SMALLHOLDER FARMERS' PERCEPTIONS ON ADOPTION OF ORGANIC FARMING PRACTICES IN KISII CENTRAL SUB - COUNTY, KISII COUNTY, KENYA

VIVIAN M. ARERI

A Thesis Submitted to the Graduate School in Partial Fulfillment of the Requirements for the Master of Science Degree in Geography of Egerton University

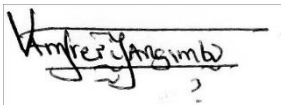
EGERTON UNIVERSITY

AUGUST, 2023

DECLARATION AND RECOMMENDATION

Declaration

This thesis is my original work and has not been presented for an award of a degree in any other University.

Signature  Date: **2023-08-23**

Vivian M. Areri

NM13/03574/13

Recommendation

This thesis has been submitted for examination with our approval as University supervisors.

Signature..... Date.....

Dr. Humphreys W. Obulinji, PhD.

Department of Geography

Egerton University

Signature.... ..... Date....23.08.2023.....

Dr. Wambongo C. S. Recha, Ph.D.

Department of Geography, Environment and Development Studies

Bomet University College

COPYRIGHT

DEDICATION

This thesis is dedicated to

my dear husband Gideon N. Oyagi and

our children: Steve, Tonny and Tatiana

whose prayers, efforts and support were not in vain.

ACKNOWLEDGEMENTS

I would like to thank the Almighty God for the gift of life and good health throughout the research period. Also, many thanks to Egerton University for the opportunity to study and utilize their facilities. My uttermost appreciation to my supervisors Dr. Humphreys W. Obulinji and Dr. Wambongo C. S. Recha for their quality time and constructive criticism that shaped this study. The professional advise of Prof. Francis Wegulo Prof. Ondimu, the late Dr. Mironga and Dr. Janepha Kumba of Geography Department were equally found useful in informing this research. Special thanks go to the administrators of Kisii Central sub-County and the respondents for their time and valuable input in this study. Finally I would like to appreciate my family and friends for their support throughout the period of this work. God bless you all abundantly.

ABSTRACT

Organic farming (OF) is a form of sustainable agricultural production that is gaining popularity globally, including Africa. This is mainly because products from OF are known to contribute to: healthy living, increase in farm income, and safe and sustainable environments. It is in view of these benefits that OF systems are encouraged across countries in Sub-Saharan Africa, including Kenya. For Kenya to derive more gains from OF, there is need to understand the perceptions of smallholder farmers (SHF) on adoption of OF practices for their individual as well as society's benefits. This study sought to: determine the extent to which SHFs' perception influence adoption of OF practices; determine the influence of SHFs' socio-economic characteristics on adoption of OF and examine the socio-economic and environmental effects of OF as perceived by smallholder farmers, in Kisii Central Sub – County. The study employed descriptive survey research design which enabled collection of data from a sample of 306 SHFs from a population of 6,025 farming households. Proportionate sampling technique was used to select SHFs while purposive sampling was used to select key informants. Data was collected using questionnaires and interviews and later analyzed using the statistical techniques including frequencies, percentages and correlation. Results indicated that nearly all (97%) of SHFs are practicing OF with use of animal manure (87%), crop rotation (72%) and cover crops (55%) as the predominant practices. The high number of farmers practicing OF can be attributed to information on OF farming being easily available (52%); strong agreement on positive effects of OF on environment (69%), and the anticipated future demand for OF products (84%). Majority of respondents, farm size (79%), income (73%), household size (67%) and age (66%) are the lead socio-economic characteristics influencing adoption of OF. The study further established that education significantly contributed to SHFs' use of animal manure (r=.114) and cover crop (r=.121). To a majority, health benefits (61%), income (46%) and neighbour's influence (41%) are the leading motivational factors to adoption and practice of OF. There exists awareness among SHFs that OF practices such as use of legumes (41.15%), green manure (42.35%) and use of animal manure (50.8%) improved soil fertility. The study established a significant relationship between social benefits of OF with crop rotation (r= 0.12) and water conservation (r =0.13). This study recommends that promoters of OF should take note of the positive rating and perception of OF. In addition, promotion of OF practices should take into account income, household size and age of farmers. Finally, there should be creation of awareness among farmers on socio-economic and environmental benefits of OF.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF ACRONYMS AND ABBREVIATIONS

FAO:	Food Agriculture Organization
GEM:	Global Environmental Management
GoK:	Government of Kenya
IFAD:	International Fund for Agricultural Development
IFOAM:	International Federation of Organic farming Movements
IFPRI:	International Food Policy Research Institute
KARLO:	Kenya agricultural Research Livestock Organization
KIOA:	Kenya Institute of Organic Agriculture
KIOF:	Kenya Institute of Organic Farming
KIPPRA:	Kenya Institute for Public Policy Research and Analysis
KNBS:	Kenya National Bureau of Statistics
KOAN:	Kenya Organic Agriculture Network
KOF:	Kenya Organic Farming
MoA:	Ministry of Agriculture
NEMA:	National Environmental Management Authority
NFSNP:	National Food Security and Nutrition Policy
NGOs:	Non-governmental organizations
OF:	Organic Farming
SDGs:	Sustainable Development Goals
SHF:	Smallholder farmers
SPSS:	Statistical Package for Social Science
TOF:	The Organic Farmer
TPA:	Theory of Planned Action
TRA:	Theory of Reasoned Action
UNEP:	United Nations Environmental Program
US$:	United States Dollar
USDA SARE:	United States Department of Agriculture-Sustainable Agriculture Research and Education
USDA-NOP:	United States Department of Agriculture- National Organic Programme

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Globally, organic farming (OF) practices have continued to increase (FiBL & IFOAM, 2021). It is estimated that the OF global annual production growth rate is between 20 and 30 percent (IFOAM, 2011). Data shows that the land area under organic agriculture increased to 72.3 million hectares in the year 2019, constituting 1.5% of land covered in 187 countries of the world surveyed (FiBL & IFOAM, 2021). Land devoted to organic farming accounted for 2.3% of the total agricultural land (35 million hectares) in 2008 worldwide (Willer *et al.,* 2009). It is also evident that over 120 countries have adopted organic practices (Willer & Yussefi, 2007). Estimates by FiBL and IFOAM (2016) indicate that approximately 17.7 million hectares were under organic farmland within 170 countries, accounting for only 0.98 percent of farmland worldwide.

The rise and increase in attention to organic farming in parts of the world is attributed to various factors. First, the practice is seen as a means of diversifying agricultural production with the aim of improving productivity, farm income and food as well as environmental safety (Patidar & Patidar, 2015). Second is the contribution of organic farming products to family health. Other factors include concern for livestock health, a strong land stewardship ethic, peer pressure, a desire for independence, and quality of life issues (Patidar & Patidar, 2015).

Statistics by Food and Agriculture Organization (FAO) found that that there are more than 608 million farmers around the world (FAO, 2021). It is estimated that about 3.1 million producers were involved in production of different organic crops globally on 72.3 million hectares in 2019 (IFOAM, 2021). It is also evident that the demand for organic products worldwide is on the increase. However, the demand remains subdued, partly because of high product prices which is up to five times as much as conventional foods. FiBL and IFOAM (2021) indicate that in 2019 there was approximately 3.1 million with organic sales growing globally to reach a market size of 106 billion euros. In addition, statistics show that the revenue from organic products in the global market reached US$ 72billion in 1999, and has increased of almost 500% folds in 2015 (FiBL & IFOAM, 2016). Further, the global demand

for organic products remains robust, with sales increasing to over 106 Billion euros in 2019 (Nechaev *et al.*, 2018).

The countries with the most organic agricultural land are Australia (35.7 million hectares), Argentina (3.7 million hectares) and the Spain (2.4 million hectares). The highest shares of organic agricultural land are in the Oceania (9.6%), Europe (3.3%) and European Union (8.1%) (FiBL & IFOAM, 2021). The regions with the largest areas of organically managed agricultural land are Oceania (12.2 million hectares of 32 percent of the global organic farmland), and Latin America (6.8 m ha or 18%). Eighty nine point one (89.1) m ha of agricultural land are managed organically by 1.8 m producers (FiBL & IFOAM, 2021). Comparative data on OF in different parts of the world reveal growth in new organic farm area between 1999 to 2019. For instance, IFOAM and FiBL, (2021) report that OF in Northern America grew by 47.5%. In Africa, the rapid growth of organic farming sector is linked to economic and socio-cultural development (Willer & Kilcher, 2013). Willer and Kilcher, (2013) noted that in Africa there is slightly more than one million hectares of certified organic agricultural land, most of it in Uganda (228,000 ha), Tunisia (178,500 ha) and Ethiopia (140,500 ha).

Whereas the increase in organic farming has been on the rise in most industrialized countries, the practice is only gaining popularity in developing countries (IFOAM & FiLB, 2020). Its popularity in Africa is partly in view of the recognition of its contribution to the achievement of Sustainable Development Goals (SDGs) III and VIII on improved health and food security and economic development, respectively, and generally to the environmental conservation (Setboonsarng & Gregorio, 2017).

Over 481 organizations globally including International Fund for Agricultural Development (IFAD), International Federation of Organic Agricultural Movements (IFOAM), International Food Policy Research Institute (IFPRI), Food and Agriculture Organization (FAO) and Non-Governmental Organizations (NGOs) opened up to the idea that Organic farming (OF) and offer organic certification services (IFOAM & FiBL, 2022). Organic farming was identified at FAO and IFOAM forum as a sustainable agriculture approach since it conserves resources, it is environmentally non-degrading, is technically appropriate, and economically and socially acceptable (IFOAM, 2011). Organic farming practices worldwide aim to optimize quality in all aspects of agriculture and environment while basing upon sustainable ecosystem, safe food, good nutrition, animal welfare and social justice (IFOAM, 2011).

The size of land under organic farming in Africa is more than 2.0 million hectares (0.2 percent of agricultural lands). This involves mainly permanent crops such as olives, tropical fruits, nuts, coffee, cocoa but also cotton, herbs/spices and so on (IFOAM & FiBL, 2022). Comparative data on organic farming in 35 countries indicate that Tunisia has the largest organic area (Willer *et al.*, 2021). They further found out that the main countries with certified organic farms are: Sudan (650 farms), Kenya (15,815 farms), Uganda (45,000 farms), Tunisia (515 farms), Tanzania (43,791 farms) and Zambia (9,248 farms). Most certified organic production is geared toward export markets, mainly the European Union (FiBL-IFOAM Report, 2017). The continent, therefore, offers great potential basis for the development of non-certified OF; based on improved agro ecological management of traditional African agriculture, which is a de facto low external input system, practiced by smallholders who cannot afford expensive technologies and who lack functioning markets (KOAN Report, 2014).

Organic farming in Kenya, started in the early 1980s mostly championed by rural Non-Governmental Organizations, Faith Based Organizations, Community Based Organizations and individual farmers as a low cost approach in response to declining agricultural productivity, rising poverty and food insecurity (Kenya Organic Agriculture Network - Strategic Plan 2010-2014). Kenya Organic Agriculture Network (KOAN), Kenya Institute of Organic Agriculture (KIOA) and Kenya Organic Farming (KOF) have been at the fore-front in promoting OF practices publication on organic farming practices in the country and marketing organic products in various parts of the country.

Kenya has relatively small number of farmers practicing OF although the sector is growing fast mainly led by NGOs and private sectors, including companies that grow organic produce for export (Ayuya *et al.,* 2015). More than 85 per cent of organic produce in Kenya is exported mainly to Europe, the Middle East, Asia and the Far East (The Organic Farmer Magazine, 2014). There are more than 200,000 organic farmers in Kenya. About 12,647 farmers are involved in production of vegetables, fruits, chillies, coffee, tea, nuts, herbs and spices on 104,211 hectares (Willer & Lernoud, 2017). The organic area in Kenya is about 301,128 hectares mainly consisting of organic agricultural land (123,744 hectares) and 177,384 of wild and extensive production (IFOAM & FiBL, 2022). Farmers in different parts of the country undertake different types of organic production. For instance, indigenous vegetables, rosemary, macadamia and raspberries are common organic products in Mt. Kenya

region; coconut oil and avocado oil in the Coast region, chamomile, carcade, honey and wax in the Eastern region; indigenous vegetable, tomatoes and kales in Nairobi; straw berry, milk, coriander and borage, in the Rift-Valley region (Willer & Lernoud, 2017). The OF practice is also being adopted within the urban, in-built and town informal settlements (Gikunda *et al.*, 2020).

Kisii Central Sub - County, in Kisii County is a rich agricultural area dominated by smallholder crop and animal rearing practices. Agriculture in the county is rain fed, consist of food and cash crop farming and small scale. Agriculture is the main economic activity in Kisii County which employs over 70 percent of the workforce directly or indirectly. According to Kisii County Integrated Development Plan 2018-2022, agriculture sector in Kisii faces numerouses challenges including high population density, outdated farming practices, poor eating habits and dwindling farm sizes. Most farmers in Kisii Central Sub - County mix traditional farming with adaptations of conventional technologies that suit their farming systems which lend themselves well to conversion to organic farming (Kisii County Integrated Development Plan 2018-2022). This study focuses on perception of smallholder farmers' adoption on organic farming in Kisii Central sub - County, Kisii County. The study provide important insights and understanding characteristics of the farmers and the effects the progressive spread of organic farming practices as a sustainable agricultural approach in the study area, in other areas of Kenya, and indeed in other countries.

1.2 Statement of the Problem

There is need for sustainable agricultural practices in developing countries. In Kenya various agricultural stakeholders, including the National Government, Non-Governmental Organizations, consumers and farmers are in continuous discussions on the acceptable sustainable agricultural methods that increase farm yields as the socio-economic and environmental aspects are considered. Organic farming (OF) practices and products are rapidly receiving wider acceptance among farmers and consumers across the world including Kenya. This is because OF improves farm yields using locally available inputs, its products are health-friendly, socio-economically viable and have little or no adverse impacts to the soil and environment.

Despite the efforts made to promote organic farming (OF) by various stakeholders, little research has been conducted in Kisii Central sub-county focusing on its aspects. Available evidences shows that studies conducted in Kisii County focused on farming systems,

economics of agriculture, food security and the agricultural land use (Kumba, 2015). There exists, therefore, paucity of information on how smallholder farmers' perception and socio-economic characteristics affect adoption of the practices. Also, information on the socio-economic and environmental effects as perceived by the smallholder farmers is lacking in the study area. Consequently, this study investigated and generated information useful in formulation of policies and planning for sustainable agricultural development and in particular OF.

1.3 Objectives of the Study

1.3.1 Broad Objective

The broad objective of this study is to provide understanding of how OF among smallholder farmers can be enhanced to contribute to sustainable agricultural development in Kisii Central sub-county, Kenya.

1.3.2 Specific Objective

i. To determine the extent to which smallholder farmers' perception influence adoption of organic farming practices in Kisii Central Sub - County.

ii. To determine the influence of smallholder farmer's socio-economic characteristics on adoption of organic agriculture farming in the study area.

iii. To examine the socio-economic and environmental effects of organic farming as perceived by smallholder farmers in Kisii Central Sub - County.

1.3.3 Research Questions

i. To what extent do the smallholder farmers' perceptions influence the adoption of organic farming practices in Kisii Central Sub - County?

ii. What is the influence of the small holder farmers' socio-economic characteristics on adoption of organic agriculture farming in the study area?

iii. What are the socio-economic and the environmental effects of organic farming as perceived by smallholder farmers in Kisii Central Sub - County?

1.4 Justification of the Study

Organic farming and products are gaining popularity as a result of their beneficial impacts to the environment and human health. As an agricultural production system it improves farm

output, protect the environment and humans from harmful effects to their health resulting from use of chemicals Various stakeholders including farmers, consumers, the Government of Kenya, Faith Based Organizations, Community Based Organization and Non-Governmental Organizations, among others, have played important roles geared towards encouraging and promoting OF practices (Kenya Organic Agriculture Network - Strategic Plan 2010-2014). Although significant achievements are being made on the adoption and practice of organic farming, the progress and perception of smallholder farmers' on organic farming adoption and practices have been uneven across regions and countries leaving significant gaps (IFOAM, 2011).

This study contribute to the achievement of Sustainable Development Goals (SDG) 2015 - 2030, Food and Nutrition Security, which is one of the components of the National Government's Big Four agenda,, Kenya's Agriculture Act Cap 318 on stable agriculture, soil conservation and fertility and development of agricultural land, the National Food Security and Nutrition Policy (NFSNP) 2017-2022 on achievement of food security in a sustainable way and Climate Smart Agriculture Implementation Framework (KCSAIF) 2018-2019 on agricultural productivity and sustainable building of resilience of the national agricultural systems. These pieces of agricultural legislations and policies emphasize among other things: diversifying agricultural production, improving productivity, farm income and food as well as environmental safety. These constitute some goals of OF. Most notably, this study will make contribution to SDG number 2 which aims at ending hunger, achieving food security and nutrition and promote sustainable agriculture, SDG number 12 on sustainable consumption and production, SGD 13 that seek to combat climate change and its impacts and SDG 15 that seeks to promote protection, restoration and sustainable use of terrestrial ecosystems among others.

Furthermore, the study sought to verify OF as an innovative approach and intervention that can be used in solving various challenges in the socio-economic and environmental issues in the agricultural sector. This research is in line with the government's agenda to ensure food and nutrition security in the country. It gives information on the perception of the smallholder farmers' towards OF as a form of sustainable agriculture.

This study provides insights and understanding on the spread of organic farming practices by smallholder farmers (SHF) as a sustainable agricultural approach in Kisii Central Sub-County, Kisii County. The perception of the SHF on the adoption of organic farming

practices within the study area was assessed. This was by determining the SHF's knowledge; opinion; availability of organic farming information, and the extent of its adoption and practices. Examination of the socio-economic characteristics of SHF and environmental and socio-economic effects of organic farming as perceived by SHF helped in understanding it's influence on adoption of organic farming. Data emerging from assessment of perception of SHF's adoption of organic farming in the study area will offer guidance to other OF researchers in the region and elsewhere. In addition, findings from this research are expected to contribute to policy formulation within the agricultural sector and in particular policies on organic farming as a sustainable agricultural practice. Further, sharing the findings with smallholder farmers will serve to build their capacity to be better as practitioners of organic farming; and thereby maximize on the benefits of the practice in the study area.

