ASSESSMENT OF THE FACTORS AFFECTING FARMERS' INVOLVEMENT IN ENVIRONMENTAL CONSERVATION IN GATUNDU NORTH SUB-COUNTY, KIAMBU COUNTY.

BY

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DECLARATION

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This project paper is my original work and has not been presented in any other university.

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DEDICATION

I dedicate my dissertation work to my family and many friends. I wish to pay a special gratitude to my loving parents, whose words of encouragement and push for tenacity keep ringing in my ears. To my late sister Damaris, I know you'd have been proud of me today, keep resting with the Angels.

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LIST OF ACRONYMS

CBO	Community Based Organization
CDC/DDC	County/District Development Committee
EIA	Environment Impact Assessment
FAO	Food Agricultural Organization
GoK	Government of Kenya
KARI	Kenya Agricultural Research Institute
KWS	Kenya Wildlife Service
OECD	Organization for Economic Cooperation and Development
SPSS	Statistical Package for Social Sciences
UNEP	United Nations Environmental Programme
USAID	United States Agency for International Development
WCED	World Commission on Environment and Development

ABSTRACT

Farming, being an agricultural activity that utilizes water, soil, and air, can expose the environment to destruction. Farmers can therefore embrace practices that effectively conserve the environment. This study was aimed at establishing factors that affect farmers' involvement in environmental conservation in Gatundu North Sub County. A number of variables were analyzed during the study including: knowledge and awareness level; access to information; community participation; utilization of technology; socioeconomic and political factors. The study adopted a descriptive cross sectional design. Stratified random sampling was employed to select a sample population of 384 farmers drawn from 4 wards of Gatundu North (strata), namely-Mang'u, Chania, Githobokoni, and Gituamba. Data was collected by administration of semi-structured questionnaires to the sample population. All data was recorded in Microsoft Excel sheets and analyzed using the Statistical Package for the Social Sciences (SPSS).The following statistical techniques were applied: regression, standard deviation, mean, sample size determination and hypothesis testing.

The study findings indicate that 53% of the farmers were aware of environmental conservation. The findings also indicated that technology had significant effect on the involvement of farmers in environmental conservation($p=0.0002$).Empirical results from a multiple regression model revealed that gender, marital status, level of education, training, extension services and land ownership are significant predictors of involvement in environmental conservation. Correlation between farmers' perception and adoption of agro-environmental conservation practices are; p-value=0.043 and r-value=0.277. Technology and involvement in Environmental Conservation ranged between 0.000-1.000 in the correlation analysis. This study thus recommends that conservation practices of natural resources would be most effective when understood by individual farmers, so that analysis of farmers' attitude would have paramount importance, not only in controlling potential conflicts but also in examining policy efficiencies.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Community conservation initiatives play very important role in environmental conservation, especially with the increased effects of climate change taking place globally. Environmental conservation involves protection of soil, water, land and air. It can thus be defined as the process of ensuring sustainable use of natural resources by adopting practices that reduce deforestation, soil erosion, water pollution, and loss of biodiversity (Rezvanfar *et al.*, 2009). Local communities define environment conservation broadly as an arrangement involving managing and caring for natural resources. It covers three main areas, which are wildlife, forestry and marine management. Environmental conservation acts and practices are done to protect our environment. Similarly, environmental protection is a practice of safeguarding the natural environment on individual, organizational, or governmental levels, for the benefit of both the natural environment and humans (Dercon *et al*., 2008).

According to the World Commission on Environment and Development (WECD), the following three elements should be sustained: nature, life support systems and *community*. Broadly defined, nature comprises of the earth, biodiversity and ecosystems that need to be taken care of; life support systems comprise of ecosystem services, resources and the environment that need to be maintained; while, community comprises of cultures, groups and places that need to be preserved. Some of the support systems the community is actively involved in are agriculture. There are varied options of agricultural conservation that can be utilized at a local community level. They include practices such as agro-forestry, fodder cropping, use of cover crops and mulching, a practice also known as conservation agriculture. Agricultural

practices such as crop and livestock farming have a great bearing on the state of the environment, including forests, climate, soil, and water, among others (Silici *et al.*, 2011).

In other literature, Muneer (2008) states that the adoption of conservation practices such as agro-forestry is dependent on factors such as level of formal education, access to extension agents, level of environmental awareness, total area of owned land and extent of social participation. Given the importance of environmental conservation and the role local communities can play in enhancing conservation of the environment, this study explored how different factors affect the sustainability of community conservation initiatives.

There is need to educate farmers on the importance of environmental conservation to achieve sustainable conservation projects (Silici *et al.*, 2011). According to Rosalino *et al.,* (2012), access to information shapes and directs one's attitude towards environmental conservation. It also improves level of awareness and hence adoption of conservation practices. Mechtenberg (2008) advocates for the need to educate community members on land management techniques which includes environmental conservation measures.

Lack of participation and knowledge on conservation activities, especially in relation to agricultural activities, has predisposed the environment of Gatundu North to issues like deforestation, poor water quality and reduced rainfall. The utilization of new farming practices such as crop rotation, mulching, agro-forestry together with disease control and mechanization of farming has an effect on socioeconomic development as

well as in environmental conservation. It is important to encourage farmers to adopt new technology since it not only increases productivity, but also helps in promoting the adoption of important environmental conservation practices by the community (UNEP 2003).

1.2 Statement of the Research Problem

Human activities are by far the leading cause of environmental degradation across the world. The environment in most parts of Kenya has been degraded by intensive and unregulated agricultural practices, which is the mainstay of the economy. A case in point is Gatundu North Sub County and its immediate surroundings, an agricultural zone in Kenya where the environment has been degraded by farming practices. There has been increased level of environmental degradation in the Aberdare forest lands through indiscriminate agricultural activities. Besides lack of participation and knowledge on conservation activities, especially during agricultural activities, have predisposed the Gatundu North environment to issues like deforestation, poor water quality as a result of reduced rainfall.

The intensification of agriculture in and around Gatundu North has resulted in major environmental problems in recent decades, such as declines in bird populations together with their associated food resources, especially in the surrounding forestland and Game Park (Virani *et al.,* 2011). There are also implications for wider environmental issues, such as floods risk and effects on water quality that would affect rivers and springs originating in the Aberdare highlands, which cover some part of Gatundu North.

Attempt have been made to address environmental conservation in Gatundu North through promotion of environmental conservation activities, with these attempts there has been increased focus to understand reasons that explains farmers adoption of environmental conservation. A number of studies have been carried out in Kenya to understand factors that explain participation in environmental conservation in Kenya. These include: Macharia (2015) study on establishing the factors that influence community participation in forestry projects in Meru County, Kenya; Njeru (2016) study on investigating factors influencing adoption of Conservation Agriculture by small holder farmers in Laikipia East sub County. From these studies it is evident that a number of factors influence farmer's decision to participate in environmental conservation in Kenya. However, conclusions on how different factors affect decision to participate in environmental conservation are still contradictory and inconclusive in Kenya. Thus the need for more region specific studies to analyze factors influencing participation in environmental conservation. This study will thus be carried out to analyze the factors influencing farmer participation in environmental conservation in Gatundu North.

1.3 Research Questions

i. What is the farmer's knowledge and awareness level on land management and conservation practices in Gatundu North?
ii. What are the socioeconomic factors that influence farmers' participation in environmental conservation initiatives in Gatundu North?
iii. What is the attitude and perception of Gatundu North farmers towards environmental conservation initiatives?

iv. To what extent does uptake of new farming technology affect community conservation initiatives in Gatundu North?

1.4 Objectives of the Study

1.4.1Broad Objective

To assess factors affecting farmers' involvement in environmental conservation measures in Gatundu North Sub County.

1.4.2Specific Objectives

i. To assess the farmer's knowledge and awareness level on land management and conservation practices in Gatundu North.

ii. To establish the socio-economic factors that influence farmers' participation in environmental conservation initiatives in Gatundu North.

iii. To assess the attitude and perception of Gatundu North farmers towards environmental conservation initiatives

iv. To assess how new farming technology affects farmers' environment conservation measures in Gatundu North.

1.4 Hypotheses

H_0: There is no relationship between landholder awareness and adoption of environmental conservation practices

H_1: There is relationship between landholder awareness and adoption of environmental conservation practices.

H_0: There is no relationship between economic factors and adoption of environmental conservation practices

H_2: There is a relationship between economic factors and adoption of environmental conservation practices.

1.6 Justification of the Study

The adoption of conservation practices such as agro-forestry is dependent on factors such as level of formal education, access to extension agents, level of environmental awareness, and total area of owned land and extent of social participation. Given the importance of environmental conservation and the role local communities can play in enhancing conservation of the environment, this study was aimed at exploring how different factors affect the sustainability of community conservation initiatives. The study recognized that it was also important to analyze various factors that affect involvement of Gatundu North farmers in conservation initiatives.

Farmers should be educated on the importance of environmental conservation to achieve sustainable conservation projects (Silici*et al.,* 2011). Utilization of new farming practices such as crop rotation, mulching, agro-forestry together with disease control and mechanization of farming has an effect on socioeconomic development as well as in environmental conservation. Furthermore, forestlands located in communities with dense population densities usually suffer from deforestation effects (Porter-Bolland, 2011). Thus, there is need to conduct an inquiry into the environmental conservation initiatives adopted by farmers in Gatundu.

The success of Community conservation is dependent on the success of individual conservation efforts within the community. Various attempts have been made by different stakeholders in Gatundu North to improve environmental conservation

initiatives. Individual conservation initiatives are affected by a number of personal factors as well as communal factors. However, inconclusive findings still exists on factors affecting individual conservation activities as well as communal conservation activities. Therefore, there is need to examine environmental conservation mechanisms adoption among farmers and factors affecting the adoption of such practices in the study area as there is no such study that wholly focusses on individual conservation practices.

1.7 Significance of the Study

The findings and recommendations drawn from this study might inform the researcher on design and implementation of community conservation initiatives. Secondly, the study sought to identify barriers to success of the community conservation projects, that would help the local communities, District/County Development Committee (DDC/CDC), and other stakeholders successfully plan and implement projects that meet the needs of the community. The findings of this study will enable the local community to identify their development needs and share the same with both the government and the other conservation agencies such as Ministry of Environment, UNEP, and Green-Belt Movement. The findings will also contribute to the body of knowledge on community conservation initiatives, which can be used not only by future researchers but also by development partners in environmental conservation.

1.8 Scope of the Study

This study focused on the conservation initiatives among farmers in Gatundu North. Gatundu North was selected as a case study because of increased environmental

degradation that has been going in Gatundu North, coupled with several conservation initiatives ongoing(KFS, 2015).

1.9 Limitation of the study

Some of the respondents due to low literacy were unable to give the needed information and this forced the researcher to include the services of research assistant to translate the question to respondents with low literacy.

Moreover, lack of an up to date sampling frame and actual population of Gatundu North affected sample size calculation. How to correct this sample size correction factor was applied in the final sample size to address problems of under sampling. The other challenge encountered was the unwillingness by some farmers to provide information. To address this, the researcher explained to the farmer the ethic governing the study to calm their fears and build their confidence in the study.

1.10 Operational Definitions

Community: A group of people that share a common territory, a set of common resources, and a common culture, that interacts frequently, and that considers them as part of a social group.

