAIROBI,
25355-100 Nairobi,has been permitted
to conduct research in *Laikipia County*

on the topic: *FACTORS INFLUENCING ADOPTION OF CONSERVATION AGRICULTURE BY SMALL HOLDER FARMERS IN LAIKIPIA COUNTY*

for the period ending:
8th November,2017

.....
Applicant's Signature

Permit No : NACOSTI/P/16/68702/14425
Date Of Issue : 9th November,2016
Fee Recieved :Ksh 1000

.....
Director General
National Commission for Science, Technology & Innovation

CONDITIONS

1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit.
2. Government Officer will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2) hard copies and one (1) soft copy of your final report.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice

REPUBLIC OF KENYA

National Commission for Science, Technology and Innovation

RESEACH CLEARANCE PERMIT

Serial No.A 11731

CONDITIONS: see back page