Agriculture has various components including livestock farming, crop farming, mixed farming, subsistence farming and organic farming among others (Sayre, 2009). The geography of agriculture varies with the components in a number of ways. Agricultural geography is concerned with the spatial relationships between agriculture and human livelihood. The geographical factors include natural (climate, weather, altitude and soil), economic (market, labour, transportation) and political (political system) factors influence farming practices. For instance, organic farming (OF) takes into account the spatial distribution and patterns of farming practices without use of agro-chemicals (Kamau *et al.*, 2018). Thus, the OF is in harmony with nature as it is friendly to the environment and human health. The distribution and demand for organic farming food are growing and picking up gradually in most parts of the world. Of importance, it has grown out of efforts to create the best possible relationship between the earth and men (Meena *et al.*, 2013). Hence OF is key major topic in agricultural geography.

1.5 Scope and Limitations of the Study

This study focused on the perception of the smallholder farmers' adoption of organic farming practices in Kisii Central sub-County with the most concentration of organic farming in Kisii County. Data was collected in Keumbu Division which has the highest small holder farmers between November 2019 and May 2021. Birongo and Ibeno locations with the highest and growing number of OF farmers comprised the study area. Thus, inquiries were limited to knowledge and understanding of the smallholder farmers. Organic farming can be done by both large and smallholder farmers. However, this study was limited to smallholder farmers

who are the majority in the study area because of the low population density. Organic farming adoption can be influenced by environmental, socio-economic, political and government policies among other constituents. However, in this study, the socio-economic characteristics of the SHF were the focus. There are various effects of organic farming practices including biological, climatic, socio-economic and environmental among others. This study, however, limited itself to assessing the socio-economic and environmental effects of OF as perceived by smallholder farmers in the proposed study area.

Besides, data collected may produce biased results as the perception of the key informants may be different from those of the smallholder farmers. Therefore, analysis of data captured limited information from the respondents. To counter this challenge, the researcher complemented the finding with secondary data from existing literature.

The main limitation experienced during the study included: Some respondents were nervous in revealing their views on their farming practices. The researcher explained clearly the objective of the study and assured the respondent confidentiality and writing their name was optional. In addition, the respondents were unable to differentiate the types of organic farming. The limitation was addressed by enlightening the respondents on the content of the questionnaire. The research was carried out during COVID 19 pandemic period which required social distancing, wearing of masks and washing of hands or use of hand sanitizers. Thus, the researcher had to avoid crowding of the respondents, purchase masks and hand sanitizers for the respondents.

1.6 Assumptions of the Study

The study assumed that all small-holder farmers in the study area carried out their farming activities in more or less similar socio-economic and physical environment, i.e., equal access to agricultural services, markets, technology, credit, same culture and environment.

1.7 Operational Definition of the Study Variables

Adoption: is the act of starting to use something new. In this study adoption among the smallholder farmers will imply choosing the different organic farming practices.

Attitude: In this study attitude refers to the opinions and views of the smallholder farmer on organic farming. Level of information, knowledge and views on organic farming in addition to the assessment of organic products was important in measuring attitude in this study.

Awareness: This refers to having knowledge. In this study awareness refers to the act of smallholder farmers knowing aspects of organic farming. It is assessed by the measure of the present and future demand of OF product by the respondents and recognition of the practices among others.

Conventional Agriculture: is a type of farming that involves use of synthetic inputs such as artificial fertilizers to improve soil fertility, and inorganic herbicides for controlling pests.

Certified organic farming: is an organic farming system that has been verified and confirmed by a third party (certification body) in terms of meeting set of organic standards of production, handling, and storage and processing

Household size: this refers to the number of persons residing in a dwelling. In this study, household size are members of the smallholder farmers.

Knowledge: In this study, knowledge refers to information on OF transmitted and shared through formal or informal education and personal experiences by and among the SHF in the study area. Thus, knowledge in this study was based on the level of education i.e,. no formal education, primary education, secondary education, college and university.

Non-certified organic farming: is an organic farming system that has not been verified and confirmed by a third party (certification body) in terms of meeting set of organic standards of production, handling, and storage and processing

Organic farming: is farming that involves the use of organic manure and employment of techniques such as intercropping, crop rotation and biological pest control with an aim of improving farm output, protecting the environment and humans from harmful effects to their health resulting from use of chemicals and pesticides.

Perception: is the opinion, understanding, belief of smallholder farmers. In this study perception is conceptualized as the way an individual interprets, regards, or understands organic farming. Thus, in this study perception on OF included availability of information such as easily available, available, not easily available and hardly available.

Smallholder farmers: are farmers who practice agriculture on small pieces of land, ranging between 0.5 and 5 hectares that are adjacent to their households (Abraham & Pingali, 2020). In this study, however, smallholder farmers refer to the number of households practicing mixed farming on pieces of land of less than one hectare.

Sustainable agriculture: is a system of farming that maintains and preserves the agriculture base of soil, water, and atmosphere thus enabling the future generations to have the capacity to feed them with adequate supply of safe food

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature on the organic farming, including elements of organic farming, perception on organic farming, socio-economic characteristics of organic farmers and socio-economic and environmental effects of organic farming. Also, covered in the chapter are theoretical framework and conceptual framework.

2.2 Organic Farming

According to IFOAM (2020), organic farming (OF) was defined as a sustainable and environmental friendly agricultural production system that promotes economic, environmental, social and cultural benefits of food and fibers production. During the IFOAM assembly, there was discussion on the concept, components and statistical growth of organic farming. The concept of organic farming practices refer to organic farm as an organism in which all the component parts (the soil minerals, plants, organic matter, micro-organisms, insects, animals including humans) interact to create a coherent and stable whole (Adamchak, 2021). Organic farming is a production system managed to respond to local specific conditions by integrating culture, biological and mechanical practices that foster cycling of resources, promotion of ecological balance and conservation of biodiversity (Bouttes *et al.*, 2019).

Organic farming relies on natural processes such as crops rotation, animal manure, green manure, pest-free plant varieties, companion planting, agro-forestry and integrated pest management among others thus controlling pests, weeds and diseases; maintaining health of soil and that of all the living organisms (IFOAM, 2020). It is based on natural cycles and systems adapted to local conditions, combining tradition, innovation, modern agro-ecological research and science in production systems that promote fair relations along supply chains (FAO, 2017). Organic production system is managed by integrating cultural, biological and mechanical practices that foster cycling of resources, promote ecological balance and conserve biodiversity. This works under the four principles; health, care, fairness and ecology (IFOAM, 2020).

Organic farming as a practice started 1000 years ago and has roots in traditional agriculture (Paull, 2014). It was practiced during the ancient civilizations such as Mesopotamia and

Hwang Ho basin (Behera *et al.,* 2012). This was necessitated by the desire for the smallholder farmers to convert from the conventional farming characterized by use of synthetic chemical fertilizers, fungicides, insecticides, and herbicides during farming (Azarbad, 2022). The farming system increases food production at a lower cost. However, conventional farming has been criticized for being a contributor to greenhouse gas emissions, soil erosion, water pollution, and related threats to human health. Thus, organic farming expanded worldwide promoted by the then governments and Non-Government Organizations in 1990s (FAO, 2017). Organic farming was and is continuously being developed and improved by farmers, scientists and concerned people all over the world (Njeru, 2016). IFOAM and FAO (1996) set guidelines for the production, processing, labeling and marketing of organically produced food (FAO, 2008 - though under revision). Organic scientists and farmers in Africa have integrated the age-long traditional organic system to enable a holistic development of the organic sectors. According to Aulakh and Ravisankar (2017), OF as a production system, excludes the use of synthetically manufactured fertilizer, pesticides, growth regulators and livestock feed additives. It applies simple eco-friendly techniques in growing crops and use of the locally available resources (Kamau *et al.,* 2018). Some of the agricultural inputs needed for organic agriculture production include biological fertilizers (compost) and bio-fungicides, bio-insecticides, bio-herbicides, and biological nutrition (Soytong *et al.,* 2021).

The other combination techniques used in organic farming are cultural practice, crop rotation, inter-cropping, organic amendment, biochar technology (Soytong *et al.,* 2021). The use of net, greenhouse in closed or semi-closed system to control temperature and relative humidity are also applied. The herbs or medicinal plants, and natural wood vineagar to eliminate plant pathogens and insects are introduced too. The light and yellow traps, natural pheromones, natural sulfur, white oil, repellent plants, neem-oil etc. are equally recommended.

A wide range of studies have demonstrated the advantageous aspects of OF in terms of ecosystem functioning, soil fertility conservation and economic impact (Ferreira *et al.,* 2020). Organic farming system has been found to have environmental, social and economic benefits in Congo (Lambrecht *et al.,* 2016). OF contributes towards maintaining the fertility demands of various crops to avoid excessive depletion of soil nutrients. The main aim of OF is to create sustainable agricultural production system. It stabilizes yields and enables achievement of food security (Ferreira *et al.,* 2020). According to IFOAM (2020), OF produces enough food, on a global per capita basis, to sustain the current and potentially larger human

population without allocating more land under agricultural production. Thus, the focus of organic farming is to provide sustainable solutions, such as the protection of land and procedures to achieve, sustain, and improve environmental stability (Smith *et al.,* 2015).

Organic farming system work to diversify agriculture by practicing poly-culture where varieties of crops are grown on a single piece of land (IFOAM, 2020). This improves soil health by increasing soil nutrients while some crops act as pest repellents a form of bio-pest control. A concept of mixed farming in OF has been proposed by among others (Palaniappan & Annadurai 2018). This involves integration of livestock and crops on a single farm. The integration helps improve soil fertility through recycling of organic materials such as crop residues, farmyard manure, composts and green manure thus limiting synthetic fertilizers.

Another method of mixed farming associated with OF is crop rotation (entailing growing one crop per field per season), inter-cropping, mixed cropping or relay cropping. This practice boosts soil fertility, helps in controlling weeds, and reducing soil borne insects. In addition, OF methods incorporate Organic Cycle Optimization which involves farms being managed to minimize the burden of agricultural practices on the environment to save on the loss of biodiversity, high consumption of non-renewable energy resources and pollution (Palaniappan & Annadurai, 2018).

Organic pest control is a recognized component in the practice of organic farming. This involves undertaking various activities such as growing beneficial insects, disease resistant variety of crops and companion crops to control pests without using chemical pesticides and insecticides (Krause *et al.,* 2020). Biological control techniques are used to manage weeds, and insects, and decrease the risk of disease spread (Barratt *et al.,* 2018). Organic farming also includes mixed-forage pastures for livestock, pasture rotation, and alternative health care for the well-being of animals (Moore *et al.,* 2020).

The concepts of biodiversity and ecological balance are integrated into the OF systems as a way of sustaining the environment (Meemken, & Qaim, 2018). Scientists and engineers believe that the key to future sustainability and common heritage is biodiversity. However, one of the greatest challenges confronting humanity lies in understanding, educating, caring, and conserving biodiversity (Romanelli *et al.,* 2015). The OF system propagates management of the production capacity of the agro-ecosystem on comparison to specialization which leads to destruction of mixed and diversified farming. Therefore, OF practices among smallholder

farmers incorporate various methods in meeting the need for food and fibres on the local ecological carrying capacity.

Agroforestry is an agricultural technique based on interactions between trees and crops (Gomiero *et al.*, 2011). It is a system followed by indigenous cultures and is an integral part of organic farming systems in several countries in the tropics for the production of crops such as coffee and cocoa. It relies on vegetation diversification and promotes soil conservation (Ullah *et al*., 2023). The methods are intended to enhance soil, water, and agro-ecosystems, primarily by minimizing soil disturbance, increasing the amount of plant residue on the surface and boosting biodiversity.

The OF technology is frequently regarded as the solution to environmental problems that are related to agriculture as well as food safety as concluded by Adele (2014). Modern technology is also incorporated in OF to create a balanced and sustainable environment for crops' growth (Holt, 2019). Biotechnological advances have led to improvements in hybrid seed design and production, making crops more pest resistant and able to grow larger and faster. Further, new herbicides are more effective in protecting crops than previous herbicides were. However, such advances are mainly available to big farming enterprises, which are usually better able to afford the technology.

2.3 Organic Farming Development in Kenya

Traditionally, farmers across the world used manures without application of synthetic pesticides and fertilizers (Barik, 2017). However, the development of alternative agricultural systems and technologies in Kenya including OF, ecological agriculture, low external input and sustainable agriculture, biological agriculture and biodynamic agriculture started and gained popularity in the 1980s (Kenya Organic Agriculture Network - Strategic Plan 2010-2014). This was as a result of soil fertility depletion, excessive use of synthetic agro-chemical and chemical fertilizer and inadequate natural resources management.

The most prominent Kenya Organic Agriculture partners include KOAN, KIOF, *Nyumbani*, Woodlands Trust 2000, KOF, Bridge Organic Health Restaurant and Green Dream Organic Shop (GEM, 2007). Various institutions and organizations including Kenya Institute of Organic Farming which promote organic and sustainable farming systems started in the 1980s (Mwaura, 2007; Savala *et al.*,2003; Taylor, 2006). In addition, NGOs, Faith Based Organizations, and Community Based Organizations have made tremendous efforts to

promote and spread OF in Kenya (KOAN, 2010). This has been done through diversification of food production at household level and use of intensive ecological methods. However, this has changed over time to integrate commercial approaches and adoption by large scale farmers (KOAN & GoK, 2010).

Kenya Organic Agriculture Network (KOAN) is an organization mandated to facilitate the coordination of the organic sub-sector in the country (Kenya Organic Agriculture Network (KOAN) Strategic Plan 2010 – 2014). KOAN aims to increase income among smallholder farmers through sustainable land use and access to more rewarding and fairer markets. It is an umbrella network comprising of smallholder and large scale commercial farmers, traders, processors, NGOs, CBOs, training institutions, consumers and certifiers (Kledal *et al.*, 2010). The organization supports OF industry that contributes to healthy environment and livelihood security. The organization has been able to conduct technical training for small holder farmers, raised awareness and training on standards and certification to be complied by the farmers, facilitated OA linkages among policy makers, researchers, producer, traders, exporters, consumers and trainers regionally and globally, and has established information reference point on OA in the country. KOAN also plays an important role in creation of awareness, facilitations and campaigns among the OA stakeholders based on the European Union and United States standards and certifications for organic products for the national, regional and international markets. KOAN coordinates the harmonization of the East Africa Organic Products Standards in Kenya which are later adopted by Kenya Bureau of Standards. Furthermore, KOAN as an OA reference point publishes and distributes newsletters, manuals, booklets and other resource materials relevant for organic operations in the country. It also has an active website from which relevant materials on OF can be found.

The Kenya organic sector is relatively small but expanding fast especially in the growing of fruits and vegetables (IFOAM & FiLB, 2018). About 12,647 farmers are involved in production of vegetables, fruits, chillies, coffee, tea, nuts, herbs and spices cultivating on 154,488 ha (IFOAM & FiLB, 2021). Most of the production is for the export market with only 45 producers certified for selling in the domestic market (UNEP-UNCTAD CBTF, 2011). The domestic market price premiums range from 15% to 150%, while the value of domestic organic market is estimated to be Ksh. 0.25 billion with the potential to grow rapidly (IFOAM & FiLB, 2018).

2.4 Farmers' Perception on Organic Farming

The decision to participate in new agricultural technologies depends on farmer's perception which is an important factor in influencing adoption (Chouichom *et al.,* 2010). Assessing farmers' perceptions is an important means to evaluate their knowledge level on particular farming issues. Perception refers to an individual's current appraisal of an object or program (Tress & Tress, 2001). People base their perceptions on past experience and knowledge; if a person has limited knowledge and experience about a topic then he cannot accurately perceive it or form an opinion on it. If farmers are to adopt sustainable agricultural practices, they need to believe that the practices are important.

Smallholder farmers' (both organic and conventional) perceptions, motivations, and constraints were examined in New Zealand (Fairweather, 1999). A total of 83 farmers took part in the study and their consideration to convert to organic farming was of concern. The study depicted a decision tree that mainly emphasized producers' philosophical, health, financial, and farm management motivations. The importance of regional market characteristics on farmers' motivations to convert to organic production was echoed (Midmore *et al.,* 2001). The marketing and financial viability of organic food production and farmers' concerns for the environment seem to be the most notable motivations in farmers' conversion to organic agriculture.

Four different categories of motives for organic conversion among Dutch farmers were identified (Lauwere *et al.,* 2004). The categories identified included idealistic, technical, institutional, and economic motives. The economic motives were found to be the least important among all categories of motives in the organic conversion of 36 Dutch farmers. Instead of economic motives, idealistic motives for conversion were cited most frequently among the farmers in the study. Idealistic motives included farmers' pursuit of a challenge, better personal or family health, sustainable farming ideology, and relationships with consumers. Technical motives were cited second most frequently in the study. These included greater cooperation with nature, less chemical use, and better soil health. Furthermore, institutional motives, such as farmers' concern for a positive image and social acceptance were cited third most frequently among the Dutch farmers.

In addition to the work by Lauwere *et al.* (2004), Tress and Tress (2001) also identified several other farmer motivations for conversion into organic farming. These included farmers' desires to improve animal welfare, provide better quality products to consumers,

improve the work environment on farms, and defy the production practices of conventional agriculture. Findings from Lauwere *et al.* (2004) and Tress and Tress (2001) are comparable to that of Padel (2001), which presented a summary of farmer motivations for organic conversion from studies performed during the last 30 years of the 20th Century.

It was also proposed by Rogers (2010), that farmer's perception toward innovation characteristics/attributes is an important consideration in adoption of OF. Thus, if farmers perceive that OF has many advantages compared to conventional farming; they are more inclined to adopt the practice. Rogers (2010) further pointed out that adoption is a decision-making process. In this case, farmers' adoption continuum will consist of being aware or knowledgeable of organic farming technology followed by building a positive or negative perception toward such technology. Rogers (2010) further identified five characteristics of innovations namely; those associated with relative advantage, compatibility, complexity, trial ability, and observer ability. The rate of adoption will depend on individual farmer perceptions on such characteristics. According to Rogers (2010) adoption process is "a mental process through which an individual passes from hearing about an innovation to final adoption". The adoption process in practice does not occur instantaneously; instead a farmer's decision to accept or reject a new technology will involve a sequence of thoughts and decisions.

2.5 Influence of Smallholder Farmers' Socio-economic Characteristics on Adoption of Organic Farming

Integrated model categorizes factors influencing the farmers' decision to adopt a given innovation or technology (Sodjinou, 2011). These include characteristics specific to farmers and their households (e.g. age, knowledge, education, gender, household size and motivation/objective among others) and economic factors (e.g. income, markets and prices of outputs and inputs). Therefore the farmer's background characteristics have influence on the adoption of farming practices (Mignouna *et al.*, 2011).