Community initiatives: These are ventures that are undertaken within a social set up either by the people themselves or in collaboration with external development partners. In this case study, community initiatives refer to conservation practices within Gatundu North.

Sustainability: The continuation of benefits realized from a development intervention after major development assistance has been completed.

Community conservation: An arrangement involving managing and sharing of natural resources like wildlife, forestry and marine management.

Technology: Various techniques, skills, methods and processes used in production of goods and services, or in accomplishment of objectives.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Environmental conservation involves practices that are geared towards protecting our environment. Similarly, environmental protection is a practice of caring for the natural environment at individual, organizational, or governmental levels, for the benefit of both the natural environment and humans. Dercon *et al.,* (2008) argue that due to the pressures of population and technology, the biophysical environment is degraded, sometimes permanently.

The World Commission on Environment and Development [WCED] (1987) views sustainable development as the ability to make development continued by ensuring that it meets the needs of the present generations without compromising the ability of future generations to meet their own needs. WCED (1987) also indicates that there are three key elements that need proper sustainability strategies. In totality, they include nature, life support systems, and community. Under nature there is earth, biodiversity and ecosystems that need to be taken care of; under life support systems there is ecosystem services, resources and environment that need to be maintained and under the community there is culture, groups and places that to needs to be preserved.

Sustainability takes different meaning depending on the level in which it is being discussed. For example, at the grass-root level it may mean that the community projects would remain viable and stable, while among project participants it may be understood as the continuation of production gains and increased income streams from donor support. At the central or local government level, it is possible that sustainability would be taken to mean sustained funding and government takeover of

the services provided by donors, as well as a continued flow of capital and credit into rural areas (IFAD, 2009).

2.2 Farmer's Knowledge and Awareness Level on Land Management and Conservation Practices

According to Vignola *et al.,* (2010), community conservation initiatives are likely to be adopted if the communities are made aware of their role in this project. Community awareness is dependent on decision-making ability of the community. Decision-making can only be improved once farmers are made aware through education and provision of relevant information.

Silici *et al.,* (2011) in their study on advantages of conservation agriculture in Lesotho also known as *'Likoti'* realized that when farmers possess greater awareness about the long-term environmental and social benefits of conservation agriculture they are likely to accept such practices. They recommend that more efforts be directed in educating farmers on the importance of environmental conservation to achieve sustainable conservation projects. While evaluating the knowledge and attitudes of a suburban junior high school population towards nature conservation in Portugal, it was concluded that access to information is an important factor in shaping urban students' attitudes towards nature conservation. Therefore, more effort should be directed at providing information through Media such as internet to increase awareness on environment conservation (Rosalino and Rosalino2012).

A study made by Defrancesco *et al.,*(2008) on the determinants of adoption of environmental practices by farmers in Selale, central high land of Ethiopia. The study

found that factors such as farm size, land tenure, total cultivated land, wealth condition of farmers, technology characteristics and education. Bekele and Holden (1999) also indicated one of the multiple challenges that the poor countries with rapid populations growth are facing is the deterioration of food production potential of agricultural land. Small holders' production and land conservation decision are likely to be influenced by factors related to their dual natures as units of consumption and production.

Paulos *et al.,* (2004), in a study on determinants of adoption to environmental conservation practices. The results showed that farmers' motivation to adopt environmental conservation practices is influenced positively by education level of household head, technology, farm size and extension facilities. From the same study it was concluded that land tenure, and household size negatively affecting conservation decision of farmers. Moreover, Tesfaye (2003) indicated, the perception of farmers on soil erosion and measures to be taken to combat it is highly related to 18 the slope of the land. This indicated that slope is determining factor to land management decision. According to Senait (2005), determinants of choice of land management found to be land size, agricultural labor availability, and contact with extension agents, land ownership type, and slope of the plot. She also discovered that ensuring more tenure security of land ownership encourage manure use and construction of conservation structures because both activities require high initial investments and long time for the benefit to be realized.

Vignola *et al.*, (2010) carried out a study in Turbo division in Kenya. The study sought to understand the perception of farmers on involvement in agro-forest

programmes. From the findings it emerged that farmer's participation is low and this was attributed to the low level of awareness in turbo. As much as a number of organization are involved in creating awareness on environmental conservation, it was evident from the findings that perception of farmers concerning environmental conservation varies. This study is crucial in providing understanding on farmer's perception in Kenya but fail to provide understanding on farmer's perception in highlands, Gatundu North a case example.

Mahboubi*et al.,* (2005) while assessing factors affecting the adoption behavior regarding soil conservation technologies in Iran, realized that awareness on part of the farmers is a critical determinant of whether farmers will adopt soil conservation technology or not. Rezvanfar *et al.,* (2009) also argue that without knowledge of the practices associated with conservation agriculture via some information or communication channels, adoption is improbable. Therefore, they suggest that provision of required information via various information sources and communication channels; in order to raise farmers awareness is necessary to motivate farmers to adopt conservation practices.

Education and awareness on the dangers of harmful effects of poor farming practices can make farmers adopt sustainable farming practices. Vignola *et al.,* (2010) in analyzing risk perception on causes and effects of soil erosion among Costa Rican farmers affect soil conservation efforts concluded that educated farmers showed awareness of the importance of implementing soil conservation practices as compared to farmers with low education. USAID (2000) also add that education and awareness are important components in community-based conservation. They argue that

education influences the speed at which participants can attain sufficient skills to manage their natural resources as a Community Based Conservation (CBC) program. Increasing education level of the community will empower the community to be much more aware on the need to adopt conservation practices.

Mechtenberg (2008) also adds that local wildlife organizations such as the Kenya Wildlife Societies need to conduct community-based workshops to educate local people on management techniques of protected areas, as this will enable the local community acquire valuable information would help minimize human-wildlife conflict. Conservation agriculture is a concept that has continued to increase among farmers in African countries for example in Zimbabwe, Marongwe *et al.,* (2011) attributes sustained uptake of conservation agriculture to the fact that farmers have access to information. They suggest that increasing farmer's awareness through the use of user-friendly extension materials and training will go a long way in enabling more farmers to adopt conservation initiatives.

2.3 Socioeconomic Factors That Influence Farmers' Participation in Environmental Conservation Initiatives

A number of factors determine individual and community environmental conservation in given communities. From economic perspective, the adoption of environmental conservation practices is determined by several factors that are categorized into: personal income, economic benefits, and community benefits. On the social side a number of factors have been established to determine environmental conservation. These include institutional, socioeconomic, sociocultural (Agrawal and Chatre 2006), Perceptions and beliefs as well as community organization.

Personal characteristics have also been proved to be significant determinants to environmental conservation among farmers. In particular education of farmer, age and gender have been found to have significant effect on farmer's participation in conservation activities. In another study by Kasarani (2014) females were found to participate in environmental activities more than men. In some cases, it may have exacerbated opposition to reforestation. Furthermore, the Njeru (2016) concludes that income, gender, educational level and age are significant in explaining the variation in levels of farmer's participation. In a study in Kenya by Macharia (2016) it was found that the financial incentives play a key role in determining the participation of farmers in agro-conservation activities.

Economic factors have an impact on attitude towards adoption of conservation in different communities. The attitude of conservation especially among farmers is likely to be high in situation where they perceive additional benefits from such initiatives. Equally, income level determines whether a farmer will adopt conservation practices or not. This can be attributed to costs associated with such practices such as purchasing of tree seedlings for agro-forestry farming (Muneer, 2008; Heinen and Shrivastava, 2009). On the other hand, economic benefits derived from conservation may make farmers to have positive attitudes and therefore more willing to adopt conservation practices. Bellow *et al.*, (2008) while assessing the potential for adoption of fruit-tree-based agro-forestry by smallholder farmers in Guatemala, realized that farmers' attitudes towards adoption of agro-forestry changed positively when they realized that the practice of agro-forestry would bring them additional cash from their limited land holdings. Sustainability of community development projects is affected by economic factor.

Muneer (2008) suggests that farms of smaller acreage and greater crop diversity might be encouraged if more sustainable practices are to be successfully adopted. In support of this Heinen and Shrivastava, (2009) conducted a study on factors influencing the participation of farmers in environmental conservation. The findings of the study indicated that small holder farmers who believe they are more likely to benefit from environmental practices are more likely to adopt them. Further the findings indicated that the likelihood of increased benefits increased the likelihood of farmers taking risk to get involved in environmental conservation. However, the study showed that increased in farm size further increased the likelihood of farmers taking risk and getting involved in environmental conservation. Thus it can be concluded that farmer benefits and farm size are key contributors to farmer's involvement in sustainable agriculture.

2.4 Attitude and Perception of Farmers towards Environmental Conservation Initiatives

Attitude shapes the way people perceive things in different situations, negative or positive attitude has an effect on adoption of conservation practices among farmers in different communities worldwide. According to Kideghesho and Kaltenborn (2007) community attitudes on environmental conservation is shaped by the socio-political and economic context in a community. This in turns shapes the history of farmers towards farmer practices and environmental practices. In a study by Muneer (2008) which sought to establish the perception towards environmental practices targeted towards desertification in Sudan. From the findings of the study, it emerged that the perception of farmers towards environmental conservation was shaped by expected

benefits, which arises out of climate control. Thus the study concluded that perception towards desertification led to farmers adopting agro-forestry practices in Sudan.

In another study carried out to assess the effects of environmental factors on perception of farmers towards environmental practices. From the study it was evident that history of conflict between the humans and wild life affects the attitude of farmers towards environmental conservation in areas close to wildlife parks or game reserves. Heinenand Shrivastava (2009) while analyzing conservation attitudes and awareness around Kaziranga National Park in India concluded that wildlife-human conflict affects the attitudes of residents on environmental conservation. Although these studies are central to understanding perception of farmers towards environmental conservation, they fail to establish perception of farmers in areas far off wildlife reserves and hence the need for more studies.

According to a study carried out in Ethiopia by Kacho (2014) to determine the perception of farmers on environmental conservation in rural Ethiopia. The study established that farmers have a negative attitude towards conservation. The study supports the existing evidence on the importance of ascertaining the perception of farmers on environmental conservation. However, the study fails short of providing complete understanding on the perception of farmers in both rural, urban and peri-urban areas. This is key considering that Gatundu north, the study site is a peri-urban areas and hence the perception of farmers thereof may not be the same with farmers in the rural areas. According to Kasarani (2014). Farmers perception in rural, urban and perci-urban areas are affected by culture that differs based on geographic location. Such deep-rooted traditionalism as observed in the study is a serious hindrance to

sustainable development and environmental conservation (Koyenikan, 2008). A similar finding is also reported in Kenya's Laikipia District, in which peasants perceived many aspects of wildlife conservation negatively due to costs inflicted by crop raiders and dangerous wild animals (Gadd, 2005).

Attitude towards conservation is dependent on the perceived benefits that the farmers are likely to obtain from adoption of conservation practices. Kideghesho, Roskaft, and Kaltenborn (2007) suggested that support to conservation is often compromised in situations where people's interests and livelihoods are threatened. Therefore, there is a need to provide tangible benefits from conservation as a means of motivating local people to change their attitudes, support conservation efforts, and align their behaviors with conservation goals (Gadd, 2005; Kideghesho and Kaltenborn, 2007). Farmers' attitude to a larger extent is dependent on awareness and education, Studies show that farmers who have greater awareness on the economic benefits of environmental conservation normally have a positive attitude towards conserving the same environment (Kideghesho and Kaltenborn, 2007).

Moges and Taye (2017) in a stud that sought to determine farmers' perception to participate in water and soil conservation practices in Ethiopia. From the findings of the study it was concluded that perception of farmers exhibits gender difference with the females being more sensitive towards environmental conservation measures as opposed to the males.

Heinen and Shrivastava (2009) assert that when farmers become more educated on the need for environment conservation they tend to change their attitude and focus on adopting these conservation practices. Therefore, increasing farmers' knowledge and awareness on the need for conservation will go a long way in changing their attitude towards environment conservation. According to Asaah *et al*., (2011), socio-cultural heritage associated with land, forests, and other natural resources has an effect on the adoption of conservation practices. This happens especially in situation where the communities perceive that their culture is under threat from adoption of certain conservation practices. Scherri and James (2009) argue that cultural practices and heritage determines whether a community will accept participation in a community project or not, it has been realized that when community development projects are implemented in a manner that threatens the social and cultural heritage of the community, resistance is likely to occur thus affecting the sustainability of the projects.

In this regard, Mansuri and Rao (2005) suggested that participatory development should make cultural consideration when planning, designing community projects since these projects alters the existing social balance, and therefore for it to be sustainable it should not ignore the social and cultural context within which the community beneficiaries define and organize themselves. Culture can be used as a means of achieving positive attitude towards conservation. Use of methods, which promote local cultural practices such as planting of trees that are of traditional importance to the community in-terms of food, medicine, and other useful products, can do it (Asaah *et al*., 2011).

According to Sadati *et al.,* (2010), farmers' attitudes play a role in determining the degree to which farmers can adopt environmental conservation. Accordingly he argues that mental readiness, is determined through the experience of the farmers which stimulate the farmers either to adopt or not adopt. In another study that sought to assess the perception of farmers on soil and water conservation measures. From the study it was established that farmers' perception towards environmental conservation is positive, particularly on soil conservation practices. The study findings also showed that farmer's perception is enhanced by the information that farmers receive over time. Thus farmers are viewed as human information system.

The linkage between farmer's environmental attitudes and environmental conservation has been explored in various setting. Despite the many studies that have sought to explain the perception of farmers on environmental conservation, question still abound on the perception among farmers of different categories; farmers in low lands as well as farmers in highlands. In addition to lack of clarity on role of perception in adoption of environmental conservation, perception is a complex process that is mediated by many factors in different localities. The lack of inconclusively on the environmental behavior of farmer's only serves to show that farmers views on environmental conservation varies depending on different environmental conservation measures.

2.5 Effect of New Technology on Farmers' Environment Conservation Initiatives

Inadequate adoption and use of technology practices in farming has been the main reason why agricultural output has continued to drop in many African countries, the same also applies in environmental conservation (Vitale and Vognan, 2011). The

impact of technology on environmental conservation initiatives has come as a result of new farming practices that involves farm mechanization, mulching, agro-forestry, crop rotation and other practices (FAO, 1993). Adoption of modern farming practices and technology provides farmers with an opportunity to increase their productivity in a sustainable way. However, according to Moges and Taye (2017) the adoption of technology is itself affected by factors which are location specific. As a result, Greiner (2016) argues that to understand the impact of technology there is need to understand the type of technology and factors that affect its operation in various localities. In a study carried out in Laikipia by Njeru (2016) entitled factors influencing adoption of conservation agriculture by small holder farmers in Kenya. From the findings it was ascertained that technology contributes to the adoption of conservation agriculture through mediating the process of conservation practices adoption. Similarly, in a study carried out by Macharia (2015) in Kenya on factors affecting community participation in forestry conservation projects. The study findings concluded that the adoption of environmental sound technology leads to increased adoption of environmental conservation practices. As result, Macharia (2015) argues that through adoption of agricultural technologies farmers adopt technologies that are environmental friendly and this by extension encourage adoption of agro forestry conservation practices.

Utilization of environmental sound technology in community conservation is affected by lack of adequate technology transfer mechanism that builds the capacity of local farmers to understand, utilize, and replicate such technology. Dercon *et al.*, (2008) therefore propose the use of extension services in achieving meaningful technology transfer to local, farmers to adopt conservation practices. Extension services

according to Davis (2009) were conceived as a means of extending research based knowledge to local farmers to improve their lives. It has the ability to influence local farmers to adapt to climate change by, for example, developing drought-resistant crop varieties with information about the crops' advantages and disadvantages. Based on this, extension services have the potential of improving and sustaining community conservation initiatives since it provide farmers with information about how the various options will potentially increase income and yields, protect household food security, improve soils, enhance sustainability, and generally help to alleviate the effects of climate change (Dercon *et al.*, 2008).

Extension services have an effect on adoption of conservation practices such as tree planting which helps prevent soil erosion, and increase biodiversity. For farmers to adopt these practices they will need information about how the various options will potentially increase income and yields, protect household food security, improve soils, enhance sustainability, and generally help to alleviate the effects of climate change. (Davis, 2009) Use of extension services among farmers is affected by several factors which Agbamu (2005) identifies to be inadequacy and instability of funding, poor logistic support for field staff, use of poorly trained personnel at local level, and insufficient and inappropriate technologies to rural communities.

To improve on extension services provided to farmers, Koyenikan (2008) recommend that there is a need to improve the service to make its content more relevant to needs of the communities, identify alternative sustainable financing option, having well trained, and adequate staff, and the use of participatory extension approach under stable policy and sustainable institutional arrangement. He adds that training facilities

such as farmers training center and demonstration farms should be developed at the community as a means of helping build the capacity of the communities.

2.6 Theoretical framework

Human activities imposed upon a forest landscape, need careful analysis because of the effect that such activities have on various biota and ecological functions (Forman 1995). Attitude and associated relationship with human behavior has been a topic of interest among researchers for years. Attitude toward a concept can be defined as an individual or group of individuals' general feeling towards a concept (Azjen and Fishbein, 1980). In a study of effectiveness of efforts of raising levels of knowledge and positive attitudes toward environmental conservation, Armstrong and Impara (1991) found that positive attitude followed after exposure to environmental education and awareness program. Theory of Reasoned Action (TRA) and its extension and the Theory of Planned Behaviour (TPB), as a framework is good understanding, explaining and predicting attitudes. It also provides a useful guide for designing intervention strategies.

2.6.1 Theory of Reasoned Action

This theory was developed by Martin Fishbein and Icek Ajzen. Reasoned Action adds an element of persuasion in the process of establishing behavioural intention. Instead of predicting attitudes, Reasoned Action is explicitly concerned with behavior and it argues that behavior is determined by factors that predict behavior intention and change at any given time. In the context of these factors and belief, individual reason and determine their behavior. It therefore predicts behavioural intention, a compromise between stopping at attitude predictions and actually predicting behavior

with regards to change. TRA also views a person's intention to perform (or not perform) as the immediate determinant of the action. This theory works in hand with the theory of planned behavior and will be suitable in providing a model to understand the process of adoption of environmental conservation practices. This theory will thus helped in understanding the contribution of technology to environmental conservation.

2.6.2 Theory of Planned Behaviour (TPB)

This is an extension of the theory of reasoned action (Azjen and Fishbein, 1980). The central factor here is the individual's intention to perform a certain behavior; they are indications of extent of people's willingness to perform a certain behavior. The theory argues that likelihood of an individual to engage in behavior is determined by the strength of one's intention, with the behaviors that stand out having strong intention. rule that the stronger the intention to engage in a behavior the more the likely should be its performance stands out. Although some behaviors meet this requirement quite well, the performance of most depends on non-motivational factors as availability requisite opportunities and resources such as time, money, skills, cooperation of others amongst many others. Collectively, these factors represent people's actual control over their behavior. This theory states that what an individual does is determined by personal motivation, which is determined by attitude, social support and perceived behavioral control. This theory has been widely used in environmental research to predict a person's intent to participate to be part of an initiative towards environmental conservation activities (Gamba and Oskamp, 1994; Scott and Willets, 1994; Kuhlemier, Van den Berg and Lagerweij, 1999). To understand the performance of a given behaviour it necessary to understand the intentions that

underpin the behavior. Intentions encompass the motivational factors that give rise to any behavior. However, intentions affect behavior change to the degree to which various factors affect behavior of an individual. In the context of the study, TPB will contribute to the understanding of environmental conservation practice among farmers and determinants to adoption of conservation practice. From methodological perspective, the theory will be central to understanding the perceptions, attitudes and factor that influence farmer behaviour. The adoption of environmental practice by farmers is a complex behavior that is determined by many factors, to which this theory provided an overall framework to understand the mechanism involved in farmer behavior change.

2.7 Conceptual framework: Factors Affecting Conservation Initiatives

The conceptual framework shows that sustainability of community conservation initiatives is affected by level of awareness on importance of conservation, which is primarily determined by access to information. Attitudes as explained by perceived benefits, historical effects and social cultural benefits. Community participation is explained based on effects of education and land ownership as key indicators determining participation. Economic factors are identified by elements such as household income and accrued economic importance of conservation initiatives (International Fund for Agricultural Development IFAD, 2009). The framework identifies community expectation and government policies on conservation as the main moderating variable in promoting sustainable community conservation initiatives. Technological factors are explained by use of access to extension services as a means of adopting sustainable environmental conservation practices in agriculture.