The relationship between farmers' age and the decision to adopt an innovation or technology is not clear. Age of the farmer can be assumed to be a determinant of adoption of organic farming or not. Kariyasa and Dewi (2011) found out that older farmers are assumed to have gained knowledge and experience over time and are better able to evaluate organic farming practices than younger farmers. A study done on organic fresh fruit and vegetables in Syria found that most farmers were of ages between 40 and 60 years old. This was attributed to

their several years in the practice which makes them unwilling to risk by trying completely new farming methods (Issa & Hamm, 2017). Further, Abebe *et al.* (2013) in Ethiopia found that new technologies in potato farming increased productivity of the young and old smallholder farmers. On contrary, the relationship between age and adoption of organic farming was explained by Mauceri *et al.* (2005) that as farmers grow older, there is an increase in risk aversion and a decreased interest in long term investment in the farm. On the other hand, younger farmers are typically less risk-averse and are more willing to try new farming technologies. Young farmers are eager to participate in agricultural research more than old farmers and therefore become more anxious to adopt new agricultural technologies (Muchangi, 2016).

Gender issues in agricultural technology adoption have been investigated for a long time and most studies have reported mixed evidence regarding the different roles men and women play in technology adoption (Bonabana-Wabbi, 2002). In analyzing the impact of gender on adoption of new agricultural innovation, Mwangi and Kariuki (2015) had found an association between gender and probability of adoption in Kenya. On the other hand, gender affects adoption of OF practices since the head of the household who are men and in most cases the primary decision maker on the type of farming practice to adopt and control over vital production resources than women due to socio-cultural values and norms (Omonona *et al*., 2006). For instance, a study by Lavison (2013) on adoption of organic farming practices indicated that male farmers were more likely to adopt organic fertilizer unlike their female counterparts. In addition, decisions made within households depend upon the characteristics of each producer rather those of the household head (Doss *et al*., 2003). On the contrary, Muchangi (2016) found out that in Embu, Kenya women do most of the farm work unlike their male counterparts and as a result make more reliable farming decisions including adoption of organic farming practices.

Household size is simply used as a measure of labor availability. It determines adoption process in that, a larger household have the capacity to relax the labor constraints required during introduction of new technology (Mignouna *et al.*, 2011). Authors have analyzed household size as one of important determinant of OF adoption. For instance, the production of organic cotton is more labor-intensive than conventional cotton farming especially application of organic inputs. This implies that the availability of labor will positively affect the adoption of organic cotton (Sodjinou *et al*., 2015).

Education of the farmer has been assumed to have a positive influence on farmers' decision to adopt organic farming. Education enables the farmers to assess the relative benefits and risks from using alternative complex technologies and therefore make rational decision on farming (Muchangi, 2016). Also, it may widen their scope of understanding the rationale behind adoption of all the technology components contained in a package. Education increases managerial competence, thereby enhancing the ability to assess, comprehend and respond to new ideas (Muchangi, 2016). It also enables the farmers to choose wisely from a stock of available technologies. Education level of a farmer increases his ability to obtain; process and use information relevant to adoption of a new farming technologies including OF (Mignouna *et al*., 2011). In addition, education may also enhance farmers' ability to efficiently allocate inputs across competing uses and to gain more knowledge about adverse effects of conventional farming (Sodjinou *et al*., 2015). A study by Ajewole (2010) on adoption of organic fertilizers found that the level of education had a positive and significant influence on its adoption. This is because higher education influences respondents' attitudes and thoughts making them more open, rational and able to analyze the benefits of OF (Waller *et al*., 1998). A study conducted by Obedy (2012) in Bungoma on organic soil management practices found that training exposes farmers to a wide range of ideas which enable them to improve agricultural production. Other studies that have reported a positive relationship between education and adoption include Rahm and Huffman (1984) on reduced tillage, Roberts *et al*. (2004) on precision farming and Traore (1998) on on-farm adoption of conservation tillage.

The smallholder farmers' income variedly influences their adoption of organic farming technologies. According to Muchangi (2016), most adopters of organic farming technologies in Embu, Kenya had off-farm income while many non-adopters had no off-farm income. Thus he concluded from his study that an increase of a farmer's income would probably raise the level of adoption of the organic farming practices by improving the ability to buy farm inputs. On the contrary Juliet's (2004) findings that, off-farm income had no positive relationship with intensity of adoption of soil fertility management technologies in Western Kenya. Furthermore, farmers employed outside their local environment have more exposure that result in greater access to information about new agricultural technologies and are therefore more likely to try them out. Odendo *et al.* (2009) found that off-farm incomes positively influenced adoption of manure and compost use. In addition, the availability of cash is essential in hiring farm labour.

Religious value systems play such a pivotal role in agricultural decision-making. They provide a key opportunity through which to promote the dissemination and uptake of new information and practices (Davies *et al.,* 2019). Contemporary Christianity exploits the land as a matter of divine right. According to the scholar, this is exemplified by farmers who see agriculture as an aspect of religion. For instance, the Christians who bless their seeds in church before planting them in the fields seek to "bless" themselves and others through a lifestyle based upon organic growth and consumption. This may be because of the belief that the Supreme Being has commanded them to till the earth and have dominion over it (Lang, 2018). Religious institutions are often the main conduit in African rural community for connecting regional, national and international expertise, training and funding to small holding farmers (Spaling & Vander, 2019). Champions of various agricultural practices may take the form of a church organization and individual religious leaders. For instance, church leaders have substantial influence upon agricultural decision-making and thus could play an influential role in promoting the adoption of OF. In Zimbabwe, Foundations for Farming uses religious narratives to promote soil and water conservation practices such as no-till, mulching and crop rotation (Kassam *et al.,* 2015). In Namibia, it is clear that religion has prevented some farmers from taking steps to practice climate smart agriculture and organic farming (Davies *et al.,* 2019).

2.6 Environmental and Socio-economic Effects of Organic Farming

2.6.1 Environmental Effects of Organic Farming

Organic farming practices including: crops rotation, use of animal manure and green manure promotes water and soil conservation, soil fertility restoration as well as reducing harm to the environment through elimination of synthetic inputs (IFOAM, 2020). This is achieved through reduction of run off by allowing more water percolation using less energy in terms of less fossil fuels for farm machinery, fertilizers, seeds and herbicides (Nejadkoorki, 2012). Therefore, the practices mitigate climate change and lead to environmental conservation.

Several studies around the world have demonstrated the relationship between OF on one hand and the environment on the other. Cranfield *et al*. (2010) found that farmers were concerned with environmental issues of agriculture as they were converting to OF in Iran. On his part Bouttes *et al.* (2019) argued that farmers converted to OF to prevent their farmland in Scotland from being depleted of nutrients. And according to Lamine *et al.* (2014), crop diversification ensures the soil maintains its nutrients and thereby provides healthier produce

to consumers. According to Khor (2009), organic soil management practices within the sub-Saharan Africa lead to reduction of emissions, stabilizes soil organic matter, and increases soil water retention capacity. Work by Njeru (2016) shows that the main objective of the farmers converting to organic farming (OF) was because of the environmental benefits followed by the social and economic benefits.

The organic systems are adaptive to climate change due to application of traditional skills and farmers' knowledge, soil fertility-building techniques and a high degree of diversity (Khor, 2009). Therefore, the OF practices have great mitigation and adaptation potential particularly with regard to increasing yields in areas with medium to low-input agriculture and by enhancing farmers' adaptive capacity. The OF practices including crop rotations, improved farming design, improved crop land management, manure management, maintaining fertile soils and restoration of degraded land, improved water management and agro-forestry build up carbon in the soil thus acting as carbon sink (Bellarby *et al*., 2008). Organic farming practices also contribute to building more soil carbon, increasing water holding capacity, retaining more nitrogen in the soil and increasing biodiversity (Scialabba, 2007). OF favors renewable resources and recycling, returning to the soil the nutrients found in waste products. Organic farming respects the environment's own systems in terms of controlling pests and disease, and in raising crops and livestock. The practice also promotes clean environment, reduction of deforestation, soil erosion, and extinction of plant and animal species (IFOAM, 2011).

2.6.2 Socio-economic Effects of Organic Farming

Through a holistic health approach, OF considers human health in-terms of social, mental, physical and ecological wellbeing exhibited in immunity, resilience and regeneration (Ndungu, 2015). Organic farming improves ecological health because farmers maintain nutrient balances in soil through locally available organic materials or recycled farm wastes (Park *et al.,* 2008). Vigar *et al.* (2019) observed that fruits and vegetables produced organically have increased levels of flavonoids which are reported to protect against cardiovascular disease and other age-related diseases such as dementia.

According to Altenbuchner *et al.* (2018), farmers' profit from organic agriculture, mainly due to soil improvements, through reduced exposure to toxic chemicals and lower input costs, which in turn reduces dependency on money lenders. In addition, Altenbuchner *et al.* (2018), noted that organic agriculture enables smallholder farmers in the study region to improve

their livelihood by providing access to training and by organizing in groups. Important social impacts identified in their study were capacity building and strengthened communities, through training and institution building.

Organic produce have also been found to contain more vitamins, minerals, enzymes and micronutrients compared to conventional produce (Godswill *et al.,*2018). Studies demonstrate organic products as safe with no risk of containing chemical residues (UNEP, 2015). OF system is shown to be more resilient and less risky thereby providing the base for immense potential towards food security (UNEP, 2015). OF promotes food safety and quality. The past decade has been characterized by escalating public concern towards nutrition and health and food safety issues (Crutchfield *et al.,* 2000). As a result, at present, consumers perceive relatively high risks associated with the consumption of conventionally grown produce compared with other public health hazards (Williams & Hammitt, 2000).

Different studies on OF have cited the main motive for engagement in OF as the need to increase food security; while for some it is even a survival strategy (Qiao *et al.,* 2018). Nevertheless, many of the poor also sell some of the organic farming produce, in order to pay for other basic household needs. The practice of organic farming has been associated with returns on investment because it offers farmers a much more secure income than when they rely on only one or two inputs (Adebayo & Oladele, 2014). A study conducted by Setboonsarng and Gregorio (2017) showed that, urban informal OF contributes to household income through the sale of agricultural produce. The income level of organic farmers varies considerably from that of the non-organic farmers. This is because in OF, there is a reduction in the cost of farming as the farmers are able to replace expensive external inputs (including fertilizers and seeds) with organic inputs generally produced on the farm. Farmers practicing OF therefore have comparatively higher incomes than those who do not practice OF. A study conducted in Kibera slums in Kenya by Pascal and Mwende (2009) indicated that, on average, each household that practiced OF increased its weekly income by 5 US dollars. IFOAM and FiLB (2018) and IFOAM (2011) are in agreement that the proceeds from the sales of organic products have over the years been increasing, and will in future; continue to guarantee higher incomes for the practioners.

Organic farming tackles food security by addressing many different causal factors simultaneously (yield, crop diversity, nutritional content) and in particular by building up

natural resources, strengthening communities and improving human capacity (Parrott & Marsden, 2002).

Naika *et al.* (2020) indicate that OF shows great potential to improve domestic food production, empirical data is limited on the relationship between OF and livelihood goals, such as family income and nutrition. Implied here is need for a better understanding of the pathways by which OF may contribute to the welfare of farming families, and the extent to which it improves the security of livelihoods and access to food by vulnerable groups in the region. Donor agencies and other development partners that advocate OF in order to bring welfare benefits to rural people are challenged to critically appraise the contribution that OF has to food security (IFOAM, 2020).

Another important advantage of organic farming is its role in poverty alleviation through creation of employment (Crowder & Reganold, 2015). Unemployed and partially employed persons, youth, home-bound mothers, and elderly persons can supplement family food and income through small-scale OF. This does not require a lot of initial capital like growing of vegetables in sacks that requires little space and farm inputs. The youths can also come up with innovative ways of producing compost from household garbage and human waste. They can in turn use the compost for food production or sell to other organic farmers hence generating some income. Urban OF therefore is an instrument to reduce urban unemployment, because it alleviates urban poverty among those who have migrated to the city but cannot find gainful employment.

2.7 Summary and Gaps in the Literature

Study by Willer and Lernoud (2017) on organic farming show that it has been embraced by most farmers in the developed countries than is the case in developing countries including Kenya. In comparison to the developed countries, developing countries have undertaken less research on various aspects of OF (IFOAM & FiLB, 2021). For instance, whereas research on the extent of farmers' perception towards OF have been extensively carried in various countries including New Zealand, England, and USA, little of the same has been done in Kenya and in particular, within the study area. Not surprisingly very little is known about how smallholder farmers' perception influence adoption of this increasingly important land uses practice. The focus of most OF studies has been on knowledge, experience, ideas, motivation and constraints of organic farming in comparison with conventional farming (Fairweather, 1999; Tress & Tress, 2001). This study intends to seek views of smallholder

organic farmers (SHF) in regard to organic farming. Such information is required to facilitate increased adoption of organic farming in the study area. Thus, the study will provide additional information on organic farming from the SHF.

In addition, research on aspects of organic farming, for instance, the relationship between OF and resource management, economics of organic farming, factors that influence the adoption of organic farming among farmers in Kenya have been conducted (Mwaura, 2007; Ndungu, 2015; Njeru, 2016; Savala *et al*., 2003). However, no study has been carried out on the influence of smallholder farmers' socio-economic characteristics on adoption of organic farming practices in Kenya and in particular this study area.

Organic farming improves various aspects of the environment such as biodiversity conservation, prevention of water, air and soil pollution and climate change as it reduce the use of chemical fertilizers and pesticides (Nejadkoorki, 2012). In light of these effects, public awareness on benefits of organic farming needs to go beyond health and income. The contribution of organic farming to climate change mitigation and energy conservation should be brought to fore. Thus, there is need for broader study on the socio-economic and environmental effects of organic farming practice from the SHFs.

Table 2.1 ***Summary and Gaps in the Literature***

Objective	Studies	Focus	Gaps in the Literature
To determine the extent to which smallholder farmers' perception influence adoption of organic farming practices in Kisii Central Sub - County.	Willer and Lernoud (2017).	World OF	Cover OF in different parts of the world but perception of the smallholder farmers are not considered
	GoK (2020).	Agricultural statistics	Contain statistics on various sectors of the economy of Kenya. However, statistics on organic farming is missing
	Kledal, *et al.* (2010)	Organic farming, history, spread , products and statistics in Kenya	Do not have current information on organic farming in Kenya
		Knowledge, experience, ideas, motivation and constraints of organic farming in comparison with conventional farming	Specific study on perception on organic farming is missing
To determine the influence of smallholder farmer's socio-economic	Ndungu (2015) Njeru (2016)	Economic factors associated with adoption of organic farming Factors influencing	Did not cover the social factors of the smallholder farmers

characteristics on adoption of organic agriculture farming in the study area.		adoption of OF	
To examine the socio-economic and environmental effects of organic farming as perceived by smallholder farmers in Kisii Central Sub - County.	Altenbuchner *et al.* (2018) Nejadkoorki (2012)	Influence of conversion to organic cotton cultivation on the livelihood of smallholder farmers Environmental effects of Organic Farming	Knowledge, attitude, awareness, experience and beliefs of the stallholder farmers are not covered

2.8 Theoretical Framework

This study was guided by Diffusion Theory of Innovation (Rogers, 2010). According to this theory adoption, practice and spread of organic agriculture among various farming communities is a process characterized by: innovators, early and latter adopters, and laggards' phases. With reference to OF the innovators phase involved the initiation of the idea (about OF), and the beginning of adoption and practice of this technology in the early part of the 19th Century.

Applied to the agricultural sector, the Diffusion of Innovation Theory helps us to better understand the process of knowledge transfer and adoption of innovation over the past two centuries when agriculture and food production was undergoing significant changes (Mirela & Dejan, 2014). Agriculture sector has characteristics specific to knowledge, innovation and transfer of new technologies. Knowledge transfer, diffusion and adoption of innovation explain the relationships in changes in farming (Rogers, 2010).

In the context of organic agriculture, diffusion of innovation involves increased volume of indigenous agricultural knowledge over time through certain channels among members of a

social system (Mirela & Dejan, 2014). The development of organic agriculture is a response to environmental, rural development and problems of conventional agriculture (Rogers, 2010).

Increasing global need for food led to the emergent of green revolution where technology and chemicals were introduced in agriculture to improve farm yield and stop global hunger (Mirela & Dejan, 2014). Between 1950s and 1980s, agriculture had been revolutionized by innovative technologies in Britain. Modernization of agriculture concentrated on production of more agricultural output using less rural resources (Mirela & Dejan, 2014). The idea of organic agriculture was borne out of the negative impacts of conventional agriculture, especially after the Second World War (Mirela & Dejan, 2014).

The purpose of organic agriculture regardless of where it practiced in the world has remained focused on ensuring sustainable agricultural production (Rogers, 2010). Thus, organic farming has been expected to contribute towards environmental protection as well as meeting sustainability principles. The sociological frameworks of diffusion of organic farming highlight awareness and knowledge of farmers about what organic farming means, preconditions for engaging in the practice, the benefits associated with the practice evolution and spread of organic production (Mirela & Dejan, 2014). The process of diffusion of knowledge, innovation and skills in organic farming was as a result of: influence of local community, effects of migration, social structures, type and openness of society to innovative process and impacts of different social groups. The diffusion of this innovation on a farm seems much more a back-and-forth process, which is influenced by the farm's internal and external changes. The adoption and diffusion of practices is an ongoing process, and each sector of the farm has its own specific processes of change and innovations.

The development of organic farming was driven by the first organic farmers with the help of few pioneers while OF knowledge and information was distributed through informal networks. At the second stage, there were involvements of opinion leaders thus contributing to greater acceptance of organic farming. In addition, there was closer links of farmers with agricultural institutions making OF innovation acceptable. The early adopters are said to have been more integrated with their communities and other agricultural communities than innovators enabling the diffusion of organic farming. The model considers the availability of information about organic agriculture innovation as an important pre-condition for diffusion and adoption of organic farming. The conversion to organic farming implied better

profitability as a result of cost saving and subsidies and environmental conservation and protection. The diffusion of OF was based on the advantages of the organic system and on new management approaches rather than criticism of conventional agriculture, which would help to minimize the negative reactions amongst conventional farmers (Rogers, 2010).