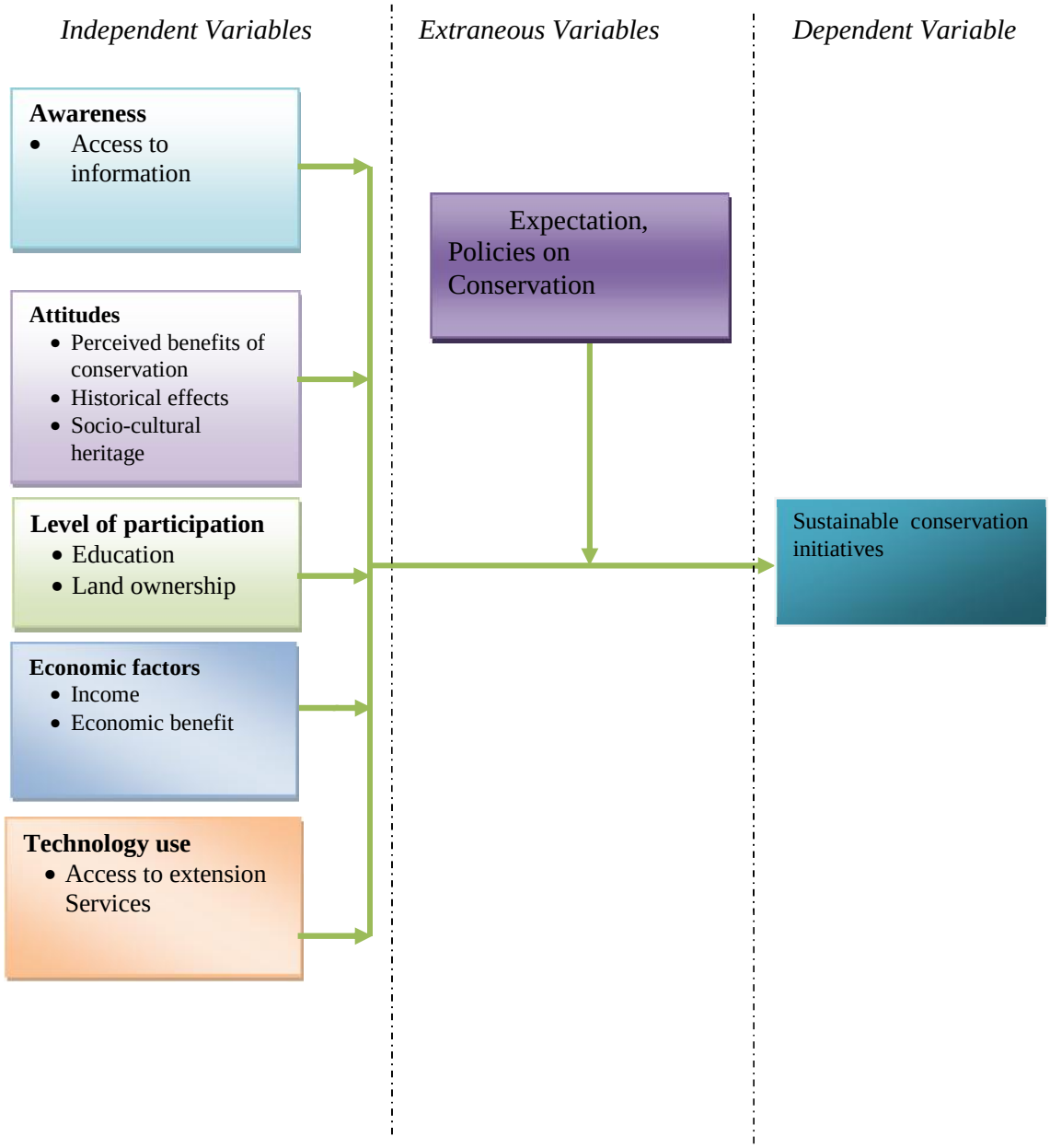


Figure 2.1: Conceptual Framework. Source: Researcher (2016)

CHAPTER THREE: STUDY AREA

3.1 Introduction

The study area, Gatundu North, which is a sub county in Kiambu County, Central part of Kenya. Its total area is 286 km2. It has a total population of 100,611 and a population density of 351.7 people per km2. The total target population is 48,798 persons. According to KNBS (2012), approximately, 24,400 persons are farmers. Gatundu North Sub County has four wards namely, Mangu, Chania, Gituamba, and Githobokoni.

Gatundu is a small town in Kiambu County of Kenya that is known as the home town of the founding president of Kenya. The town is nowadays called Gatundu sub-county and it has both Gatundu north and South Constituencies. Kiambu County is divided into four topographical zones: Upper Highland, Lower Highland, Upper Midland and Lower Midland Zone.

Gatundu Sub-County falls under the lower highland zone. It experiences bi-modal rainfall with two distinct rainy seasons; the long rains falling between mid-march to may and short rains between mid-October to November. The area is characterized by hills, plateaus, and high-elevation plains and lies between 1,500-1,800 metres above sea level. The mean temperature in Gatundu Sub County is 26^0C. The area is generally a tea and dairy zone though some activities like maize, horticultural crops and sheep farming are also practiced. The soils are well drained, extremely deep, dark reddish brown to dark brown and Ohumic Nitisols; with humic Andosols. The soils are moderately to highly fertile supporting robust agricultural activities (Jaetzold and Schmidt 1983).

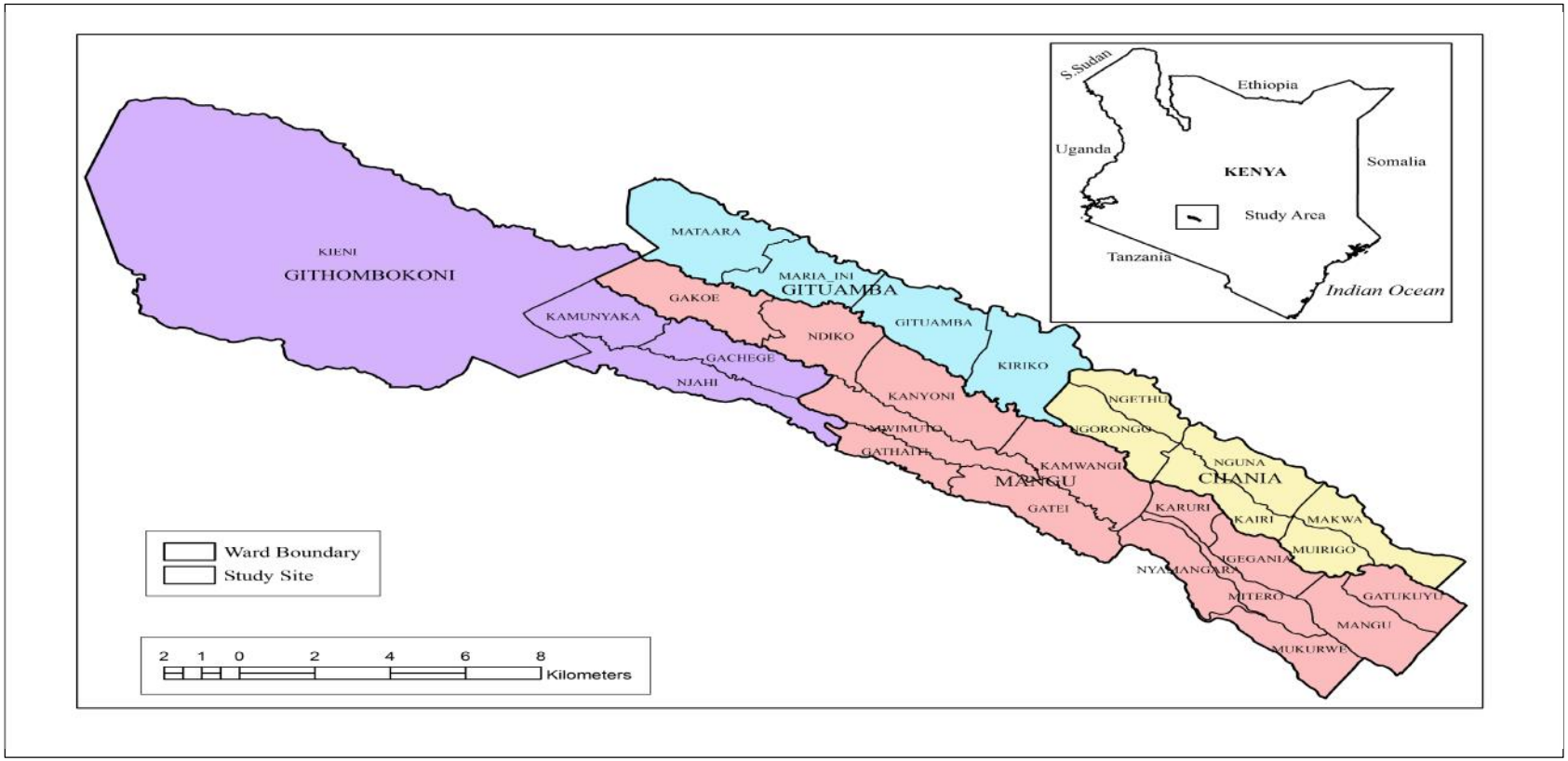
The average household land size in this area is 1.53 ha. The main agricultural activities in this area involve the growing of cash crops, vegetables, fruits and food crops. The most important cash crops at the moment in order of importance include: tea, coffee, avocados, pineapples and macadamia nuts. The important fruits in order of importance are bananas, pineapples, and avocadoes. Irish potatoes are an important food and cash crop. The main food crops comprise maize, beans, arrow roots and sweet potatoes. Pure and improved crosses of dairy cattle, mainly put under zero grazing, dominate livestock keeping enterprises, i.e. over 80 %. Keeping of local and exotic chicken is also an important livestock enterprise in this area (Jaetzold and Schmidt 1983).

3.2 Administration

Gatundu is the administrative headquarters of Gatundu and constituency. It also hosts the Gatundu sub- county offices, under the Government of Kiambu led by **William Kabogo** as the governor. Gatundu sub-county has two constituencies: **Gatundu North Constituency** and **Gatundu South Constituency** with Kigo Njenga as the Member of Parliament for Gatundu South.

3.3 Location

Gatundu town is located west of Thika about 29 Kilometers, road distance through Mang'u and north of Kiambu about 44 Kilometers, road distance through Ruiru, it is currently in Kiambu County. Back in 1960s-2007, Gatundu was in Kiambu District which would later be split and Gatundu itself became a District. Gatundu town hosts the district headquarters. Kenyatta Road connects the town to Thika Road Super-Highway- which is the main highway that connects Gatundu to Nairobi.



Source: Researcher

Figure 3.1: Map of the study area

3.4 Climate and Weather

The study site enjoys an average rainfall of 1000mm per year with temperature ranging between 11°C and 19°C. The sub county has a warm and cool climate making it suitable for farming. June and July rank as the coldest months while January-March and September-October are the hottest months.

3.5 Land Use and Land Cover

In the last three decades Kiambu County has experienced rapid growth in terms of population, which has put pressure on its limited resources and adversely affected other land uses in the entire county and more so places that are near urban centers because of demand for housing. It is currently the most built/urbanized county after Nairobi, Mombasa and Kisumu counties. Kiambu County falls within the high and medium potential areas in the agro-ecological zones I to III, where the leading income earning and employment generating cash crops like tea, coffee, pineapples, and sisal are grown. Other crops grown are wheat, beans, maize, bananas, arrowroots, vegetables and now the upcoming flower industry through green houses. Gatundu North land size holding averages between 0.35 Ha from small scale to 69.5Ha on large scale. As a result of land fragmentation in Gatundu North many farmers have been shifting to residential estate to supplement their income. Approximate 85% of land owners in Gatundu North have title deeds with the only 15% not having title deed.

CHAPTER FOUR: RESEARCH METHODOLOGY

4.1 Introduction

This chapter deals with the procedures and methods the researcher employed in order to obtain data needed for the study. The section discusses the research design, describes the study area, the population size, sampling procedures, data collection instruments and procedures, ethical considerations and methods of data analysis (Kothari, 2004).

4.2 Study Design

The study used descriptive cross-sectional study design. This design was used in the study as it allows for the research to test the what, how and why relationship of the study variables. It is useful since it has the ability to allow large amount of data to be collected quickly and at minimal costs (Kothari, 2004). This design thus contributed to the researcher achieving the research objectives. The design is also good especially when the researcher has limited time to conduct a study.

4.3 Target Population

The study target population was the residents in Gatundu North constituency. According to 2009 census the population of Gatundu North is 125, 972.

4.4 Sample Size

The sample size was calculated using the Fisher et al (1998) formula illustrated below:

Estimate of desired sample size

$n = \underline{z^2(pq)}$

d^2

Where:

n= desired sample size when target population is more than 10,000.

z = standard normal deviation at the required confidence level.

p= proportion of target population estimated to have the desired characteristics.

q = 1-p

d = level of statistical significance set (margin of error)

Proportion of the population in Mangu ward 48,785

Gatundu north = 125,972 (total target population)

Thus,

Z-statistic = 1.96 at 95% confidence level

d (desired accuracy level) = 0.05

p=50% - used if there is no estimate available on the proportion of target population with the desired characteristics, (Fisher et al, 1998).

q= 1-0.5

Therefore,

$$n = \frac{(1.96)^2 \times (0.5) \times (0.5)}{(0.05)^2}$$

$$= \frac{(3.8416) \times (0.25)}{0.0025}$$

$$= \frac{0.9604}{0.0025}$$

= 384.16

Thus, n = 384- Therefore 384 farmers were selected for the study

The research consisted of a sample size of 384 farmers who were randomly selected to participate in this study. The study made use of stratified random sampling method in which wards/ locations within Gatundu North were arranged as strata.

4.5 Sampling Techniques

Stratified random sampling was used for the purpose of this study to ensure proportionate representation of each location. The technique is summarized in Table 4.1 below.

The study area (Gatundu North) has four wards. Each ward formed a stratum from which male and female adults were selected and joined with other selected participants from the other Strata to form a total sample that is representative of the study area. Table 4.1 shows the proportion of the samples from the different strata.

Table 4. 1: Population distribution and sample size estimate in the Gatundu North strata

Ward	Total population of adults (>18 years old)	Total population (f) of farmers	Desired Sample Size ($^{f}/_{z}$ x 384)
Mang'u	13,803	6,635	105
Chania	11,458	5,896	92
Githobokoni	10,825	5,515	87
Gituamba	12,712	6,384	100
Total	**48,798**	**24,430 (z)**	**384**

4.6 Study Variables

As shown in the Table 1 above, this study factored in two categories of variables: dependent and independent.

4.6.1 Independent Variables

The independent variable identified for the study included awareness and knowledge level, access to environmental conservation information, attitude and perceptions, community participation, economic factors (income level, financial benefits), utilization of technology, and political factors (laws, policies, and guidelines on conservation). Additionally, the study assessed whether farmers were aware of relevant regulations, policies, as well as land management and conservation initiatives in Gatundu North, and in Kenya generally. Access to information on conservation requirements as well as sources of extension services and financial resources will be analyzed. The study will also aim to assess the attitudes of farmers and utilization of technology in land management and conservation. The study evaluated economic factors like income level and cost that may have an effect on adoption of conservation practices (Infield and Namarari, 2001).

4.6.2 Dependent Variables

On the other hand, dependent variables included environment conservation initiatives. This included land management and conservation initiatives inherent in the area and the universally accepted conservation practices. These are what were measured; they form what the researcher thought were to be affected during the experiment.

4.6.3 Operationalization of Variables

Table 4. 2: Operationalization of Variables

Variable	Indicator	Measurement	Question Number
Digital Technologies	E books, E library, CDs, printing technology, Website	Nominal and ordinal level	Section A question 7
Marketing strategies	Presence on social media, website, employment of an online marketer	Nominal and ordinal level	Section B Question 1-4
Growth strategies	Increase in Sales, Products of publishers	Nominal and Ordinal level of measurement	Section C Question 1- 4
Cost Cutting strategies	Printing technologies in use, distribution technologies in use	Nominal and ordinal level of measurement	Section D Question 1- 5

4.7 Data Collection

The study involved the collection of both secondary and primary data collection using qualitative and quantitative methods. The Secondary data collection included a review of scholarly articles and publication on environmental conservation. This process provided the background and perspective for the subject under study. Secondly, secondary data provided the baseline data upon which the collection of primary data was configured. Primary data on factors affecting sustainability of community conservation were also collected by the use of pretested structured questionnaires. The questionnaire allowed time for respondents to give well thought answers and time to

respond to the items. Furthermore, use of questionnaire was also deemed convenient and within the researchers financial limits.

4.7.1 Pilot Study

A pilot study was conducted to establish the validity and reliability of the research instrument. Validity in this case refers to the ability of a test or tools to measure (Kothari, 2004). While reliability is the ability of an instrument to provide consistent results in data gathering (Kothari, 2004). To test the reliability, the researcher carried out a pretest of the research tools before undertaking the real research. A pilot study was conducted in Ndeiya ward, and it involved 38 respondents representing 10% of the sample size. Data collected from pilot study was analyzed through factorial analysis and Cronbach Alpha test for reliability. The reliability results indicated a score above 0.7 thus proving the instrument to be reliable.

4.7.2 Data Collection Procedures

The researcher collected data with the aid of four other research assistants. The team of research assistants were initially trained on the data collection methods as well as ethical principles in research. Data was collected by use of a semi-structured questionnaires. Communication to the respondents was done mainly in English, Swahili and native language of the Agikuyu. This was to ensure full incorporation of both the learned and the unlearned, most of whom were the old residents of the area. The prospective respondents were approached, explained for the principles involved and the purpose of the study, and further requested for their consent to participate in the exercise by giving their sincere responses to the questions asked.

4.8 Data Management and Analysis

Data collected in the study was cleaned for quality purposes. Descriptive statistics through means, standard deviation and frequencies was used in the study to answer objective one and three. Pearson correlation and logit regression analysis was used in study. Pearsons correlation was used to test how technology affect environmental conservation. Logit regression model was used to test the relationship between socio-economic factors and environmental conservation practice in Gatundu.

CHAPTER FIVE: RESULTS AND DISCUSSION

5. 1 Introduction

The study was conducted to establish the factors affecting farmers' involvement in environmental conservation initiatives. In particular the study sought to establish farmers' level of awareness, attitude and perceptions towards land management and environmental conservation initiatives. In addition, the study sought to find out the extent of uptake of such initiatives by farmers.

5.2 Response Rate

The study targeted 384 farmers. However, a response rate of 76% was achieved as shown in table 5.1. This percentage is acceptable since a response of 70% has been deemed good for analysis. This met the acceptable response rate according to (Craig and Egerton-Warburton, 2013)

Table 5. 1: Response Rate

Response rate	Frequency	Percentage
Returned questionnaires	293	76%
Unreturned questionnaires	91	24%
Total	384	100%

5.3 Socio-Economic Demographics

Table 5.2 presents the demographic characteristics of the respondents. Slightly above half of the respondents (53%) were male while 47% were female. Majority of farmers in Kenya are males who own land and this shows gender differences in natural resource control and management. In addition the gender difference among farmers

indicate that males and females have varying environmental consciousness Ogunjinmi, Onadeko and Adewumi (2012). Half of the respondents 51% were married, 31% single, 10% widows and widowers and 9% were either divorced or separated. Majority of the farmers were married thus revealing that most farmers were dependent on the environment for sustenance due to increased responsibilities. The study also sought to establish the literacy levels of the respondents. The results showed that 32% had college level of education, 28% had secondary education and 20% had primary education. Further 18% had university education and 6% had no education at all. These findings show higher literacy in the study site, with high literacy an enabling factor in environmental conservation adoption. Regarding the religion of the respondents, most of them 85% were Christians, 5% were Muslims and 2% Hindus. However, 8% were not subscribed to any form of religion. These results indicate that majority of members do subscribe to some form of faith and this is in line with Kenyan Demographic and Health Survey (KDHS, 2008-2009) that established that 96% of Kenyan subscribe to some form of faith. Christian, Muslim and Indian belief system encourages environmental conservation as such this may give the farmers positive perception towards environmental conservation (Chen *et al.,* (2011).

Table 5.2: Demographic characteristics

Variable		Frequency	Percentage
Gender	Male	151	53%
	Female	134	47%
Marital status	Married	150	51%
	Single	90	31%
	Widowed/Widower	28	10%
	Divorced/Separated	25	9%
Level of education	College	93	32%
	Secondary	82	28%
	Primary	58	20%
	University	54	18%
	None	6	2%
Religion	Christianity	248	85%
	Pagan	22	8%
	Muslim	15	5%
	Hindi	6	2%

The respondents were youths making up 41% of the total respondents and 19% were between 35 and 45 years while 10% were between 46 and 55 years and another 10% were above 55 years (Fig *5.1*).

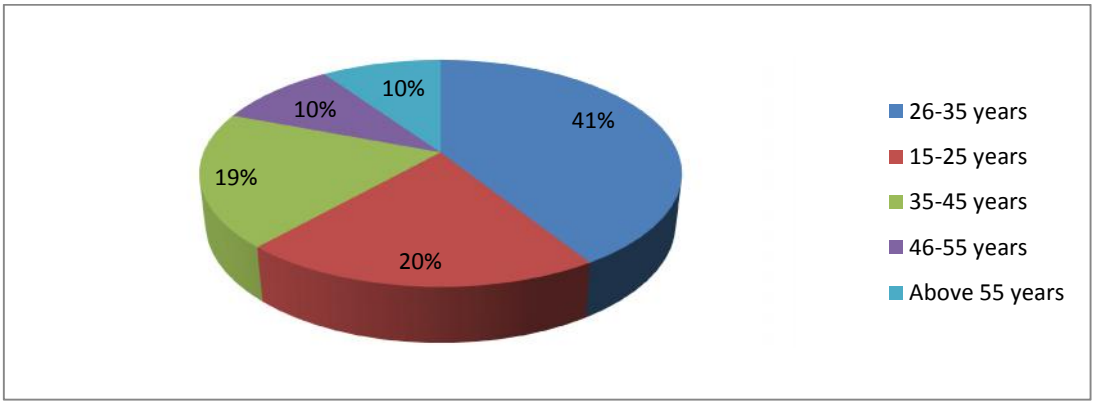


Figure 5. 1: Distribution Respondents based on Age

The results revealed that there were four categories of farmers among the respondents. 33%, 30% and 28% were full time, part time and seasonal farmers respectively. Nine per cent were casual laborers (*figure 5.2*).

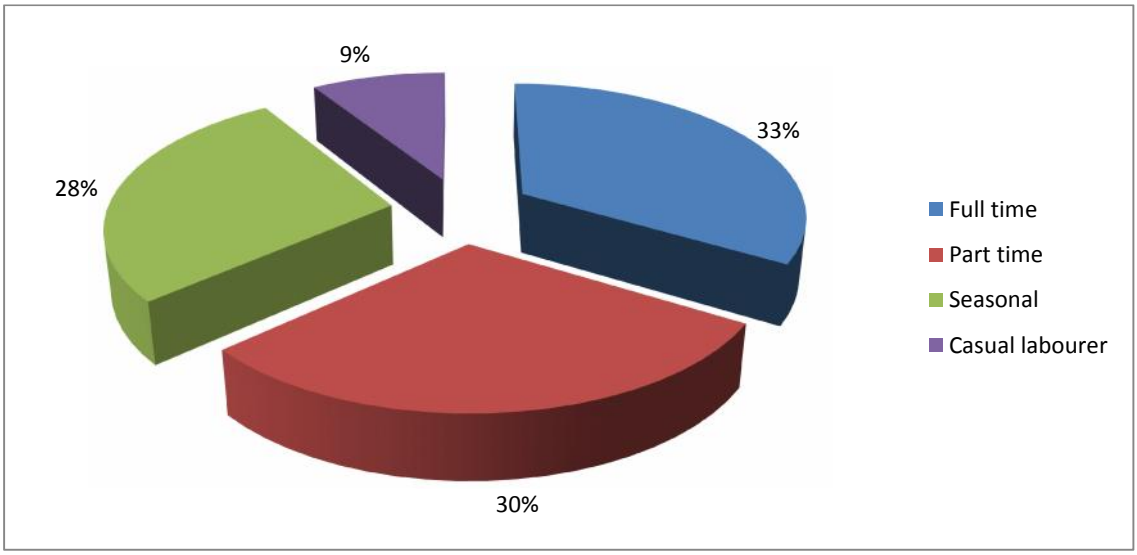


Figure 5. 2: Distribution of Respondents based on their farming Status

5.4 Knowledge and Awareness of environmental conservation

The study sought to establish the level of awareness and knowledge of agricultural and environmental conservation. Table 5.3 presents the results. Majority of the respondents 64% had received agricultural training and 53% had received environmental conservation and management trainings. These findings show that most farmers in Gatundu North are aware on environmental conservation. Thus it can be concluded that awareness on environmental conservation is relatively high.