2.9 Conceptual Framework

The smallholder farmers' perceptions and socio-economic characteristics determine the adoption of organic farming. On the other hand, the socio-economic and environmental effects are perceived by the organic farmers. Therefore, perceptions and socio-economic characteristics of the SHF's are the independent variables. The socio-economic and environmental effects and adoption of OF are dependent variables in this study as shown in figure 2.1.

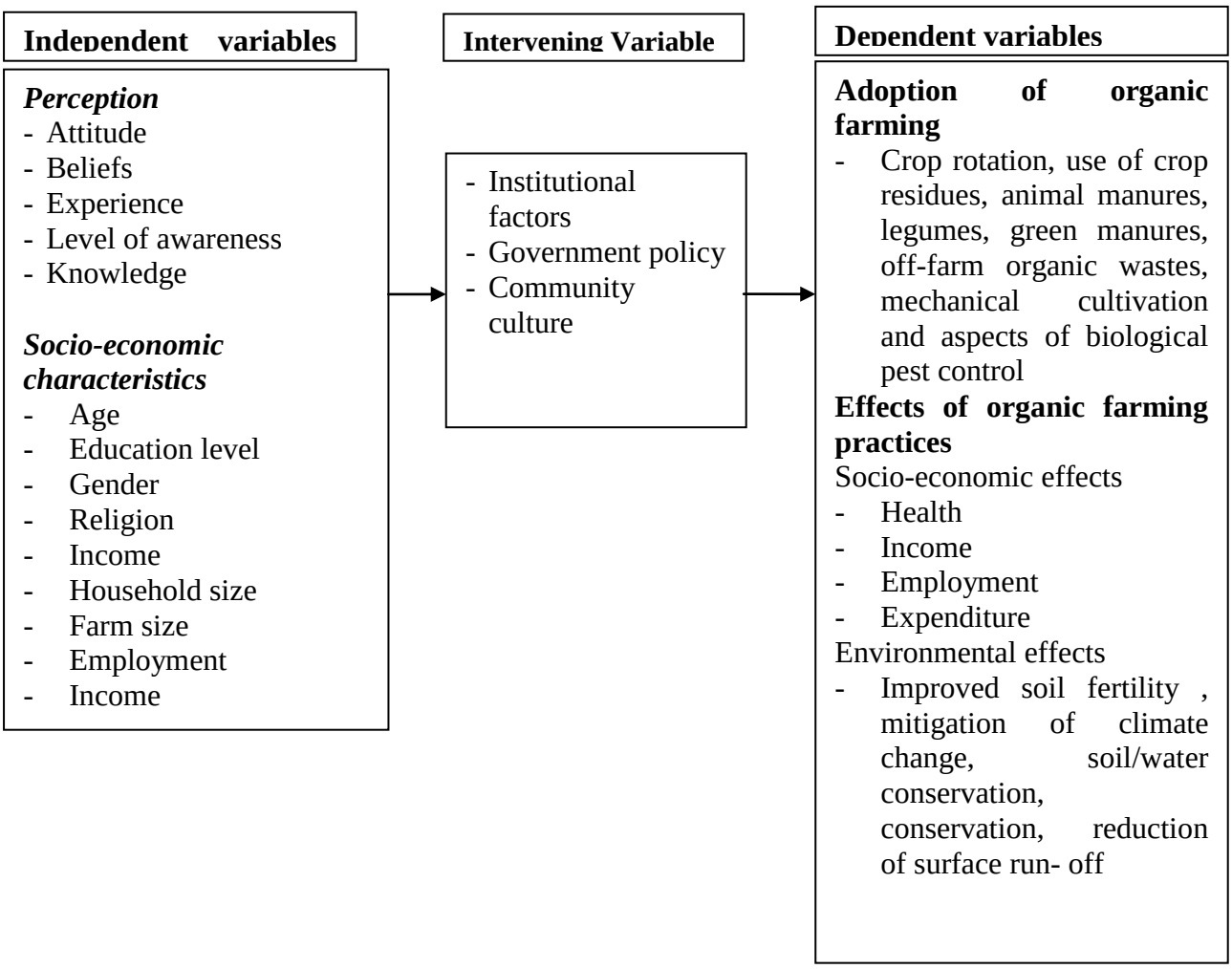


Figure 2.1: ***Conceptual Framework***

Source: Derived from Literature Review.

Figure 2.1 shows that the smallholder farmers' perception including knowledge, experience, level of awareness and beliefs influence the adoption of OF. Perception plays an important role in influencing the smallholder farmers' level of awareness of the various OF practices, benefits and effects of OF. The dependent variables in this study are adoption of OF practices and socio-economic and environmental effects of organic farming adoption. The following are some of the organic farming practices that smallholder farmers are likely to adopt: crop rotation, use of crop residues, animal manures, legumes, green manures, off-farm organic wastes, mechanical cultivation and aspects of biological pest control.

The socio-economic and environmental effects are concerns resulting from the adoption of OF practices. For instance, organic products are free from chemicals hence improves human health. Because of the health benefits and value of the organic products, the SHFs are guaranteed high prices within the markets. On the other hand, OF adoption have environmental effects on soil, water and air. Use of composed manure increases the soil quality, mulching conserve soil moisture and control weeds, and use of biological pest control methods improves the quality of soil and air, crop rotation lead to increased soil carbon, water holding capacity, retention of more nitrogen in the soil and increase in biodiversity.

Intervening variables in this study including government policies, culture of the community and agricultural institutional factors (land use and ownership, agricultural policies) may influence the smallholder farmers' perception towards organic farming practices. For instance, formulation and enforcement of favorable OF policies such as policies on training of the farmers on organic farming can improve the farmers' perception and the rate of adoption of organic farming.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents description on the following aspects: the study area, research design, sampling procedures, data collection instruments and procedures, types and procedures of data analysis, reliability, validity and ethical issues guiding the research to be conducted.

3.2 The Study Area

This study was conducted in Kisii Central sub-County of Kisii County (Figure 3.1.). This sub-section describes the geographical setting of the area of study with specific reference to location and size, the climate, physical and topographical area, soils, social economic activities and population characteristics.

3.2.1 Geographical Location and Size

Kisii Central Sub - County is one of the eleven sub-Counties in Kisii County. It borders Gucha, Bonchari and Kitutu Chache South Constituencies (Kisii County Integrated Development Plan 2013-2017). It covers an area of approximately 135.8 km^2 (KNBS, 2020). It consists of 3 divisions and 14 locations. It is situated in the South-Eastern part of Lake Victoria Basin (GoK, 2012). Kisii County has three agro-ecological zones: Upper midland (UM) (75%) Lower Highland (LH) (20 %), and Lower Midland (LM) (5%). Kisii Central sub - County lies in the Upper Midland agro-ecological zone of Kisii County where farming is the main source of livelihood. In addition, the sub-County is the most densely populated region in the entire Kisii County with a population density of 1,320 people per square kilometer (Kisii County Integrated Development Plan 2018-2022). (Fig 3.1)

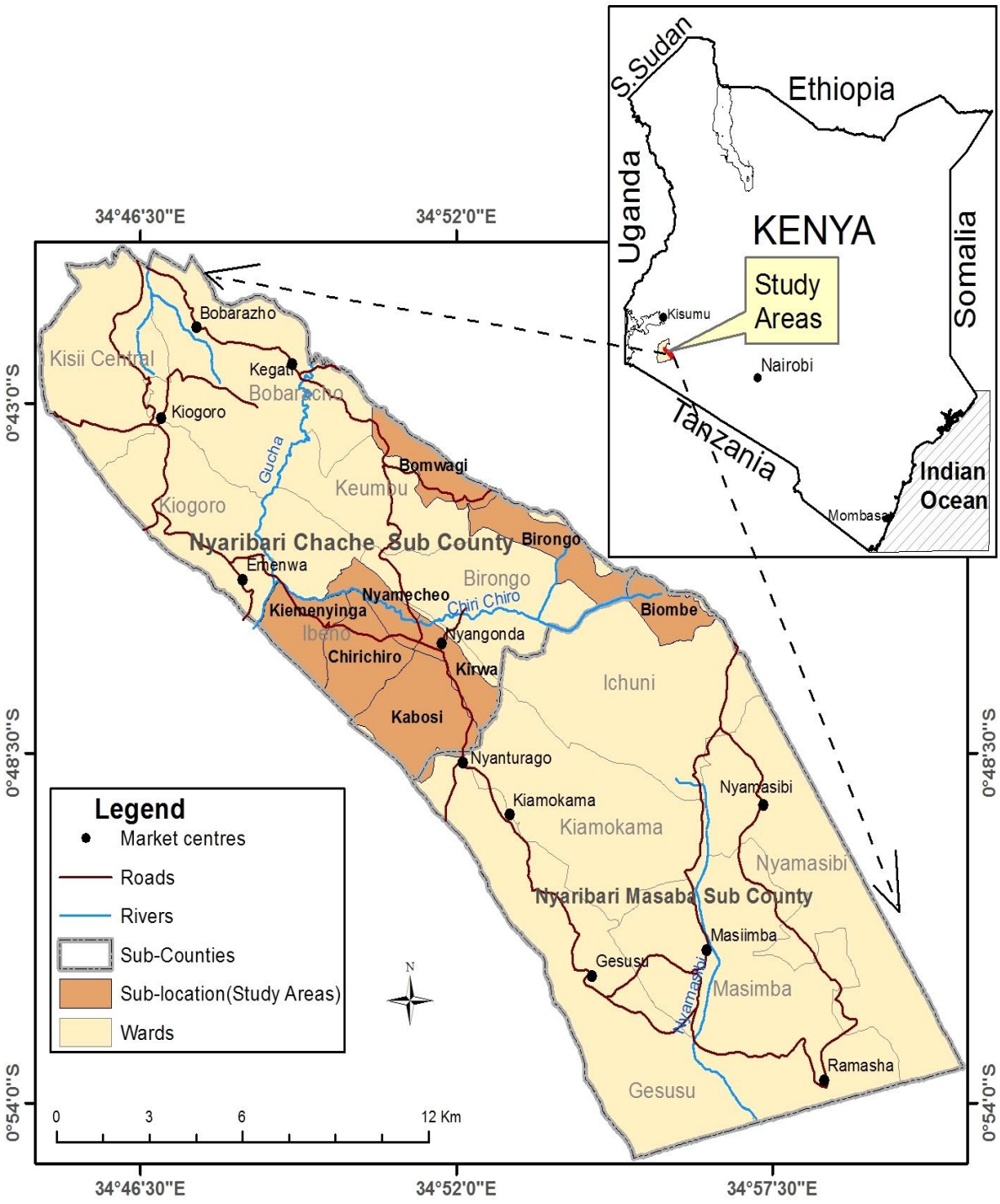


Figure 3.1: ***Study Area Map - Kisii Central Sub-county***

3.2.2 Climate

Kisii Central Sub-County exhibits a highland equatorial climate with a bimodal rainfall pattern. The average annual rainfall is approximately 1,500 mm. The long rains are received between March and June and the short rains between September and November. The months

of July and January are relatively dry with maximum temperatures ranging between 21^{o}C–30°C and minimum temperatures between 15– 20°C (Kandji, 2006).

3.2.3 Physical and Topographic Features

The study area lies within the Kisii highlands characterized by hills, ridges and valleys as shown partly in plate 3.1. The western part of Kisii Central sub - County has an elevation of between 1500 – 1800 m above sea level while the eastern and south eastern is 1800 m above sea level (Kisii County Integrated Development Plan, 2018-2022).

Plate 3.1: ***Overview of Kisii Central sub-County***

Source: Picture taken on 8th December, 2020 in Birongo

3.2.4 Soils

The sub-County has a great diversity of 20 different types of soils, although nitosols (constituting 49%) and pheozomes (13%) are the most commonly occurring. Other soil types include vertisols (2%), planosols (8%), solonetz (0.8%), gleysols (2%) and greyzems (4%) constituting 16.8% of the total soil that are poorly drained (Kisii County Integrated Development Plan, 2018-2022).

3.2.5 Socio-economic Activities

Kisii Central Sub - County has a mixed land use activities consisting of businesses, residential, transport and agricultural among others. Cash crops grown include tea, coffee, pyrethrum, bananas, avocadoes and sugar cane, while subsistence crops include maize, beans, potatoes and finger millet. According to Obaga and Mwaura (2018), banana farming is a lead

economic activity in Kisii County and subsequently in Kisii Central (See plate 3.2). Dairy farming is another important activity practiced in the sub-County. There are pre-primary, primary, secondary and tertiary institutions where trainings, learning and community empowerment are undertaken. Within the study area there are health centre including public and private dispensaries and faith base health centres. In addition most of the residents of the study area are of Seventh Day Adventist religion (Kisii County Integrated Development Plan, 2018-2022).

Plate 3.2: ***Farming in Kisii Central sub-County***

Source: Picture taken on 8th May, 2021

3.2.6 Demographic Characteristics

Kisii Central Sub – County had a population of 166,906 people with a population density of 1,229 persons per square kilometer (KNBS, 2020). The population growth rate for Kisii Central Sub – County is 2.0 percent. Children below 5 years make up about 18.5%, the youth of age group between 15 years and 30 year comprise 31.8% of the total population while the labour force comprise of 56.7% of the population (GoK, 2020).

3.3 Research Design

This study used descriptive survey design. Descriptive survey design allows obtaining information through the use of interviews and questionnaires and also enables examination of relationships among variables. It included cross sectional household survey. This choice was based on the fact that this study sought information on perception of smallholder farmers' adoption of organic farming practices Kisii Central Sub - County, Kisii County. In addition, this research design focuses on describing the perception of SHFs on OF in the study area.

A cross sectional household survey was to gather data about the smallholder farmers' perception on OF within Kisii Central Sub - County, Kisii County. The household survey was conducted in Birongo and Ibeno locations in the study area.

3.4 Target Population, Sampling Frame and Sample Size Determination

3.4.1 Target Population

Target population is the total composition of all elements from which a sample is drawn (Cant *et al.,* 2011). The target population for this study was 6025 smallholder farmers practicing mixed farming on land less than one acre in Ibeno and Birongo locations (of Kisii Central sub – County Kisii County) with 3266 and 2759 smallholder farmers respectively (GoK, 2020). The eight sub-locations include: Biombe with 1457 smallholder farmers , Birongo - 450 smallholder farmers, Bomwage - 852 smallholder farmers, Kabosi - 790 smallholder farmers, Kiemenyinga - 537 smallholder farmers, Kirwa - 854 smallholder farmers, Chirichiro - 325 smallholder farmers and Nyamecheo – 760 smallholder farmers as shown in table 3.1.

Table 3.1: ***Number of Smallholder Farmers in Birongo and Ibeno***

Location	Sub-Location	No. of smallholder Farmers
Birongo	Bomwaga	852
	Birongo	450
	Biombe	1,457
Ibeno	Kabosi	790
	Kiemenyinga	537
	Kirwa	854
	Chirichiro	325
	Nyamecheo	7
		60
TOTAL		**6,025**

3.4.2 Sampling Frame

Sampling frame is a list of all the specific elements of population to be sampled (Kauda, 2012). The sample frame in the study area was smallholder farmers practicing aspects of organic farming in Ibeno and Birongo locations of Kisii Central Sub-County.

3.4.3 Sample Size Determination

To generate the sample of the smallholder farmers, Newey and McFadden (1994) formula was used as shown below. The sample formula was appropriate for this study since the target population size is 6025 smallholder farmers which is less than 10,000. In addition, the formula has a low sampling error, a high degree of variability and higher confidence level.

$$n = \frac{[Z^2 \times q^2 \times N]}{e^2 (N-1) + e^2}$$

Where;

n = sample size

q = 1-p

Z = 1.96 of confidence level

e = margin of error

N = size of the population (6025)

We take p as 50% to give a representative sample with a minimum error making

q = 1-p i.e., 0.5

e = 0.05

Therefore

$$n = \frac{[1.96^2 x 0.5 x 0.5 x 6025]}{0.05^2(6025-1) + 1.96^2}$$

$$= 306$$

Therefore, the sample size for the proposed study was 306 smallholder farmers (Table 3.2).

Table 3.2 ***Sample Sizes by Sub-location***

Location	**Sub-Location**	**No. of smallholder farmers**	**Calculation of Sample Size**
Birongo	Bomwaga	852	43
	Birongo	450	23
	Biombe	1457	74
Ibeno	Kabosi	790	40
	Kiemenyinga	537	27
	Kirwa	854	43
	Chirichiro	325	17
	Nyamecheo	760	39
TOTAL		**6025**	**306**

Purposive sampling was used to select seven key informants based on their knowledge on farming in Kisii Central Sub – County in general and organic farming in particular The key informants included, Head of field KARLO, County NEMA field officer, two administration leaders and one opinion leader who was sub-County Agricultural Officer in Kisii Central Sub - County.

3.4.3 Sampling Procedure

Multi-stage sampling design was used in this study to select two study locations in Kisii Central Sub-County; Birongo and Ibeno (Figure 3.2). In stage 1, Kisii County was purposively sampled from the 47 counties in Kenya because of the suitability of the area for diverse agricultural activities. According to Kisii County Integrated Development Plan 2018-2022, approximately 78 percent of the County is arable with 57% of the area being under crops. In stage 2, Kisii Central Sub-county was purposively sampled because of its high population (166,906) as well as agricultural intensity of the various farming practices (GoK, 2014; GoK, 2020).

At Stage 3, Keumbu Ward was also purposively sampled as data collection area based on its high population density and its proximity to the county headquarters (rural). Stage 4, Birongo and Ibeno locations, within Keumbu Ward, was purposively sampled as data collection areas based on their high and low population densities, respectively. In addition, they have high and low concentration of smallholder farmers practicing different types of agricultural agriculture (GoK, 2014).

At stage 5, probability sampling procedure was used to select smallholder farmers in Birongo and Ibeno Locations, which have several sub-locations. Probability sampling is a sampling technique based on random process. Thus the samples are gathered in a process that gives all the individuals in the population equal chances of being selected (Thompson, 2012). Probability sampling techniques used included proportionate sampling procedure, simple random sampling and systematic sampling procedure. Proportionate sampling procedure was applied to collect data from smallholder farmers within the sub-locations in Birongo and Ibeno locations of Kisii Central Sub – County. Proportionate sampling technique is used when the population is composed of several subgroups that are vastly different in number. In this study, the study sub-locations in Birongo and Ibeno have different number of smallholder farmers. Thus, to sample the smallholder farmers for the study, proportionate sampling technique was used. It was based on the total population of the smallholder farmers as shown in Table 3.2. Simple random sampling was applied to randomly pick the smallholder farmers practicing aspects of organic farming for administration of questionnaires within the sub-locations.