Table 5. 3: Agricultural and environmental conservation training

Variable		Frequency	Percentage
Background Training in agriculture	Yes	186	63%
	No	107	37%
Trained in environmental conservation/management	Yes	156	53%
	No	137	47%

Table 5.3 shows respondents' awareness of the causes for land degradation problems. The result indicates that, majority (53%) of the respondents were aware of environmental conservation and had received training. This shows that relatively majority of the farmers were found to have better awareness about environmental conservation. Generally, more than half of the farmers found to have better awareness about the causes of land degradation and land management measures. From these findings it can be deduced that most farmers in Gatundu have been exposed to environmental conservation practices. This findings support the results of Makango (2014) who establish that majority of community members in Ethiopia were aware on land management.

Majority of the respondents (33%) were not aware of the provision of agricultural extension services in their area. However, 32% cited that the services were provided but on a rare occasion while 30% cited that the provision of agricultural extension services were occasionally and 5% mentioned that it was provided frequently (*Fig 5.3).*

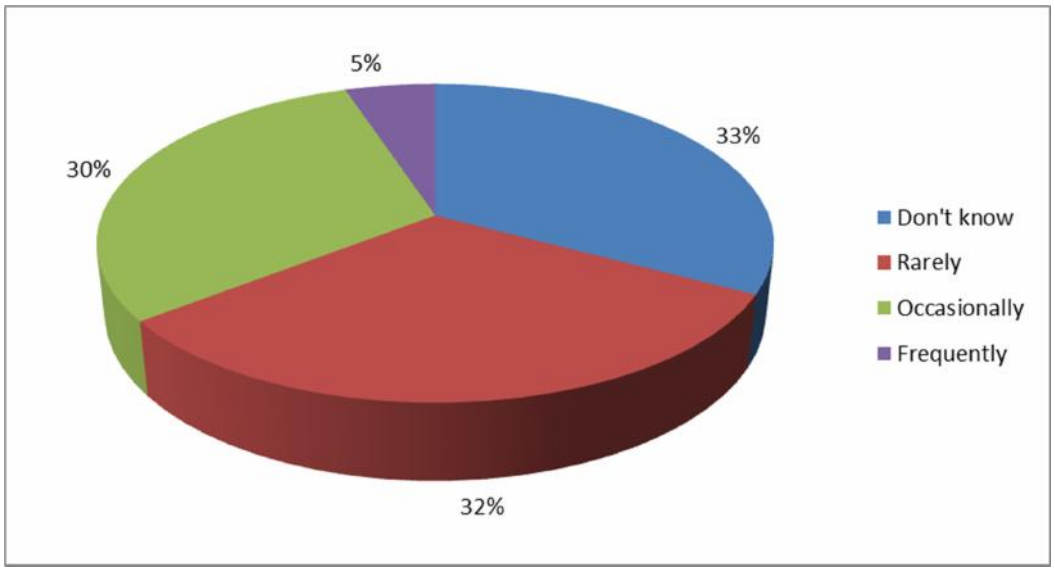


Figure 5. 3: Extension service provision

Forty-eight per cent of the respondents cited that there were community conservation initiatives projects in their area (Table 5.4). This implies that a great majority were not aware of existence of organizations that work on environmental conservation and that there was relatively minimal exposure to environmental activities by the farmers. According to Macharia (2015), awareness on environmental conservation is relatively high in rural areas notwithstanding minimal knowledge on organizations that deals in environmental conservation. This attributes to the need for increased use of media and social media in public campaigns.

Table 5. 4: Existence of community conservation projects

Are there community conservation projects in your area	Frequency	Percentage
Yes	142	48%
No	151	52%
Total	293	100%

Data in the figure 5.4 clearly indicated respondents' awareness of land management initiatives in the areas with some of the initiatives cited include; 33% Mt Kenya Christian Community Service, 17% Chania Environmental Community service, 17% Chania Community Development Initiative 15% forestation, tree planting and projects to keep the environment green. In addition 13% mentioned livestock farming 3% gabion construction and 2% horticultural farming. These imply that there exists a number of organizations that deals in land management in the areas as confirmed by Ikiugu (2011) who established that a number of NGOs exists that deal with environmental conservation.

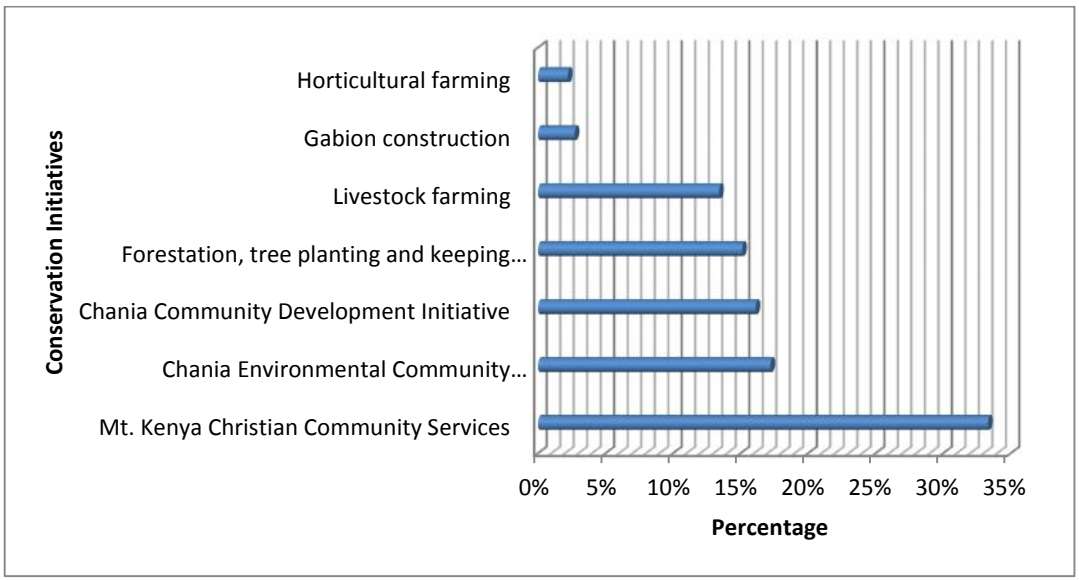


Figure 5. 4: Conservation Initiatives

5.5 Socio-economic factors

Table 5. 5: Land ownership

Type of your land ownership	Frequency	Percent
Fully owned	192	66%
Don't have my own	70	24%
Leasehold	31	11%
Total	293	100%

In the study area more than 66% of the farmers have their own land holding and 24% have no private land holding while 11% are on leasehold (*Table 5.5*). These results show that individual land ownership is dominants in Gatundu North constituency. According to Macharia (2015) land ownership makes it easier for farmers to engage in environmental conservation. The results are as shown in Figure 5.5 below:

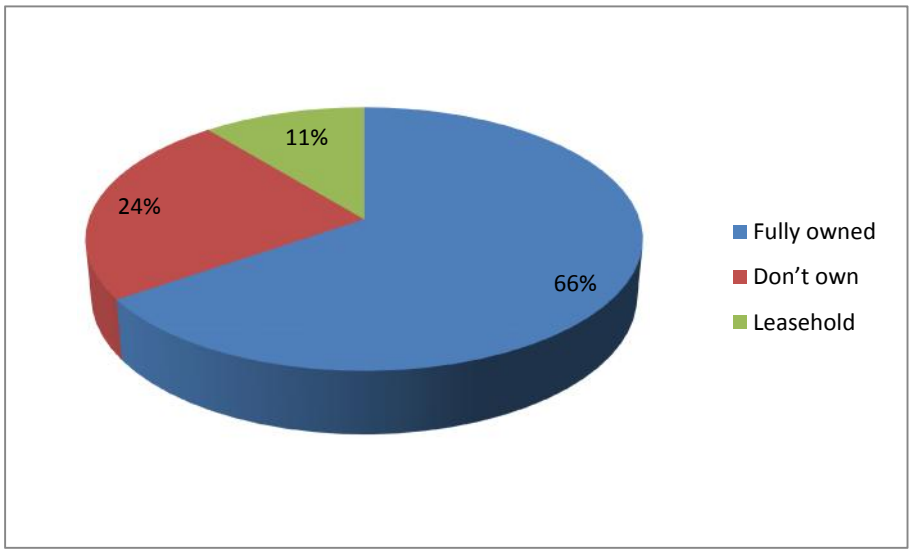


Figure 5.5: Land ownership

Among those who owned or leased land, only 26% practiced gabion construction, 87% practiced mixed cropping, 40% fodder cropping and 52% practiced agro-forestry

(Table 5.6). These findings indicate that majority of farmers engaged in mixed cropping as land conservation practices thus proving that conservation agriculture is the dominant form of environmental conservation in Gatundu North. This view is supported by Hudson, (2002) who established the most common land conservation measure among farmers to be crop rotation, mixed cropping and terracing. Chala (2015) further asserts that mixed cropping is common techniques used among farmers for the reason that the technique is used both for erosion control and fertility improvement.

Table 5. 6: Land conservation practices

Variable		Frequency	Percentage
Gabion construction	Yes	56	26%
	No	162	74%
Mixed cropping	Yes	211	87%
	No	33	14%
Fodder cropping	Yes	80	36%
	No	142	64%
Agro forestry	Yes	119	52%
	No	111	48%

The results revealed that a few people (17%) held cultural connotation to land (Fig 5.5). There are circumstances such as land being inherited from the ancestors thus such land could not be given away for cultivation or any other activity that would involve any such like activities. Some people also used some pieces of land as worship places e.g. shrines thus no activity was allowed in such places except worship, just to name but a few. This indicates the influence of globalization and

modernization on the cultural practices of community members. This is supported by the reason than Kiambu County is located at the outskirts of Nairobi County.