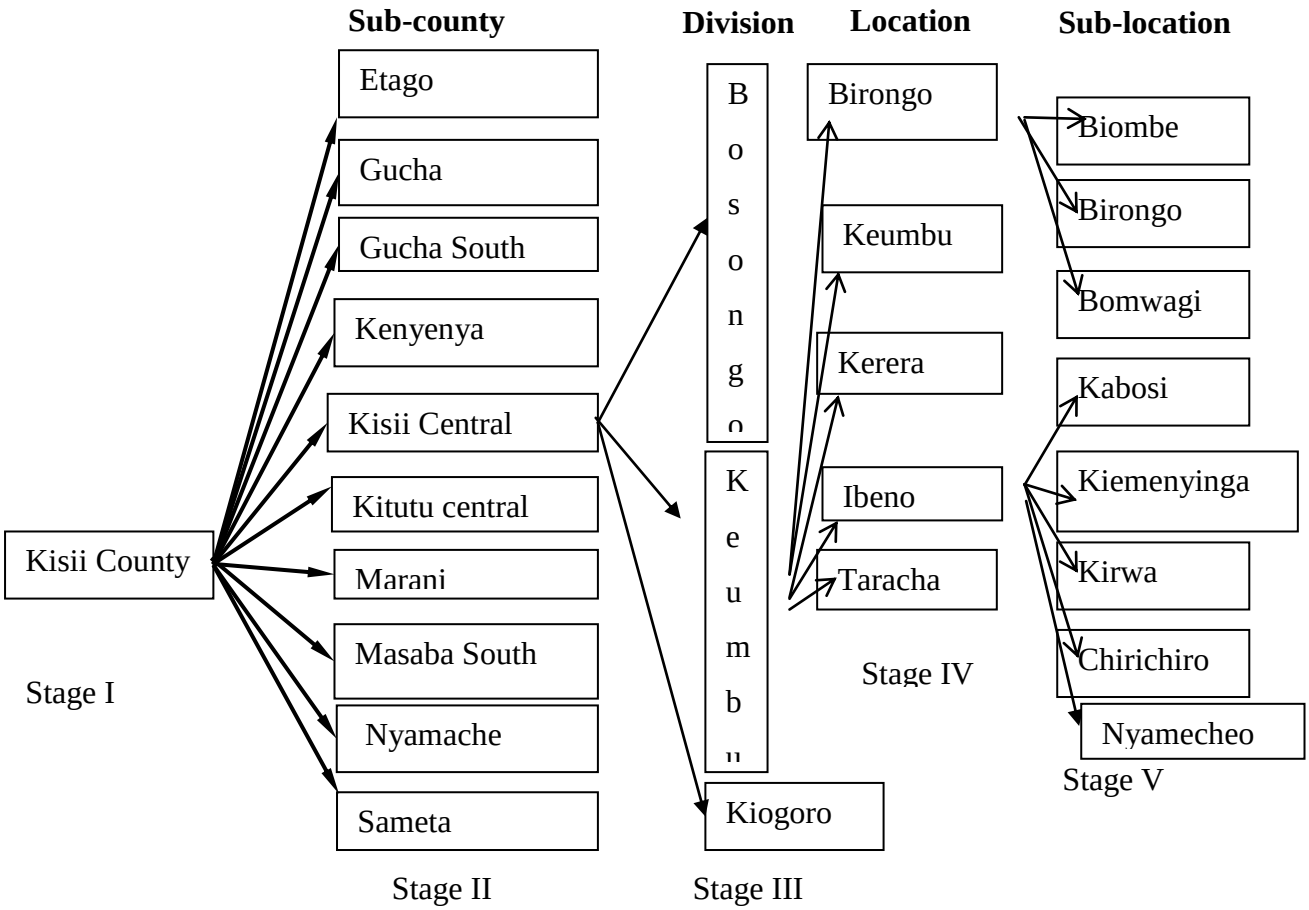


Figure 3.2: ***Sampled Study Areas***

In addition to smallholder farmers' interviews, the researcher also interviewed key informants. Purposive sampling was used in identifying the key informants based on their knowledge and experience in organic agriculture. In addition the sampling was based on the basis of the researcher's own judgment on the key informants' awareness, knowledge, experience in the agricultural sector in the study area and location they come from. Purposive sampling was appropriate when the informants have a specific type of knowledge or skill required in the study. Purposive sampling was used together with the both qualitative and quantitative methods of data collection and statistical analyses (Thompson, 2012). Thus non probability sampling was applied in identifying and conducting key informant interviews for various government departments, non-governmental and local institutional

3.5 Data Collection Instruments

Data collection was conducted in two phases complementing each other to ensure quality data was collection. The first phase involved a survey to collect quantitative data. In this phase, structured questionnaire was administered to the sampled 306 respondents

(smallholder farmers) from the study areas in Kisii Central Sub – County, Kisii County (Appendix I). The use of questionnaire helped in reaching a large number of respondents within a short time. Within smallholder farmers' questionnaire, questions were put in four thematic areas namely (i) Socio-Economic Characteristics of the Respondent (ii) Organic Farming Practices (iii) Perception and adoption of Organic Farming and (iv) Socio - economic and Environmental effects of Organic Farming. Open ended questions in the questionnaire were useful in eliciting the respondents' opinion concerning the study problem while the closed-ended questions prompted the respondents to choose from a limited number of responses predetermined by the researcher.

The second phase involved in-depth qualitative key informant interviews with 7 sampled heads of the following departments relevant to the study objectives including Ministry of Agriculture, Livestock and Fisheries, Kenya Agricultural Research and Livestock Organization Officer, National Environmental Management Authority officer, Sub-County Agricultural Officer, Birongo and Ibeno Chiefs and Kenya Organic Agriculture Network representative. Key informants interview schedules were used in seeking specific information about the subject in question from the key informants in Birongo and Ibeno locations of Kisii Central Sub-County as in Appendix II. Use of key informant schedules was opted for in this study because questionnaires enable the researcher to ask structured questions which was easier to analyze as well as to administer. In addition, the schedule accorded key informant adequate time to respond and offer a sense of privacy and confidentiality. From the key informants, interviews was used in obtaining data on number of smallholder organic farmers, OF practices, spread and sizes of organic farms, effects of OF and OF extension services offered in the proposed study area.

3.6 Validity and Reliability

3.6.1 Validity of Data Collection Instruments

Validity defines the accuracy and meaningfulness of inferences drawn from study findings, (Baumgarten, 2012). If the instrument is valid, the results obtained from the research represented the study variables. Content validity which was determined by the researcher's judgment and the supervisors' opinion was considered to address the match between test questions and the subject area - assessment of the perception of smallholder farmers' adoption of organic farming practices.

The research instruments were pretested to 24 respondents (10% of the sample size) within the neighboring Masaba Sub-location. This was done to ensure that the questionnaires are free from ambiguity and that the data generated are meaningfully analyzed in relation to the research questions. The selected respondents were not be included in the study because they were similar to the samples used in the actual study. The feedback was used to validate the instruments in readiness for the study.

3.6.2 Reliability of the Data Collection Instruments

Reliability is the measure of the degree to which a data collection instrument yields consistent results or data after repeated trials (Baumgarten, 2012). A reliable data collection instrument is one that produces consistent results when used more than once to collect data from a sample randomly selected from the sample population. The split-half method was used to test reliability of the research instruments by comparing the results of one half of a test with the results from the other half. Responses from 24 respondents (10% of the sample) were used for the test. The data obtained was then entered into the Statistical Package for Social Science research (SPSS) to determine the reliability of the tool.

3.7 Data Analysis

Data collected from the proposed study was edited, coded, and entered, checked and analyzed by use of Statistical Package for Social Sciences (SPSS) version 22. Descriptive statistics (frequency distribution, mean, standard deviation and percentages) and inferential statistics analysis (cross tabs and correlation) was determined. The findings were then presented in form of tables and graphs. Table 3.3 shows how each of the variables under study was analyzed by objectives.

3.8 Ethical Considerations

The researcher sought approval to conduct research from the Directorate of Graduate School, Egerton University. This was in turn be used to seek authority and permission to conduct research from the National Commission for Science, Technology and Innovation (NACOSTI) (Appendix III). In addition, permission was sought from Egerton University the Ethical Review Committee at the division of research and extension.

In the course of conducting the research, the researcher ensured that research ethics were observed. This was achieved by ensuring the following: respondents provided informed consent of their participation in the study, respondents were in no way coerced to provide

answers to the questions, and that they could opt out of the survey at any stage if they so wish, respondents were assured of their anonymity and privacy, the data and information they provided was given utmost confidentially, they were handled with dignity in the entire course of data collection. The objectives of the study were explained to the respondents with an assurance that the data provided would be used for academic purpose only.

Table 3. 3: ***Data analysis matrix***

Research objectives	**Independent variable**	**Dependent variable**	**Statistical Techniques Used**
Determine the extent to which smallholder farmers' perception influence adoption of organic farming practices in Kisii Central Sub – County	**Perception** • Awareness • Attitude • Knowledge • Experience • Belief	**Organic farming practice** • Crop rotation, use of crop residues, animal manures, legumes, green manures, off-farm organic wastes, mechanical cultivation and aspects of biological pest control	Frequencies, Percentages, Spearman's correlation.
To determine the influence of smallholder farmer's socio-economic characteristics on adoption of organic agriculture farming in the study area	**Socio-economic characteristics** • Age • Education level • Gender • Household size • Religion • Income • Farm size • Employment	**Organic farming practice** • Crop rotation, use of crop residues, animal manures, legumes, green manures, off-farm organic wastes, mechanical cultivation and aspects of biological pest control	Frequencies, Percentages. Rank biserial correlation
Examine the socio-economic and environmental effects of organic	**OF**	**Socio-economic effects** • Health benefit, food security, safety and quality of organic products, survival	Frequencies Percentages

farming as perceived by smallholder farmers in Kisii Central Sub – County		strategies • Income, employment, poverty reduction, reduced expenditure **Environmental effects** • Soil fertility and restoration, mitigation of climate change, water conservation, soil conservation, energy conservation, reduction of surface run- off

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

The chapter presents results on socio-economic characteristics of respondents, influence of smallholder farmers' perception on adoption of organic farming practices, influence of socio-economic characteristics on adoption of organic farming, and perceived effects of organic farming in Kisii Central sub-County.

4.2. Socio-economic Characteristics of the Respondents

The socio-economic characteristics of the respondents of interest in this study include gender, age bracket, education, religion, household size, farm size and source of income. Table 4.1 shows the socio-economic characteristics of the respondents in the study area.

Table 4.1 ***Socio-economic Characteristics of Smallholder Farmers in the Study Area (n = 306)***

Factors	Category	Study area
Gender (%)	Male	57.8
	Female	42.2
Age (years)(%)	<25	11.8
	25-35	21.6
	36-45	36.9
	46-55	17.3
	>55	12.4
Education (%)	No formal	7.8
	Primary	15.7
	Secondary	47.7
	College	19.0
	University	9.8
Religion (%)	SDA	39.2
	Protestant	22.9
	Catholic	31.0
	Muslim	1.0

	Others	5.9
Household size (people)(%)	1-3	28.4
	4-6	53.9
	7-9	15.0
	>10	2.6
Farm size (Acres) (%)	<1	52.3
	1	26.5
	2	18.3
	>3	1.6
Involvement in farming (%)	Full time	68.3
	Part time	31.7
Source of income (%)	Business	18.0
	Jua Kali	3.9
	Farming	68.3
	Employed	9.8

Generally, majority of the respondents were male at 57.8% while 42.2% were female as shown in Table 4.1. This would imply that decision-making on organic farming would largely be made by men than women in Kisii Central sub-county. The study finding concurs with a study done by Africa Development Bank in Nigeria which indicated that there are more male smallholder farmers than their female counterparts in the agricultural sector (Mukasa & Salami, 2015). However, this contradicts finding in Uganda and Tanzania where females account for 75.7% and 80% respectively in the agricultural sector (Salami & Mukasa, 2015).

Farmer's age is a key factor in adoption rate of farming methods and their performance. Aiyar and Ebeke (2016) suggested that older workers are, on average, less productive than younger workers and that labor force aging has a modest negative direct impact on productivity growth in Canada. The study found that a majority (37%) of the farmers involved in this study were of age category 36 – 45 years. Those of age 25-36 years and below 25 years accounted for 22% and 12%, respectively. It is evident that a majority of the farmers in Kisii Central are mostly youthful. Given that these age categories are generally youthful and most productive; these categories can be targeted in the promotion of organic

farming. This finding implies that the study are has a population in its most productive stage, which is crucial in agricultural production. This study finding is similar to a study done in Zambia, Tanzania and Nigeria which revealed that the mean age of the farming population ranges between 39 to 45 years (Kwame & Jayne, 2020).

Education level of farmers is a factor in understanding their farming skills and ability to incorporate new agricultural innovations. According to Sapbamrer *et al.* (2021) education through training programs help farmers to learn cultivation practices and proper techniques for organic farming. In this study it was observed that varying level of education, with most of them having attained secondary level at 47.7% as shown in Table 4.1. Nearly 8% and 16% of household heads in Kisii Central had no formal education and primary education respectively while a combined 29% had tertiary education. The level of education determines the smallholder farmers' knowledge on the various aspects of farming and importance of the farming techniques they employ, among others. The results concurs with a study done in Kajiado county where it was found that majority of the respondents had acquired secondary level education (Kamau *et al*., 2018).

Different religions have different beliefs and teachings which dictates their farming and eating habits (Kwame & Jayne, 2020). In this study, religion of respondents was categorized into different denominations. It was found out that Seventh Day Adventists were the majority at 39.2% followed by Catholics at 31% while the least belonged to other denominations at 5.9% as shown in Table 4.1. In this regard, promoters of organic farming can consider using the SDA church forum to highlight the importance of organic farming.

The respondents with resident family members from 4 to 6 were the majority (53.9%). Nearly one third (28%) of the households had 1-3 members in the study area. Household size is crucial in determining labour and capital required for farming. That a majority of households have 4-6 members, potentially makes available labour required for organic farming in Kisii sub-County. According to Mohamed *et al.* (2018), organic farming is labour intensive. It therefore needs labor for the handling of pests, disease problems, and marketing which are managed using family labors (Mohamed *et al.,* 2018). However, with free primary education and supplemented secondary education, it is unlikely most members stay at home to assist in farming. Further a high number of household members mean depletion of capital (to provide for food stuffs and other basic needs) required for farming. The finding is in agreement with

Agarwal (2018) insight that individual family farm productivity is determined by various factors including farm fertility, crop farmed, crop market and source of labor among others.

Sources of income are critical in determination of the agricultural innovation to be adopted. In the study area, farming was found to be the leading source of income (68.3%), with business activities coming a distant second with 18% of the respondents. On a related note, a majority of respondents (68.3%) in the study area indicated that they are fulltime farmers. This reinforces the place of agriculture among households in the study area. The findings underscore the importance of agriculture as a major source of livelihoods to households in Kenya. With the high income associated with organic farming (compared with conventional farming) (IFOAM & FiLB, 2016), promotion of organic farming can significantly improve income among smallholder farmers in the study area. Thus the finding implies that there are higher incomes from agricultural activities.

Majority (52%) households in Kisii Central sub-County have less than one acre under farming and 1.3% had more than 3 acres. This implies that smallholder farmers are the majority in the study area. Key stakeholders including sub-county agricultural officers, administration leaders, and opinion leaders also confirmed that most farmers had less than one acre under organic farming. The findings differ with a study done in Syria by Issa and Hamm (2017), farm sizes under organic farming varied from small (<1 Ha) to large farms (>25 Ha). The same study also found out that since farmers owned relatively small farms, they engaged in other income generating activities to support themselves.

4.3. Influence of Perception on Adoption of Organic Farming Practices among Smallholder Farmers

This section presents study finding on how smallholder farmers' perception influence adoption of organic farming practices in Kisii Central sub-County.

4.3.1 Organic Farming Practices

To determine the influence of smallholder farmer's perception on adoption of organic farming, it was important to find out the respondents' understanding of organic agriculture (Figure 4.1).

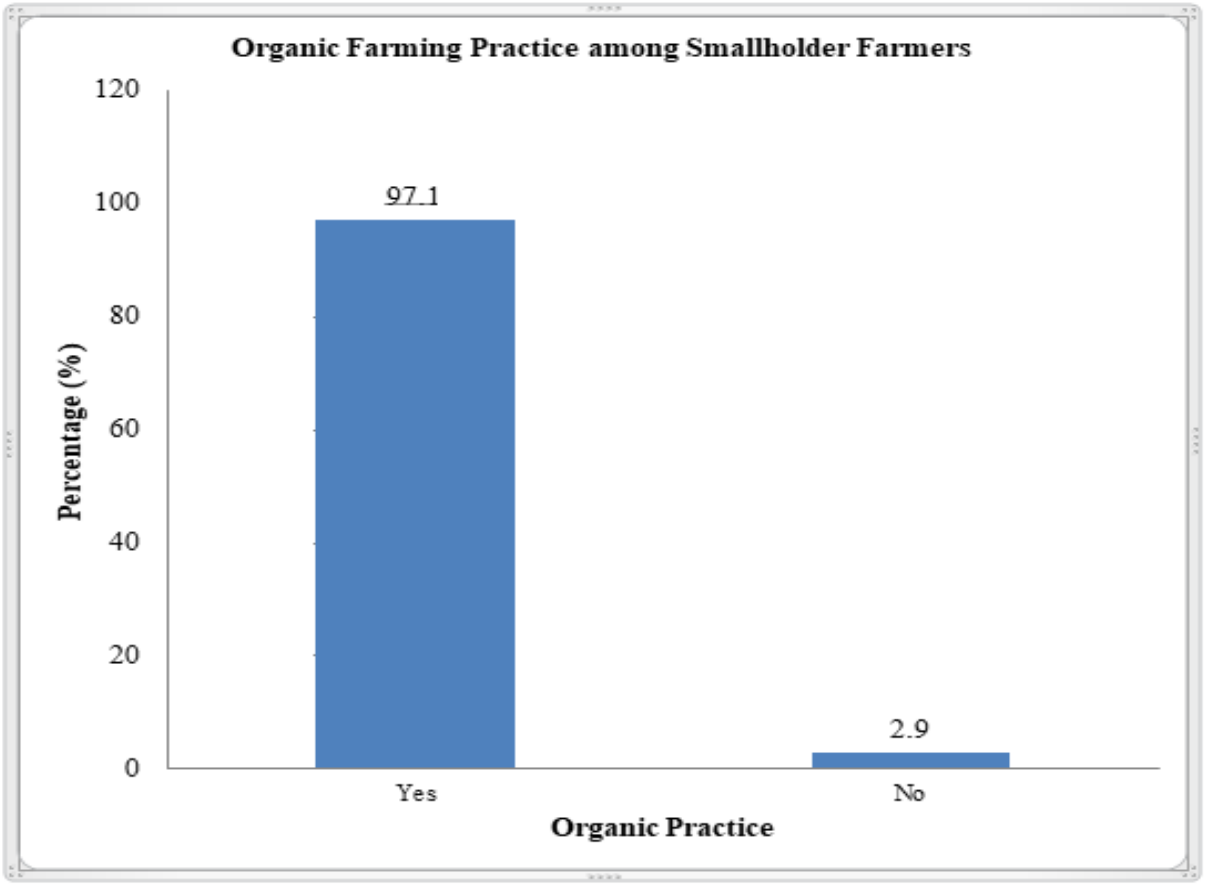


Figure 4.1: ***Organic Farming Practice among Smallholder Farmers in Kisii Central (n=306)***

The respondents were asked whether they practice organic farming (OF) or not. Figure 4.1 shows that 97.1% claimed to practice OF. This concurs with Adebayo and Oladele (2014) who found out that 86.3% of smallholder farmers in South West Nigeria practice organic methods of farming. However, the finding differs with Ozor and Nyambane (2021) who reported that agriculture sector in Kenya is largely dominated by conventional agricultural practices.

Respondents were asked to specify the organic farming practices they employ on their farms. It emerged that all aspects of Organic Farming envisaged in this study area are practiced in Kisii Central sub-County.

Table 4.2: ***Aspects and Duration (in %) of Organic Farming Employed by Smallholder Farmers (n=306)***

	1 – 5 years	6–10 years	More than 10 years	Not applicable
Crop rotation	59.8	13.7	18.0	8.5
Biological Pests Managements	20.3	18.0	6.2	55.6
Use of legumes	38.6	18.6	10.1	32.7
Cover crop	34.6	22.9	15.0	27.5
Rotational grazing	25.2	16.7	17.3	40.8
Livestock-crop diversification	47.7	17.0	15.0	20.3
Use of crops residue	42.2	17.3	16.3	24.2
Use of animal manure	60.1	13.1	18.6	8.2
Green manures	49.3	14.7	11.4	24.5
Water conservation	32.4	18.3	16.0	33.3
Off farm organic wastes	27.8	16.0	18.0	38.2

Result in Table 4.2 shows that use of animal manure has been practiced for a period of between 1 and 5 years (60%) and for more than 10 years (19%) while crop rotation has been practiced for a period of between 1 and 5 years (60%) and for more than 10 years (18%). The prevalence in the use of animal manure can be attributed to mixed farming that is common among the Kisii community – making animal manure readily available. The finding concurs with finding of Makone *et al.* (2015) that use of manure (58.9%) was one of the most employed forms of organic farming in Kisii County. However, it differs with Adebayo and Oladele (2014) finding that the most prominent OF method in the South West Nigeria included minimum tillage, crop rotation and mulching.

A majority of smallholder farmers in Kisii Central sub-county are not practicing biological pest management (56%) and rotation grazing (41%). The high number of smallholder farmers not practicing biological pest management is attributed to lack of information within the study area. The high number of farmers not practicing rotational grazing can be attributed to the highly fragmented farms due to the high population density that characterize Kisii-Central. It is also of note that at least one third of the respondents are practicing water

conservation (32%) while another one third are not practicing water conservation (33%). The almost equal percentage may be attributed to the reliable rainfall received in Kisii County Sub-County (Kisii County Integrated Development Plan, 2018-2022) hence the respondent do not conserve water for farming.

Figure 4.2 shows the organic farmers neighbouring the respondent.

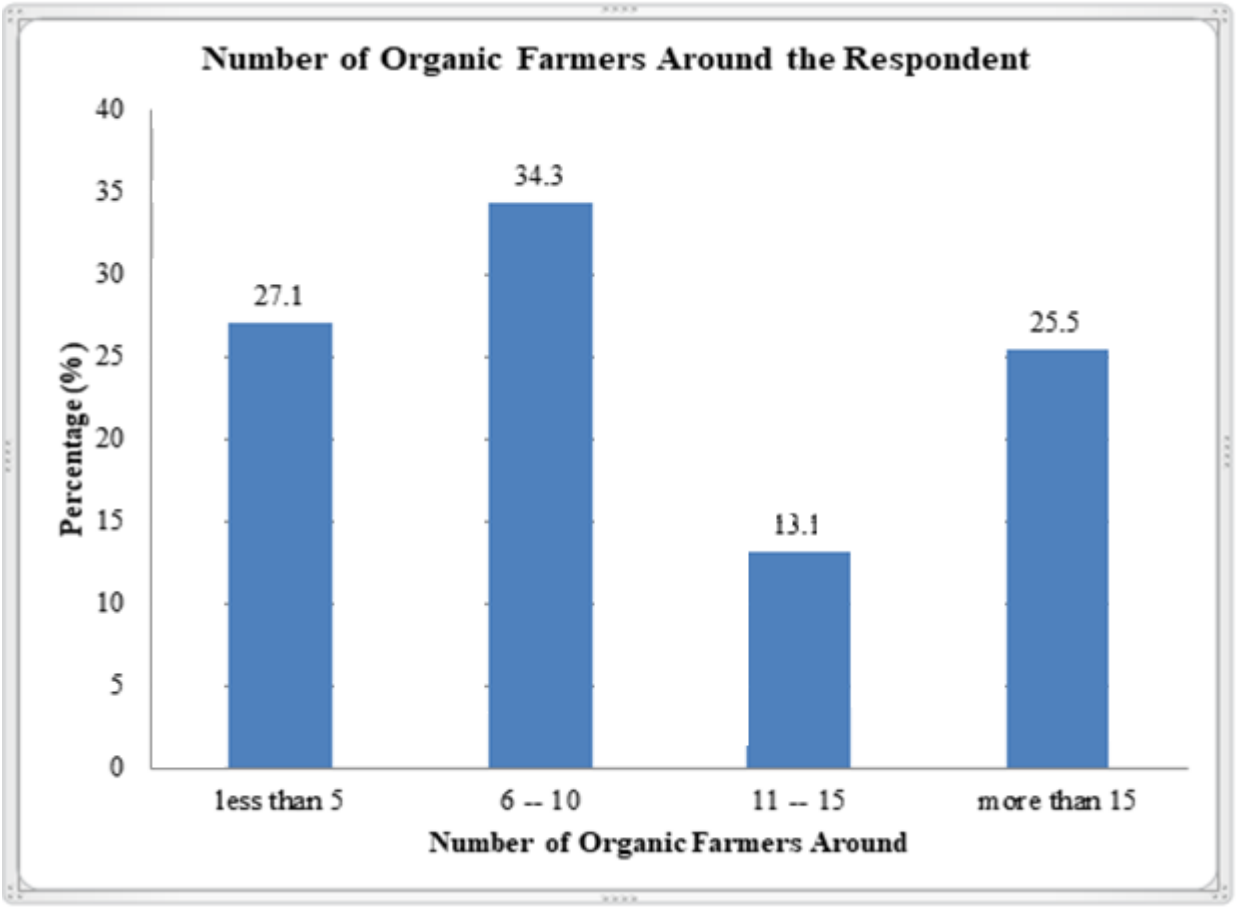


Figure 4.2 ***Number of Organic Farmers Around the Respondent (n=306)***

Out of the 306 respondents who were interviewed, 34.3% indicated that they had approximately 6 - 10 neighbours that engage in organic farming practices. This further reinforces that organic farming is spread within Kisii Central. The spread of organic farmers within the study area is in tandem with diffusion theory of organic agriculture where OF innovation spread to farmers on discovery of the benefits of the adoption (Simin & Janković, 2014). In addition, the finding implies that smallholder farmers who know other organic farmers are more likely to adopt organic agriculture. According to Sapbamrer and

Thammachai (2021), organic farmers are an important source of relevant information when it comes to sharing their experience and persuading other farmers to adopt organic farming.

The respondents were asked to identify the pre-dominant OF methods in Kisii Central. Figure 4.3 illustrate the pre-dominance of the various organic farming methods.

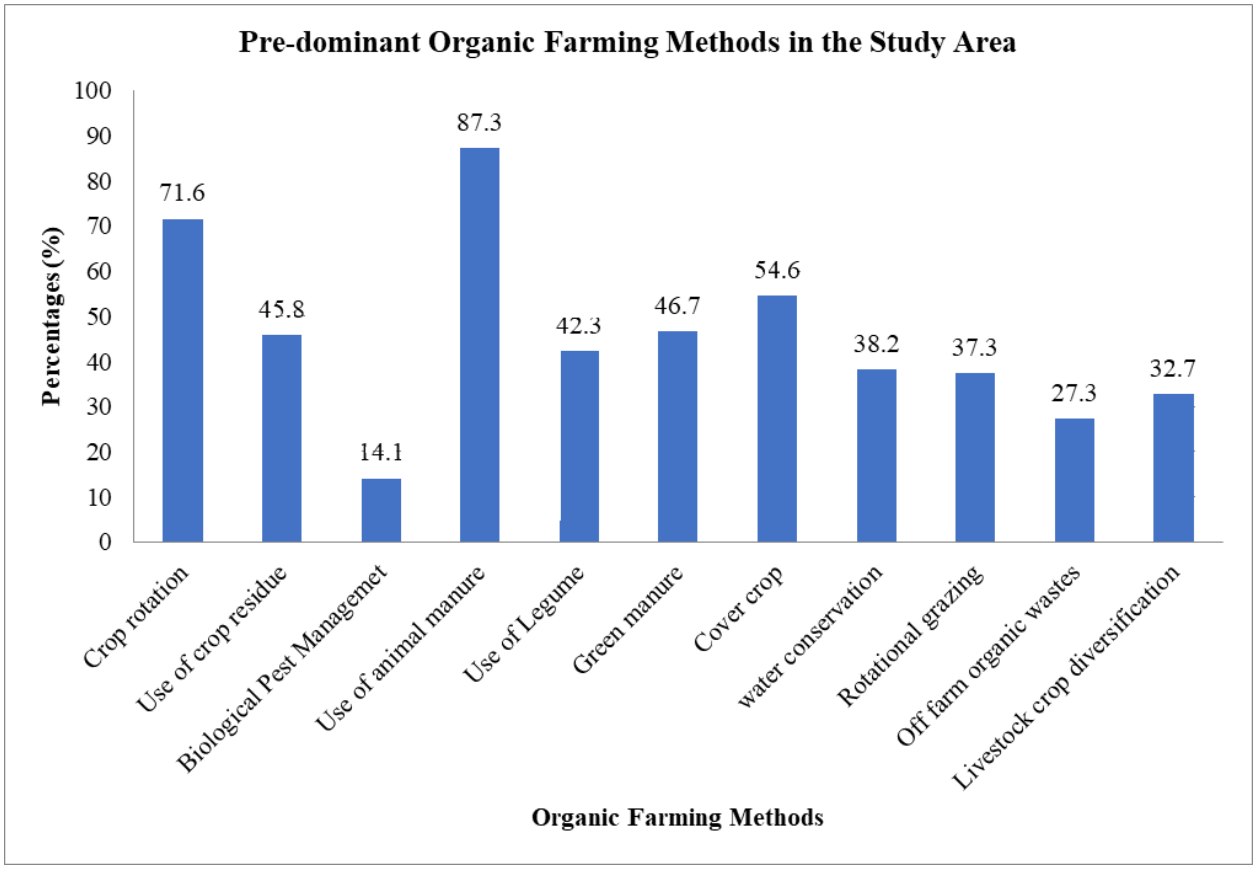


Figure 4.3: ***Predominant Organic Farming Methods in the Study Area (n=306)***

As indicated in Figure 4.3, use of animal manure (87.3%) and crop rotation (72%) are the most predominant OF method while use of biological pest management is the least pre-dominant OF method in the study area. The finding is attributed to the wide spread of livestock farming leading to availability of animal manure within Kisii Central. The finding was similar to Nelson *et al.* (2018) finding that use of animal manure was the dominant organic farming practice in the nine provinces of Phillipine. However, the results differed with Adebayo and Oladele (2014) who observed that the most prominent OF method in the South West Nigeria included minimum tillage, crop rotation and mulching.

The size of farm under OF practices is an important requirement for an OF system. Figure 4.4 present the respondents' approximate acreage of land under organic products.

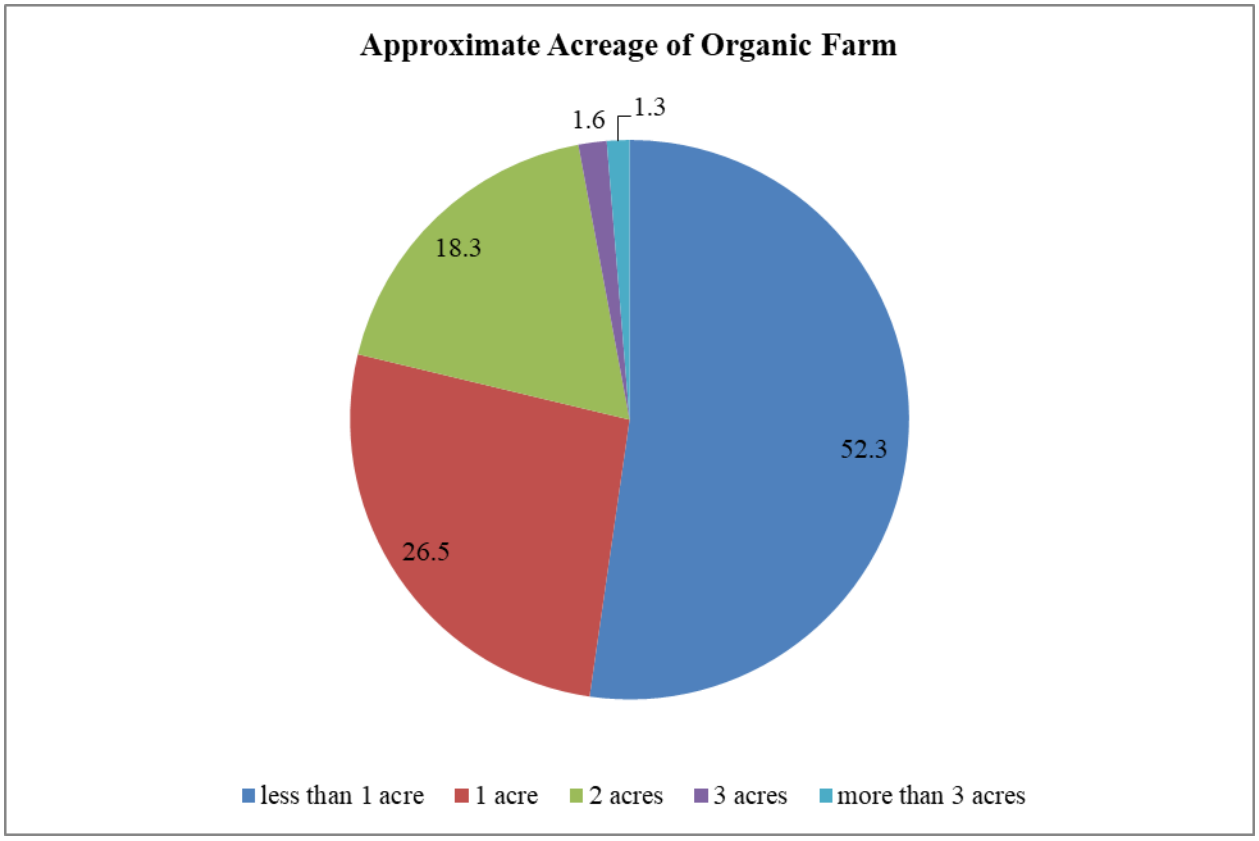


Figure 4.4: ***Approximate Acreage of Organic Farms (n=306)***

The results show that 52.3% of the respondents have approximately less than 1 acre of land is under organic farming. The findings are supported by the GoK (2020) which shows that farm holding size in Kisii County is typically small holdings, ranging from 0.5 to 4.5 acres of land. The results concur with Kiplimo and Ngeno's (2016) observation that the increasing land scarcity due to the growth in population in Kenya led to the progressive smaller farms as a result of fragmentation of agricultural farms for other land uses such as settlement. According to Liu *et al.* (2019) finding that larger farms are more difficult to manage as regards crops, inputs, and other supports, resulting in farmers having less motivation to cope with these problems. Therefore, the small farms that characterize Kisii Central sub-County can potentially act as a catalyst for organic farming.

4.3.2 Perception on Organic Farming

Knowledge on availability of information on organic farming plays key role in determining the perception.