The respondents cut trees for agricultural, settlement and for sale purposes. The study also sought to establish respondents' attitudes and perception regarding environmental conservation practices. A set of 4 point Likert questions were presented to the respondents where 1 was Strongly Disagree and 4 was Strongly Agree. The respondents agreed that agro-forestry was beneficial to both environment and farmer (m=3). They also agreed (m=3) that farmers readily embrace and participate in environmental conservation initiatives. The respondents further agreed that lack of participation in conservation agriculture destabilizes the environment (m=3) and that utilization of new technology increases agricultural productivity (m=3). Lastly they agreed that new technology in agriculture had positive impact on environment (m=3). These statements aimed at ascertaining whether farmers were optimistic that solutions to environmental problems existed and whether they had a role to play in the resolution of the existing environmental problems. Farmer's opinions suggest that farmers were sensitive towards environmental conservation and thus more likely to participate in looking for solutions for different issues that affect their environments. These findings support the findings of Mutisya, Kipgetich, and Rono (2013) who established a positive attitude between community members and environmental conservation *(Table 5.7).*

Table 5. 7: Perception of respondents towards environmental conservation

Descriptive Statistics	N	Mean	SD
Agro forestry is beneficial to both the environment and farmer	293	3	0.512
Farmers in Gatundu North readily embrace and take part in environmental conservation initiatives	293	3	0.619
Lack of participation in conservation agriculture destabilizes the environment	285	3	0.722
Utilization of new technology increases agricultural productivity	293	3	0.665
New technology in agriculture has positive impact on environment	293	3	0.754

The study results, however, revealed that there was positive correlation between farmers' perception and adoption of agro-environmental conservation practices. This was indicated by a p-value of0.043 and r-value of 0.277 (*Table 5.8*). However, the findings indicate that there was a weak significant relationship between farmer's perception and adoption of agro-environmental conservation practices. This shows intention alone is not the determinant to adoption of agro-environmental practice but needs to be complimented with other incentives (Hungerford *et al*, 2010). Therefore positive attitude shapes farmer's behaviour and perception towards agro-environmental conservation practices. (Badola, 2008).

Table 5. 8: Correlations between farmers' perception and adoption of agro environmental conservation practices

Correlations		Agro-environmental conservation practices
Agro-environmental conservation practices	Pearson Correlation	1
	Sig. (2-tailed)	
Perceptions	Pearson Correlation	0.277
	Sig. (2-tailed)	0.043

In terms of access to information, 66% of the respondents cited to be in a position to access latest farming technologies, 61% access environmental conservation initiatives information (*Table 5.9*).

Table 5. 9: Access to information

Access to information		Frequency	Percentage
Access to information on latest farming technology	Yes	190	66%
	No	100	35%
Access to information on environmental conservation initiatives	Yes	177	61%
	No	113	39%

5.6 Role of Technology on Farmers in Involvement in Environmental Conservation

Correlation analysis results show that access to information on environmental conservation initiatives was positively correlated with adoption/ practice of agro-environmental conservation practices. Technology play a key role in providing information to communities and through the technology community members become

aware on existing environmental conservation practices. These findings imply that the use of technology positively influences the participation in environmental activities as suggested by (Maffey, Homans, Banks, and Arts, 2015).

Table 5. 10: Technology and Involvement in Environmental Conservation

Correlations		Agro-environmental conservation practices	Access to information on latest farming technology	Access to information on environmental conservation initiatives
Agro-environmental conservation practices	Pearson Correlation			
	Sig. (2-tailed)			
Access to information on latest farming technology	Pearson Correlation	0.089		
	Sig. (2-tailed)	0.132		
Access to information on environmental conservation initiatives	Pearson Correlation	.218**	.506**	
	Sig. (2-tailed)	0.000	0.000	
Participation in KWS initiatives like wildlife conservancy	Pearson Correlation	.180**	.334**	.357**
	Sig. (2-tailed)	0.002	0.000	0.000

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

5.7 Agricultural conservation practices

The study also delved into the agricultural conservation practices among farmers. Agro-forestry was practiced by 56% of the farmers, 25% practiced mulching, 76% practiced mixed cropping and 54% and 37% practiced crop rotation and fodder

cropping respectively. Others also practiced contour farming, zero grazing and had green houses as indicated Table 5.11.

Table 5.11: Agricultural conservation practices

Conservation Practice		Frequency	Percentage
Agro forestry	Yes	142	56%
Mulching	Yes	56	25%
Mixed cropping	Yes	200	76%
Crop rotation	Yes	122	54%
Fodder cropping	Yes	89	37%
Contour farming	Yes	21	9%
Zero grazing	Yes	119	49%
Green House	Yes	55	24%

5.8 Regression Analysis of Socio-economic Factors

In order to establish the socio-economic factors that influence involvement of farmers in environmental conservation initiatives, logit regression was performed. This regression model was adopted since the independent variable is binary (occurs or not). The results of the regression analysis were as follows:

Table 5.13 shows the results of the model summary. Of importance to note in the table is Nagelkerke R^2 which had a value of 0.561. This means that 56% of the variation in the adoption was predicted by the predictor variables included in the model in this case gender, age, marital status, religion, level of education, background agricultural and environmental training, land ownership and frequency of interaction with agricultural extension officers. These results imply that the remaining 44% of the change in adoption are caused by variables not included in the model.

Table 5. 12: Model Summary

Step	-2 Log likelihood	Cox and Snell R Square	Nagelkerke R Square
1	174.134a	0.37	0.561

Estimation terminated at iteration number 7 because parameter estimates changed by less than .001.

Table 5. 13: Regression Coefficients

Variables in the Equation	B	S.E.	Wald	df	Sig.	Exp(B)
Gender	0.33	0.441	0.562	1	0.0454	1.391
Age	0.201	0.227	0.786	1	0.375	1.223
Marital_status	-2.099	0.43	23.805	1	0.000	0.123
Income	1.678	0.41	22.456	1	0.020	2.652
Level education	0.285	0.177	2.573	1	0.019	1.329
Economic benefits	0.109	0.427	1.078	1	0.028	1.116
Trained_envi_cons	1.937	0.495	15.286	1	0.000	6.939
Extn_freq	0.485	0.154	9.891	1	0.002	1.625
Land_ownership	3.748	0.657	32.558	1	0.000	42.417
Constant	-15.643	2.588	36.54	1	0.000	0

Variable(s) entered on step 1: Gender, Age_range, Marital_status, Income, Level_education, Economic benefits, Trained_envi_cons, Extn_freq, Land_ownership.

Marital status of a person, income, training on environmental conservation, frequency of provision of extension services, economic benefits and land ownership were all

positively and significantly affected the adoption of environmental conservation initiatives (Table 5.13).

Probit model results between the respondents' education level and participation in environmental conservation. The study revealed statistically significant differences between the respondents' education levels and their use of participation in environmental conservation. ($p= 0.019$). The results show that the more an educated a respondent is the likely the respondent will participate in environmental conservation practices. Education is associated with increased knowledge on harm of environmental degradation and benefits accruing from conservation practices. These findings are in line with Castille and Mendoza (2006) who found that education has a great impact on participation of community members in environmental conservation. The findings of the present study showed no significant difference between gender and participation in environmental conservation in Kiambu county. This means that women are highly predisposed to participate in environmental conservation activities (Table 5.14). This can be explained by high participation of women in group activities than the men thus encouraging more women to participate in environmental activities. These findings support the results of Kacho and Asfaw, (2014) who established significant gender difference on involvement in environmental conservation. The findings of the study also indicated that marital status of the community members had significant relationship with participation in environmental conservation.

From the results it was evident that the married ones are less likely to involve in environmental conservation activities. This according to Ikiugu (2011) is due to limited time that the married have in comparison to the unmarried. Land ownership

was determines to be a significant predictor of participation in environmental conservation, with an increase in private land ownership leading to increase in participation. This means that that those who fully own their land are more incentivized to participate in environmental conservations. These findings align to the results of (Abbas and Singh, 2014). Frequency of extension services was established to be significant determinant of participation in environmental conservation. Frequency of visit reinforces the importance of farmers to engage in environmental conservation thus encouraging their participation. These findings affirm the results of (Arts, van der Wal, and Adams, 2015). The study results indicated that economic benefits is a significant predictor to participation in environmental conservation. These shows that financial incentives is key to incentivizing farmers to participate in environmental conservation. This results are not surprising as similar findings were established by Greiner (2016) who affirmed that financial incentives encourage farmers to engage in environmental conservation. From the findings it was established that training on environmental conservation is a significant predictor to participation in environmental conservation. According to Macharia (2015) training increases the awareness of farmers on importance of environmental conservation to them and this has the effect to motivate the farmers to participate in conservation activities. In addition to training the findings also established that income is a significant predictor of farmer's participation in environmental conservation. The findings show that increase in income predisposes farmers to participate in more environmental conservation. This supports Kacho (2014) assertion that income allow farmers to access resources that allows them to participate in environmental conservation.

Age was found to have no effect on the participation of farmers in environmental conservation, with these findings supporting the results of Makango (2014) who established non-significant results on age. This shows that both youth and adults equally engage in environmental conservation in Gatundu North.

CHAPTER SIX: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This section presents the study findings based on the study objectives, discussion on the results, conclusion, recommendation and areas for further research.

6.2 Summary of Findings

On the first objective which was to establish the level of awareness among farmers on environmental conservation. The study findings indicates that majority of the farmers had background training in agriculture. Additionally, the study findings showed that a majority of farmers had awareness on environmental conservation. This means that farmers in Kiambu County have been exposed to knowledge on environmental conservation. This was affirmed by study findings on farmer's knowledge on environmental conservation activities in the county which showed that all farmers were at least aware of one environmental activity in the county. These findings imply that government and other stakeholders have provided training and information to farmers on environmental awareness. These findings support the results of Abbas and Singh (2014).

The present study evaluated community member's attitude towards environmental conservation. The study revealed that most farmers were sensitive and positive towards environmental conservation. This is in lines with the goals of SDG's development of positive attitudes and motivation and commitment to providing solutions to current environmental problems and prevention of new ones from occurring is emphasized. Hence it is asserted that government and non-governmental

organizations in Kiambu had achieved the attitudinal objective by inculcating positive environmental values and attitudes to farmers in Kiambu County.

The understanding and perception of local land users regarding land resources conservation is important when sustainable land management options are considered. The positive attitude of the local farmers towards land resources conservation is a favorable predictor for future prevention of land degradation. The positive attitude of local farmers towards conservation of land resources is increasing due to influence of some socioeconomic factors. Positive attitude may lead to increased motivation and likelihood to successful conservation due to increased input. Education is necessary to create public awareness for land resources conservation.

These findings are similar to a study by Yilmaz, *et al*. (2004) that investigated the farmer's attitude and which found out that, community members had positive attitudes toward environmental conservation. Another similar study by Tuncer, Sungur, Tekkaya and Ertepınar (2005) that examined the youth attitudes towards environmental conservation affirmed youth concern for environment conservation. A study by Mutisya, Kipgetich and Rono (2013) in Kenya further revealed that younger community members had high conceptual understanding and awareness of environmental degradation.

Finally, the findings of the study indicate that technology influences farmer's environmental measures. This was supported by p-values of 0.002 and 0.00and the results also showing p-values of 0.218 and 0.18. The study results show weak positive influence of technology on farmer's environmental measures. From the findings it can

be implied that increased use of technology can lead to more involvement of farmers in environmental conservation. These findings are consisted with the results of Howe (2009) that increase use of technology results in enhanced participation in environmental activities.