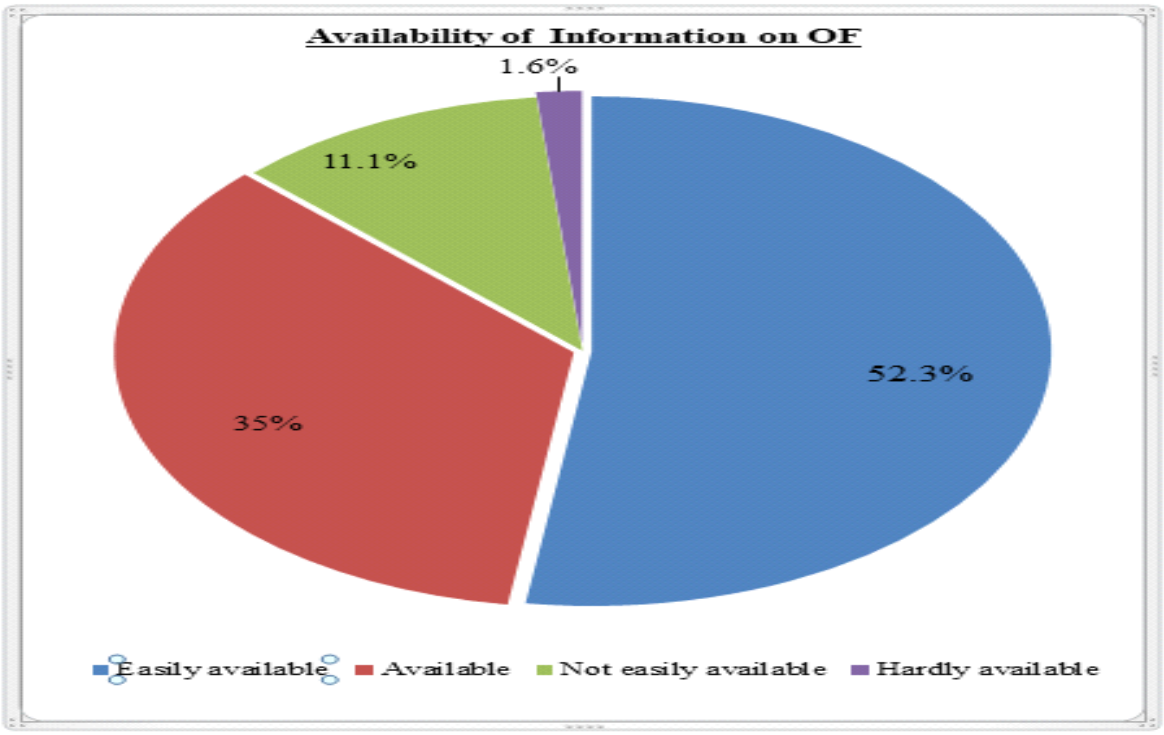


Figure 4.5: ***Availability of Information on Organic Farming (n=306)***

The results in Figure 4.5 indicate that 52% and 35% of the respondents consider information on organic farming to be easily available, and available respectively. Its only 11% and 2% of the respondents who noted that information on organic farming was not easily available and hardly available, respectively. Access to information on organic farming can be attributed to the increasing awareness on benefits of organic farming. According to Tsvetkov *et al.* (2018) organic agriculture is gaining popularity as a result of the increasing awareness of its health and environmental benefits. In addition, there is growing interest on organic agricultural knowledge. Skoufogianni *et al.* (2016) noted that OF have gained a place in the spotlight of the mainstream media. This finding has thus practices further concurs with Bernzen and Kristiansen (2017), that new peer-review research on organic agriculture are emerging annually giving various information on aspects of organic farming.

Structured statements in regard to OF were posed to the respondents to give their views. Table 4.3 present results on the farmers' views.

Table 4.3 ***Farmers view on Statements about Organic Farming (n = 306)***

Statement	No. of farmers (percentage)				
	Strongly agree	**Agree**	**Disagree**	**Strongly disagree**	**Don't know**
Organic farming has positive effects on the environment	68.9	26.1	3.3	1.6	0.3
Organic farming has negative effects on the environment	11.4	25.8	36.3	20.9	5.6
Organic farming are more profitable than inorganic farms	46.7	37.6	9.5	3.6	2.6
Organic farming is a form of traditional agriculture	33.7	51.3	8.8	2.9	3.3
Organic products are readily available in the market	24.8	48.4	19.6	2.9	4.2
Most organic farms are small scale	40.5	44.4	9.2	2.0	3.9

Results indicated that 68.9% of the respondents strongly agreed that organic farming has positive effects on the environment. Conversely, 39.3% disagreed that organic farming has negative effects on the environment. The respondents also agreed that organic farming is a form of traditional agriculture (51.3%), organic products are readily available in the market (48.4%) and that most organic farms are small-scale (44.4%). The high percentage agreement with the views on OF imply that the smallholder farmers of Kisii Central sub-County are knowledgeable on the positive aspects of organic farming. A study done in Pakistan showed that organic farming was more profitable than conventional farming (Husnain *et al.,* 2017). The study also tested soil nutrients in organic and conventional farms and it was found out that organic farms had improved and conserved soil fertility better than conventional farms. Further, a study by Singh (2021) indicated that organic farming is beneficial to the environment as the practices enable farmers to live in accord with nature and profit from it economically. In another study done in Japan, the results indicated that organic fields supported the highest, richness and abundance of animal and plant species (Katayama *et al*., 2019). This, therefore, confirms that organic farming practices have positive effects on the environment as suggested by respondents. The positive rating of organic farming among

smallholder farmers of Kisii sub-County offer an entry point for scaling up commercial level organic farming.

In this study, respondents were asked the present demand of organic farm products. Their responses were categorized as follows: low, average and high.

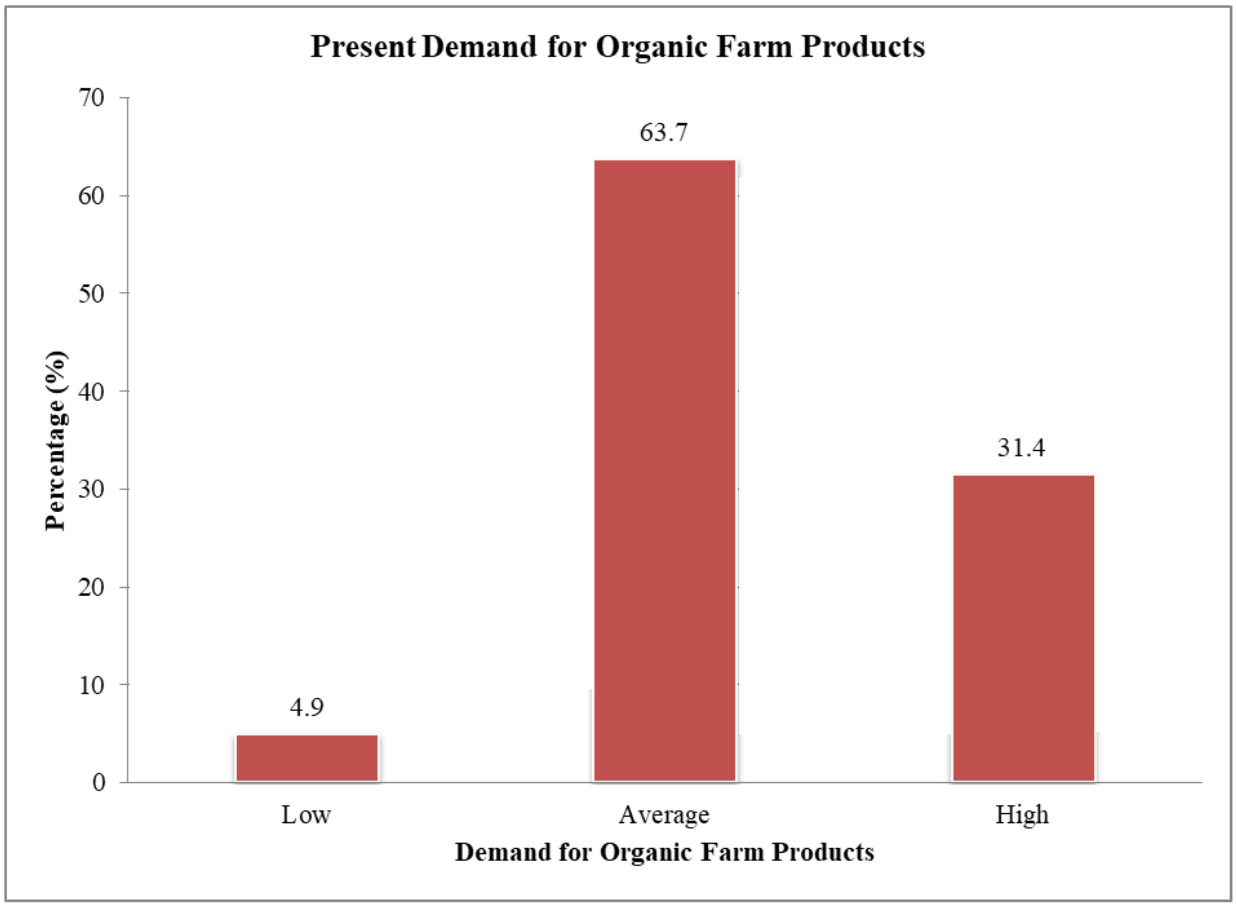


Figure 4.6 ***Present Demand for Organic Farm Products (n=306)***

As indicated in Figure 4.6, 63.7% of the respondents were of the opinion that the present demand for organic farm products is average. The results are in tandem with FAO (2021) report that the demand for organic agricultural products is on constant increase worldwide as consumers are shunning the use of chemical fertilizers and pesticides. A research in Chicago by Huang *et al.* (2016) revealed that shoppers preferred organic fruits and vegetables, albeit, their cost was a significant barrier to purchase them.

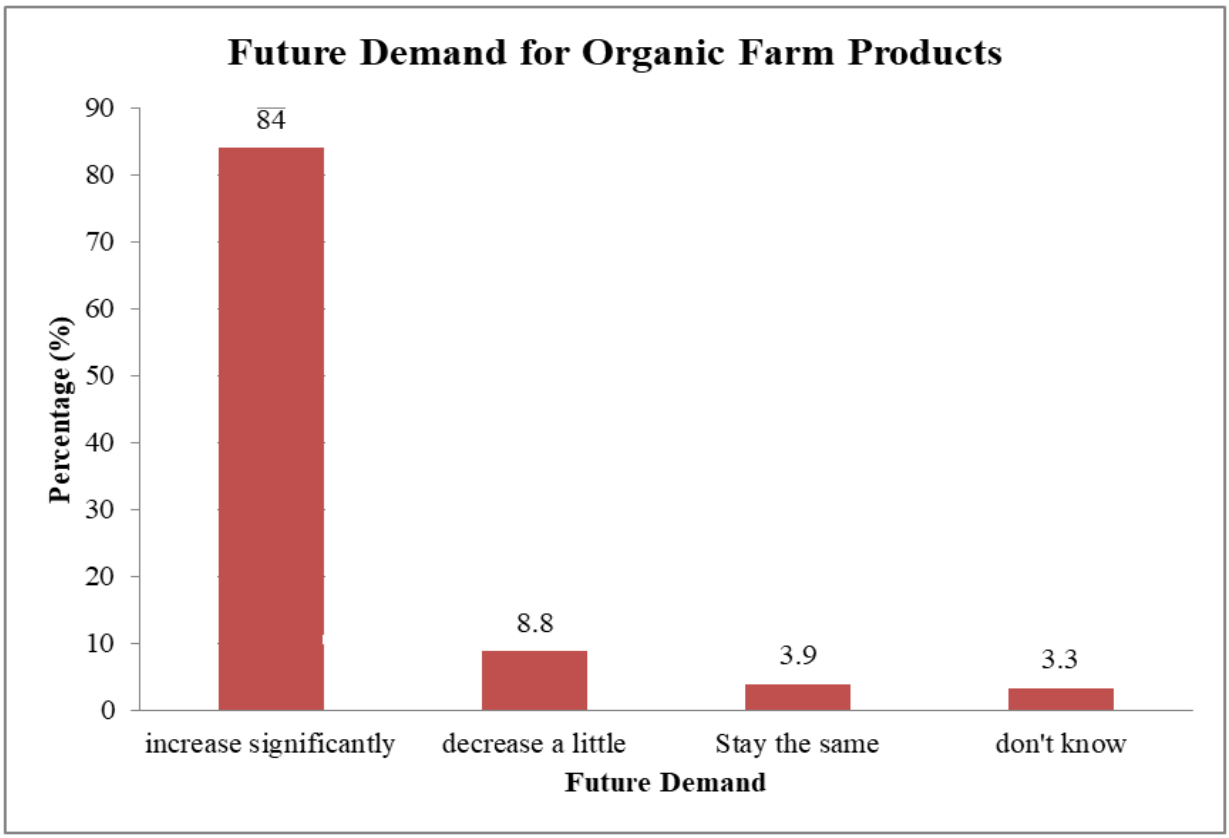


Figure 4.7 ***Future Demand for Organic Farm Products in Kisii Central (n=306)***

An overwhelming 84% observed that the future demand for organic farming products increase significantly (Figure 4.7). The findings imply that although there is high awareness on organic farming, not as many households insist on organic farming products. It is possible that purely organic farming products are rare and expensive. Thus, not many households can access and afford them. This study finding concurs with a study in India which revealed that the rapid demand for organic products in future will be attributed to how to get enough sustainable healthy food (Manida & Nedumaran, 2021). In addition Aryal *et al.* (2009) argued that the future of organic agriculture will, to a large extent depend on consumer demand and their motive for paying extra price for organically grown food. As such, a high price on organic food affects its consumption. The finding is similar to a study done by Nechaev *et al.* (2018) which found out that there was a general increase in demand and expansion of organic food market in European countries. However, the study also indicated that the demand might decrease unless the prices for organic products are reduced.

The study also sought to establish smallholder farmer's perception of organic farming practices compared to conventional farming.

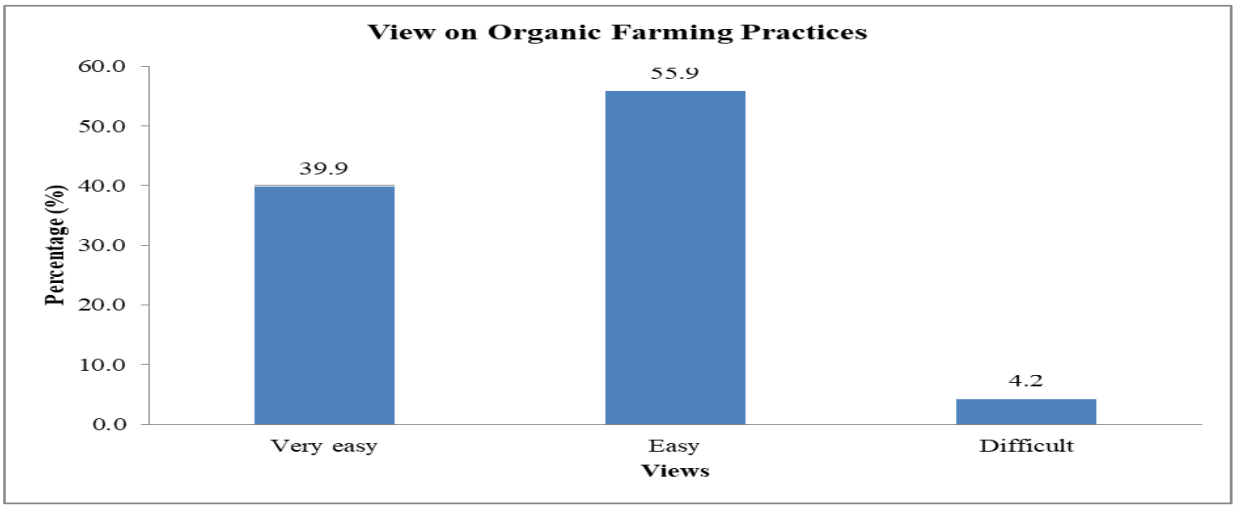


Figure 4.8 ***Views on Organic Farm Practices (n=306)***

The results are presented in Figure 4.8. A majority of respondents (56% - Easy and 40% - very easy) opined that organic farming practices are easy compared to conventional farming. This partly affects the adoption of organic farming practices. The finding is in tandem with Seenirajam (2021) generalization that since OF practices are known to exclude all synthetic off-farm inputs and include crop rotations, crop residues, animal manures, off-farm organic waste, mineral grade rock additives and biological system of nutrient mobilization and plant protection which are easier in terms of application.

Table 4.4 presents the respondents preferences on the OF farming methods.

Table 4.4 ***Smallholder Farmers' Preference on Organic Farming Methods (n=306)***

Practice	Preference (%)			
	Most preferred	**Preferred**	**Least preferred**	**None preferred**
Crop rotation	72.2	23.2	3.6	1
Biological pest management	17.3	37.6	23.9	21.2
Use of Legumes	36.6	31.7	15.4	16.3
Cover crop	45.1	41.8	5.9	7.2
Rotational grazing	34.3	26.8	22.9	16
Livestock-crop diversification	33.3	27.8	16.7	22.2
Use of crop residues	39.9	35	6.2	19
Use of Animal manure	70.9	19	2.6	7.5
Green manures	47.4	22.9	14.7	15
Water conservation	33	26.8	16	24.2
Off farm organic wastes	27.1	28.4	20.9	23.5

Organic farming involves various practices such as crop rotation, use of cover crops, green manure and off farm organic wastes among others. The most preferred practice was crop rotation at 72.2% and use of animal manure at 70.9%. The least preferred practice was the use of biological pest management at 23.9%. Other OF practices that were most preferred included green manure (47.45), cover crops (45.1%), use of crop residues (39.9%) use of legumes (36.6%), rotational grazing (34.35%) and water conservation (33.0%) as shown in Table 4.4. On the other hand, key informants indicated that animal manure was the most preferred organic farming practice as they encouraged farmers to use it. This was because animal manure is easily available to farmers since most of them own livestock. According to Katayama *et al.* (2019), farmers who practiced organic farming embraced crop rotation. This is evidenced by a study done by Adesope *et al.* (2012), found that crop rotation and mixed cropping were the most preferred practices. Other practices in the study included hoeing and hand weeding, intercropping and use of organic manure. In a review study done by Duong *et al.* (2018) found out that livestock-crop diversification and biological pest management were practiced mostly by farmers as a response to curb production risks encountered by farmers.

Availability of information on organic farming and views of the farmers on: the effects of organic farming, market of OF products, present and future demand of organic farming products and the various OF methods were used to determine the relationships between perception and adoption of organic farming. The finding on Figure 4.5 to 4.8 and Table 4.4 shows that the easy access to information on OF is one way of increasing the probability that smallholder farmers would be willing to practice these methods. In addition, the strong agreement on views implies that smallholder farmers in the study area are aware of the effects of organic farming, thus they adopt the methods according to their preferences. This is particularly important since OF methods and products tend to have socio-economic and environmental benefits.

4.4. Influence of Socio-Economic Characteristics on Adoption of Organic Farming

The second objective of the study was to find out the influence of the smallholder farmer's socio-economic characteristics on adoption of organic farming in the study area. Socio-economic characteristics are hypothesized to influence the adoption of organic farming practices in this study, including age, gender, education, household size, income, religion, employment and farm size.

Rank biserial correlation was applied to determine the relationship between age, level of education, household size and farm size and adoption of organic farming. The results of Rank bi-serial correlation are presented in Table 4.5.