6.3 Conclusions

Natural resources conservation and sustainable land resources management in a way that would fit specific environmental and socio- economic condition is an issue that recently rose in Gatundu North and many investigators have developed interests towards this method. Conservation practices of natural resources would be most effective when understood in the context of individual farmers so that analysis of farmers' attitude would have paramount importance not only in controlling potential conflicts but in also examining policy efficiencies. To implement desirable land management method in a more sustainable way, it is essential to generate viable changes in the attitude of farmers as initial step. Therefore, exploring attitude vis-à-vis the idea and principles of sustainable land management would serve as a corner stone for initiating appropriate planning and program implementation. Hence, the purpose of this study was appraisal of farmers' attitudes towards the conservation of land resources and identifies most important factors that influence it.

Large sections of the farmers volunteered to participate in conservation efforts and supported the practice of tree plantation not only on farm plots but also where they would serve in conserving the environment. Attitude of farmers was favorable towards the conservation of natural resources. Over 62% of the participants had very high and positive attitudes to preserve soil, water and vegetation resources. The

empirical results from a multiple regression model showed, farming experience, household income, benefits gained, and farmers' age were significant predictors of conservation attitudes. Results of correlation analysis also showed farming experience, farmers' age, household income, extension contact and benefits gained had higher attitudes towards conservation efforts than their counter parts.

The role of technology has been upheld in the study through the study findings. Thus it can be concluded that technology can play a major role in encouraging the participation of farmers in environmental conservation. Technology can help in mobilization of farmers, improving access of information to farmer and making farmer knowledgeable on latest conservation technologies. Finally, it can be concluded that there is increased awareness among farmers on environmental conservation in Kiambu County. The study suggests that knowledge of farmers on environmental awareness should be tapped into to encourage more participation in environmental conservation.

6.4 Recommendations

A greater section of the research participants could read and write but only few had formal education. This might have contributed for building up of positive attitude across the study villages. Although the entire interviewed farmers acquired cultivable land, more than 40 percent had no privately registered plots for farming so that they were compelled to borrow or rent from others who were not able to cultivate the plots themselves for various reasons. This indicates that a significant section of the community had insecure land tenure. In addition, this in turn affects attitudes of

farmers towards land management negatively, because it may affect farmers' interest to invest in land improvements. The study thus recommends the following;

6.4.1 Government

- Both the government and all stakeholders to make use of technology to disseminate more information on environmental conservation.
- Increased leverage of information particularly among the youth on latest agricultural technology and environmental technology should be encouraged.
- Increased attention to social factors and extension factors to improve access to environmental awareness information and adoption of conservation measures.
- The government should make use of attitude and perceived behavioral policy to direct and channel farmer's behavior to environmental conservation.
- The government should continue with their title deeds issuance policy as this will encourage more farmers to fully participate in environmental conservation.

6.4.2 Practitioners

- The government and NGOs should promote corporate collective responsibility through raising the level of farmer's awareness on environmental conservation opportunities.
- There is increased need for the government and other non-governmental organizations to provide more incentives to farmers to encourage environmental conservation.

6.4.3 Further Research

There is need for more disaggregated analysis of factors to understand the factors affecting awareness of farmers, attitude of farmers and adoption and use of technology.

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APPENDICES

APPENDIX I: QUESTIONNAIRE

Background

My name is Admolla Sime, a Masters student at the University of Nairobi. I am carrying out a study into the factors affecting farmers' involvement in environmental conservation initiatives in Gatundu North. I request for your voluntary participation and be assured that the information obtained will be handled with utmost confidentiality and only used for academic purposes. Thank you.

Date: _____ Sign_____

Instructions

- Kindly attempt all the questions and be as honest as possible
- Please tick, circle or answer as required
- Do not indicate your name
- There is no right or wrong answer

SECTION A: SOCIO-DEMOGRAPHIC DETAILS

1. Residence _____
2. Gender

    a) Male b) Female

3. Age _____years old

4. Marital status

    a) Married

    b) Single

    c) Widowed

    d) Divorced

    e) Others (specify)

5. Level of education

    a) Primary education

    b) Secondary education

    c) College

    d) University level

    e) None

6. Religion

    a) Christianity

    b) Muslim

    c) Pagan

    d) Others (specify) ……..

SECTION B: AWARENESS AND KNOWLEDGE LEVEL

7. Do you have any background training in agriculture?

    a) YES [ ] b) NO [ ]

8. Have you ever been trained in environmental conservation/management?

    a) YES [ ] b) NO [ ]

9. How frequently are extension services provided to farmers in your area?

    a) Rarely provided

    b) Occasionally provided

    c) Frequently provided

    d) Don't know

10. Are there community conservation projects in your area?

a) YES [ ] b) NO [ ]

11. If YES, please list some of the projects/initiatives in your area.

……

……

SECTION C: SOCIO-ECONOMIC AND POLITICAL FACTORS

12. What is the type of your land ownership?

    a) Leasehold [ ] b) fully owned [ ] c) don't have my own land [ ]

13. If lease hold/fully owned, do you readily practice the following?

	YES	NO
Gabion construction		
Mixed cropping		
Fodder cropping		
Agro forestry		

14. Does land in your community have a cultural connotation?

a) YES [ ] b) NO [ ]

15. If YES, please explain the association between land and your culture.

……

……

16. Do people in your area cut trees (deforestation) for the following purposes?

	YES	NO
Agriculture		
Settlement		
Selling purposes		

SECTION D: ATTITUDES AND PERCEPTION

17. Please state your opinion towards the following statements.

Parameter	Strongly Disagree	Disagree	Agree	Strongly Agree
Agro forestry is beneficial to both the environment and farmer				
Farmers in Gatundu North readily embrace and take part in environmental conservation initiatives				
Lack of participation in conservation agriculture destabilizes the environment				
Utilization of new technology increases agricultural productivity+				
New technology in agriculture has positive impact on environment				

SECTION E: PARTICIPATION AND UPTAKE OF TECHNOLOGY

18. Do you or members of your community take part in the following?

PARAMETER	**YES**	**NO**	**FREQUENCY**			
			OFTEN	**OCCASIONALY**	**RARE**	**NONE**
Tree planting						
Gabion construction						
Sensitization/awareness campaigns on importance of environmental conservation						

19. Do farmers in your area access information on latest farming technology?

a) YES [ ] b) NO [ ]

20. Do farmers access information on environmental conservation initiatives?

a) YES [ ] b) NO [ ]

21. Have you ever been involved in KWS initiatives like wildlife conservancy?

a) YES [ ] b) NO [ ]

SECTION F: PRACTICE

22. What method of agriculture conservation do you practice?

NO	METHOD	YES	NO
A	Agro forestry		
B	Mulching		
C	Mixed cropping		
D	Crop rotation		
E	Fodder cropping		
F	Contour farming		
G	Zero grazing		
H	Green House		

23. What is your opinion towards Agro-forestry?

NO	Parameter	YES	NO
A	Agro forestry improves soil fertility and soil profile		
B	Planting trees with crops is beneficial to the environment		
C	Planting trees with crops has economic benefits to the farmer		

D	Agro forestry takes long before experiencing the profits		
E	Agro forestry improves food security		

24. What is your status as a farmer?

a) Full time farmer

b) Part time farmer

c) Seasonal farmer

d) Casual laborer

APPENDIX II

RESEARCH CLEARANCE PERMIT

THIS IS TO CERTIFY THAT:
MISS. ADMOLLA OCHOLA SIME
of UNIVERSITY OF NAIROBI, 42966-100
Nairobi,has been permitted to conduct
research in *Kiambu County*

on the topic: *ASSESSMENT OF THE FACTORS AFFECTING FARMERS' INVOLVEMENT IN ENVIRONMENTAL CONSERVATION IN GATUNDU NORTH SUB-COUNTY, KIAMBU COUNTY*

for the period ending:
20th November,2018

.....
Applicant's Signature

Permit No : NACOSTI/P/17/25090/20101
Date Of Issue : 22nd November,2017
Fee Recieved :Ksh 1000

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

CONDITIONS

1. The License is valid for the proposed research, research site specified period.
2. Both the Licence and any rights thereunder are non-transferable.
3. Upon request of the Commission, the Licensee shall submit a progress report.
4. The Licensee shall report to the County Director of Education and County Governor in the area of research before commencement of the research.
5. Excavation, filming and collection of specimens are subject to further permissions from relevant Government agencies.
6. This Licence does not give authority to transfer research materials.
7. The Licensee shall submit two (2) hard copies and upload a soft copy of their final report.
8. The Commission reserves the right to modify the conditions of this Licence including its cancellation without prior notice.

REPUBLIC OF KENYA

NACOSTI

National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No.A 16597

CONDITIONS: see back page

APPENDIX III

LETTER OF AUTHORIZATION

NACOSTI

NATIONAL COMMISSION FORSCIENCE, TECHNOLOGY ANDINNOVATION

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

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No **NACOSTI/P/17/25090/20101**

Date: **22nd November, 2017**

Admolla Ochola Sime
University of Nairobi
P.O. Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Assessment of the factors affecting farmers' involvement in environmental conservation in Gatundu North Sub-County, Kiambu County,"*** I am pleased to inform you that you have been authorized to undertake research in **Kiambu County** for the period ending **20th November, 2018.**

You are advised to report to **the County Commissioner and the County Director of Education, Kiambu 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.

GP Kalerwa

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

Copy to:

The County Commissioner
Kiambu County.

The County Director of Education
Kiambu County.

National Commission for Science, Technology and Innovation is ISO9001:2008 Certified

APPENDIX IV

A COPY OF PLAGIARISM TEST

ASSESSMENT OF THE FACTORS AFFECTING FARMERS' INVOLVEMENT IN ENVIRONMENTAL CONSERVATION IN GATUNDU NORTH SUB-COUNTY, KIAMBU COUNTY.

ORIGINALITY REPORT

12%	9%	5%	7%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	en.wikipedia.org Internet Source	1%
2	ijese.com Internet Source	1%
3	www.drylands-group.org Internet Source	1%
4	Submitted to Strathmore University Student Paper	<1%
5	www.ijsrp.org Internet Source	<1%
6	library.wur.nl Internet Source	<1%
7	www.dr.sulaikha.com Internet Source	<1%
8	Jafari R. Kideghesho. "Factors influencing conservation attitudes of local people in	<1%

APPENDIX V

DECLARATION OF ORIGINALITY FORM

Declaration Form for Students

UNIVERSITY OF NAIROBI

Declaration of Originality Form

This form must be completed and signed for all works submitted to the University for examination.

Name of Student:	.....
Registration No:	.....
College:	.....
Faculty/School/Institute:	.....
Department:	.....
Course Name:	.....
Title of the work:	.....

DECLARATION

1. I understand what Plagiarism is and I am aware of the University's policy in this regard.
2. I declare that this .....(Thesis , project, essay, assignment, paper, report etc) is my original work and has not been submitted elsewhere for examination, award of a degree or publication. Where other people's work, or my own work has been used, this has properly been acknowledged and referenced in accordance with the University of Nairobi's requirements.
3. I have not sought or used the services of any professional agencies to produce this work.
4. I have not allowed, and shall not allow anyone to copy my work with the intention of passing it off as his/her own.
5. I understand that any false claim in respect of this work shall result in disciplinary action in accordance with University Plagiarism Policy.

Signature: .....

Date: .....