Table 4.5 ***Relationship between Selected Socio-economic Characteristics and Adoption of Organic Farming Practices (n=306)***

Practices	**Rank biserial correlation coefficient(r_{rb})**			
	Age	**Education**	**Household size**	**Farm size**
Practice organic farming	-0.028	0.087	-0.056	-0.031
Crop rotation	-0.179*	0.011	-0.204	-0.260
Use of crop residues	-0.163*	0.113*	-0.056	-0.095
Biological pest management	0.051	-0.017	-0.140*	-0.259
Animal manure	-0.094	0.114*	-0.148*	-0.110
Use of legumes	-0.034	0.101	-0.055	-0.037
Green manures	0.005	0.100	0.011	-0.038
Cover crop	-0.032	0.121*	-0.041	-0.008
Water conservation	-0.016	-0.055	0.001	-0.045
Rotational grazing	-0.015	-0.075	-0.156	-0.217
Off-farm organic waste	0.022	0.044	-0.006	-0.055
Livestock-crop diversification	0.064	-0.140*	-0.090	-0.164*

** Significant level is at 0.05*

It is evident that that there was a positive and significant correlation between education and use of crop residues (r=0.113), animal manure (r=0.114) and cover crop (r=0.121). This suggests that the more education one has, the more likely he/she will retain crop residue, apply animal manure and cover crop. Thus, education contribute significantly to the smallholder farmers use of crop residue, animal manure and cover crop components of organic farming. A study done in Nepal indicated that education did not influence the adoption of organic farming. However, training of the farmers had an influence on adoption of the farming practices (Karki *et al.,* 2011). Other studies found out that farmers who are more educated were likely to adopt organic farming compared to less educated farmers (Azam, 2015; Digal & Placencia, 2018; Nelson *et al.,* 2019).

Further, the results show that age of respondents, household size, farm size and education negatively but is significantly correlated with some of the organic farming practices (Table

4.5). The age of smallholder farmers is negatively correlated with adoption of crop rotation (r=-0.179) and use of crop residues (r=-0.163). Household size was found to significantly relate with adoption of biological pests control (r = -0.14) and use of animal manure (r=-0.148). While education was found to relate with farm size (-0.14) and livestock-crop diversification (r =0.164 respectively). It is possible that older farmers have lower education and therefore unlikely to have knowledge of benefits of the organic farming practices such as crop rotation and use of crop residue. In addition, it is possible that older farmers burn or clear farms instead of leaving crop residue on the farm. The findings of the study also imply that families with many members are unlikely to use animal manure. This can be attributed to many demands and high cost of living which would very often lead to sale of livestock to meet these needs. It is however not clear why there exist a negative but significant relationship between farm size and livestock-crop diversification and household size and biological pest management. A study by Digal and Placencia (2018) indicated that farmers with small farm size were more likely to adopt organic farming practices compared to those with large farms. This could be because small farms require less labour and farm inputs compared to large farms. However, another study done by Rittinon and Uruyos (2017), found out that farmers with large farms were likely to adopt organic farming practices.

Respondents were then asked to state how the selected socio-economic characteristics influenced adoption of organic farming and the results are presented in Figure 4.9.

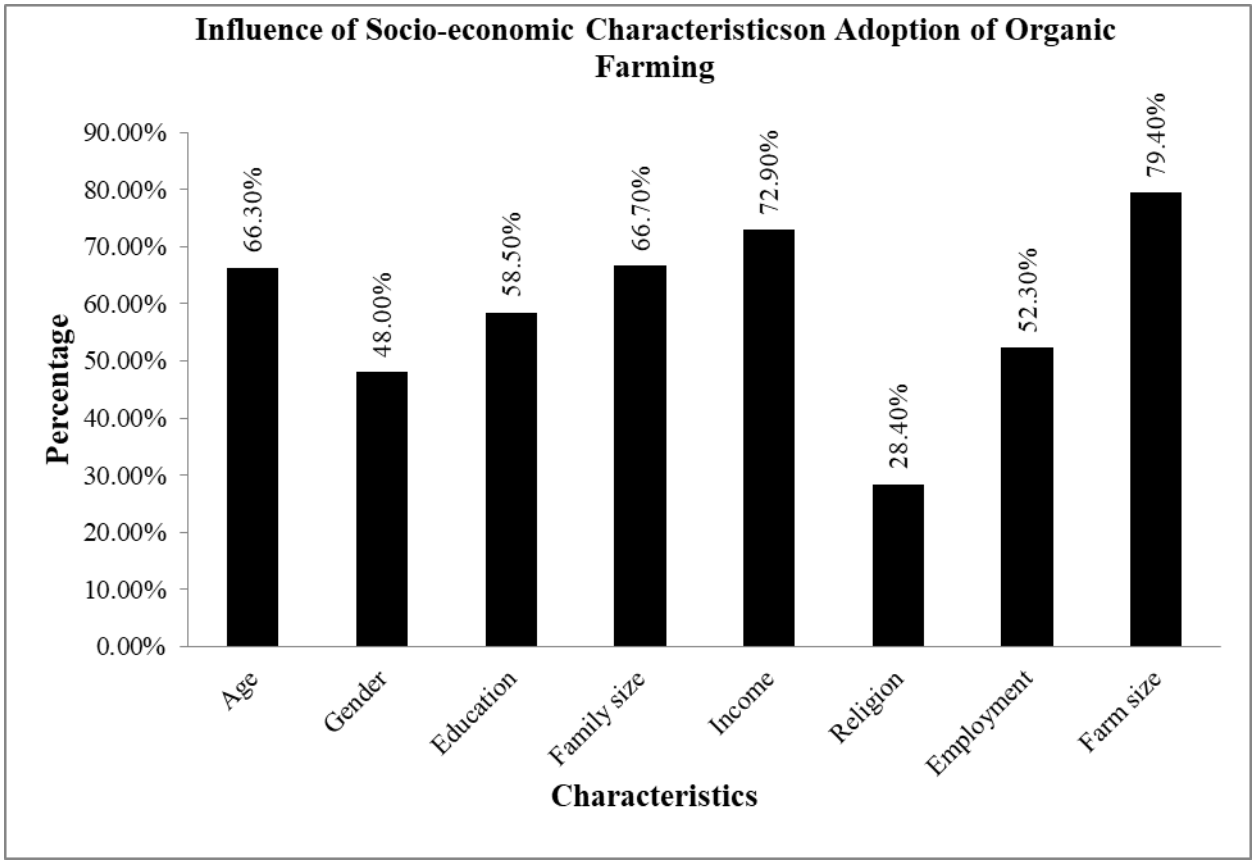


Figure 4.9 ***Perceived influence Socio-economic Characteristics on Adoption of Organic Farming (n=306)***

To a majority of respondents, farm size (79%), income (73%), household size (67%) and age (66%) are the lead socio-economic characteristics influencing adoption of organic farming. Table 4.6 presents results on specifics of how each of the socio-economic characteristics influences adoption of organic farming.

Table 4.6 ***How Socio-economic Characteristics Influences Adoption of Organic Farming Practices (n=306)***

Characteristic	Explanation	Yes (%)
Age	Efficiency of young and older organic farmers are lower than middle age	67.6
	Farmer's managerial ability on organic farming increases with increase in age	73.2
	Farmer's experience on organic farming increases with age	73.9
	Age of farmer affect labour force engaged in agricultural production	81.4
Household size	Family members are source of labour for organic farming hence reducing the cost of production	86.9
	It influences the type of organic farming method to be employed	79.7
	Large household size encourages a variety of organic farming to be practiced	73.2
Education	Training on organic farming increases the farmers' knowledge on adoption of organic farming practices	87.9
	Time taken to acquire knowledge on organic farming affects the farmers' interest to adopt organic farming methods	57.2
	Formal and informal education `affects the farmers' likelihood of adopting organic farming practices	71.9
	Availability on information on organic farming influences the farmers' choices of organic farming practices	92.5
	Knowledge on the benefits of organic farming influences the farmer to adopt organic farming practices	88.9
Gender	More women are involved in farming than men hence more women adopt organic farming easily	73.2
	Organic agriculture is mostly done on small scale hence more women who own small farms easily adopt it	80.4
	More female smallholder farmers are flexible in the adoption if organic farming practices than men	80.1

	More male than female are involved in other occupation thus, women tend to concentrate on small-scale organic farming practices	79.4
Income	Other sources of income of the farmer play an important role in the adoption of organic farming	82.7
	High income from the organic products influences the adoption of organic farming practices	72.9
	High cost on conventional farming methods promotes the adoption of organic farming practices	73.2
Religion	Most religious groups advocate for the adoption of organic farming practices	64.4
	Most religious leaders convey information on organic farming hence the adoption	59.2
	Most Christians regard organic products as natural and healthy hence leading to the adoption	80.7
Occupation	Business influences the adoption of organic farming	73.9
	Salary employment influences the adoption of organic farming	38.6
	Wage employment influences the adoption of organic farming	45.4

According to the study, age of a farmer influence the labour force (81%), farmers' experience (74%) and managerial ability (73%) in the adoption of organic farming. Labour force, experience and managerial ability are interlinked attributes of age (Holcomb *et al.,* 2009). Labour force refers to the working age population engage in various activities. On the other hand, experience is the interaction with the environment to get knowledge, skills, and understanding of aspects within farming. It is expected that farmers who are much older work less hence resulting to low production. A study done by Lapple and Van Rensburg (2011) indicated that younger farmers were more likely to adopt organic farming than older farmer. On the contrary, another study done in Benin indicated that older farmers were more open to adoption of organic farming than younger farmers (Sodjinou *et al.,* 2015).

Family members are a source of labour in organic farming hence lower cost of production was mentioned to be the reason as to household size affects adoption of the practices at 86.9%. This meant that the larger the household size the more people are available to labour in farming hence a high production and low labour costs. In addition, the respondents were of the opinion that the household size influences method (79.7%) and variety (73.2%) of organic farming. The responses might be as a result of the complexity and labour requirement of the specific OF practices. According to Guesmi *et al.* (2012), organic farming is labour intensive compared to conventional farming, however, it depends on the farm structure that is, farm type and size. Labour is required during weeding and turning of the compost that will be used in the farm. Also a study done by Orsini *et al.* (2018) found out that despite OF being labour intensive, organic farms that kept livestock had low labour requirements compared to farms that planted crops. According to Ullah *et al.* (2015), since organic farming is labour intensive, households with many family members were more likely to adopt organic farming.

Apart from having formal education, other aspects of education of interest in this study were influence of having formal or informal education, training on OF, time taken to train on organic farming, availability of organic farming information and knowledge on organic farming. Table 4.6 indicates that availability of information (93%), knowledge on the benefits (89%) and training (88%) on organic farming influences farmers' choices of the farming practices. On the other hand, time taken to acquire knowledge on OF was the least factor influencing (57.2%) the respondents approves to influence interest on OF practice. Farmers who can access more information will be well informed of the merits and demerits of the organic farming practices which will in turn influence their adoption of the farming practices. A study done in Pakistan indicated that farmers who were aware of organic farming were more likely to adopt the farming practices (Ullah *et al.,* 2015). According to Suwanmaneepong *et al.* (2020), level of education affects farmers' likelihood to adopt organic farming. The study found out that the likelihood to adopt organic farming doubled with increase in farmers' level of education.

The respondents (80.4%) agreed that organic agriculture is mostly done in small scale hence more women who own small farms easily adopt the practices. In addition, 80.1% noted that female farmers easily adopt OF than male. Thus, the finding shows that women embrace OF in the study area than men. The study finding differ with a study in Nigeria which indicated that there are more male smallholder farmers than their female counterparts in the agricultural

sector and concurs with finding in Uganda and Tanzania where female account for 75.7% and 80% in the agricultural sector (Salami & Mukasa, 2015).

Income played a role in influencing the adoption of farming practices. As shown in Table 4.6 most of the respondents (82.7%) agreed that other sources of income of the farmer played, high cost of conventional farming (73.9%) and high income from organic products (72.9%) influences the adoption of organic farming. The findings were in agreement with IFOAM (2021) report that high income associated with organic farming (compared with conventional farming) encouraged smallholder farmers to adopt various OF methods.

The respondents (81%) indicated that most Christians regarded organic products as natural and healthy hence leading to the adoption of farming practices. A study done by Falvey (2005) religion has a capacity to influence adoption of agricultural practices since societies' knowledge is controlled by spiritual wisdom. Another study done in Cameroon found out that different communities performed different spiritual rituals during land preparation, planting, weeding and harvesting. Some of the rituals involved enhancement and soil fertility and promoted crop protection (Lang, 2018). Majority of the respondents (73.9%) indicated that engagement in business influenced the adoption of organic farming. Business especially sale of organic products encourages farmers to adhere to organic farming practices to access the market (either local or International).

4.5 Socio-economic and Environmental Effects of Organic Farming as Perceived by Smallholder Farmers

The third objective of the study was to examine the socio-economic and environmental effects of organic farming as perceived by smallholder farmers in Kisii Central Sub - County.

There are many factors that influence organic farming practices. The respondents were asked to choose factors which motivated their adoption and practice of organic farming and the results are presented in Figure 4.10. It is observed that health benefits (61%) are the lead motivation to households to practice organic farming. This was followed by income (46%) and neighbour's influence (41%). The finding implies that most respondents are aware of the health benefits of OF products thus leading to adoption and practice of the various OF. According to IFOAM (2015), the first principle of organic farming is to ensure high quality nutritious food that contributes to preventive health care and well-being. The finding concurred with Safdar *et al.* (2016) who noted that awareness about negative health

externalities generated by conventional farming was a factor that consumers' choice of organically produced food products in the United Arab Emirates.

The second motivational factor to organic farming by the smallholder farmers in the study area was income from the organic products. Organic food products are valued more by the consumer since they perceive it as healthier and more environmentally friendly, thus making consumers willing to pay a premium price for them (Jayasuriya, 2016). Hence, a higher income associated with the sales of organic farming products attracts most farmers to adopt OF practices.

Neighbors influence was the third factor found to motivate OF practices. According to Métouolé *et al.* (2018), farmers who know other organic farmers were more likely to adopt organic agriculture. Their social influence and sharing of relevant organic farming information and experience pertaining OF practices play a role in motivating the neighbor to adopt the practice (Sapbamrer & Thammachai, 2021).

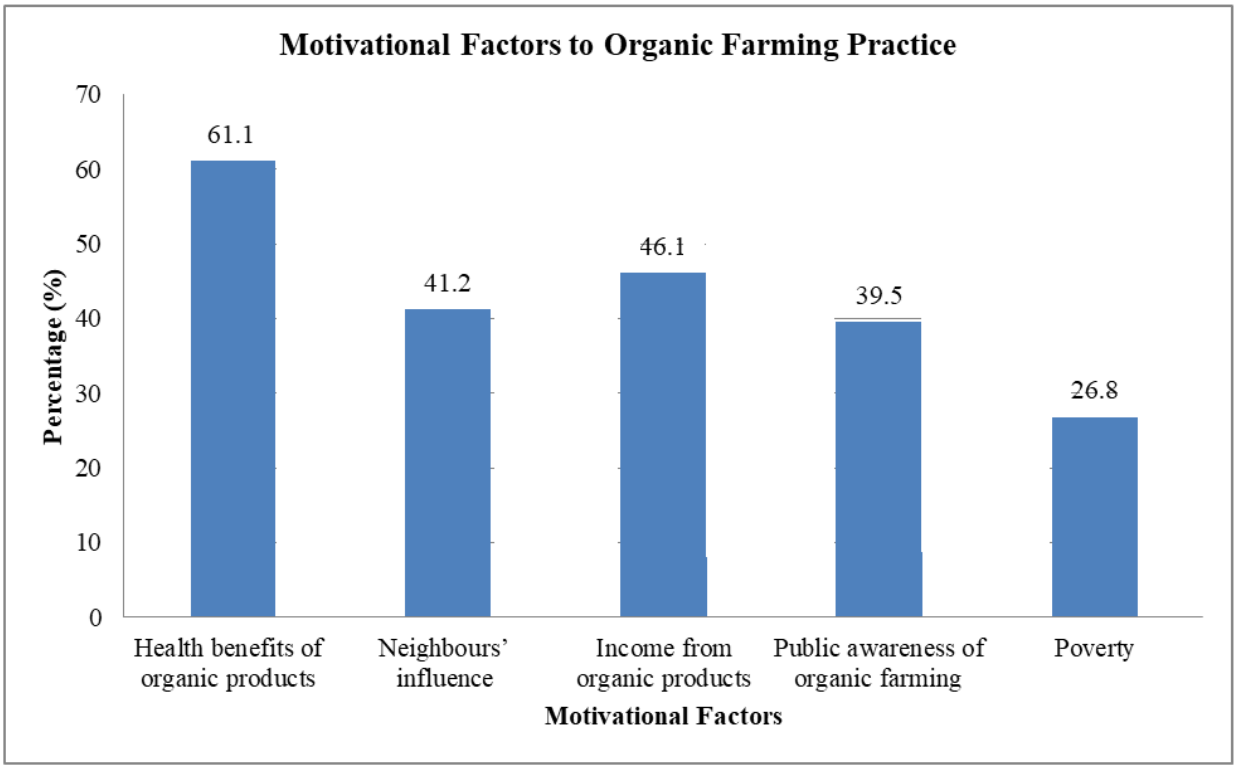


Figure 4.10 ***Motivational Factors to the Adoption of Organic Farming Practice (n=306)***

Further, the respondents were asked to state social, economic and environmental effects of organic farming and the results are presented in Table 4.7.

Table 4.7 ***Socio-economic and Environmental Effects of Organic Farming (n=306)***

Effects	Categories	Frequency	Percentage
Social	Improved human health	252	82.4
	Improved livelihood and welfare	209	68.3
	Promotion of food quality and safety	227	74.2
	Protection against diseases	207	67.6
	Ensuring food security	202	66.0
Economic	Increased income from sales of organic product	250	81.7
	Reduced expenditure on chemicals farming	210	68.6
	Creation of employment	177	57.8
	Increased access to healthy food	223	72.9
Food insecurity mitigation	Increased organic farm output	295	96.4
	Diversify crops	209	68.3
	Improved nutrients contents	293	95.8
Environmental	Soil fertility and restoration	305	99.7
	Mitigate climate change	136	44.4
	Reduce surface runoff	226	73.9
	Water conservation	229	74.8
	Energy conservation	122	39.9
	Soil conservation	270	88.2

The respondents indicated that social benefits of OF including improved human health (82.4%) and promotion of food quality and safety (74.2%). Economic benefits indicated by most respondents included increased income from sales of organic products (81.7%) and increased access to healthy food (72.9%). Organic farming was also associated with mitigating food insecurity through increased organic farm output (96.4%).

According to Singh (2021), organic farming has a number of effects compared to conventional farming. The study identified various effects such as improved human health due to access to healthy and safe food that has minimum pesticide residues. Another effect mentioned in the study was improved soil fertility as most farmers use organic inputs that nourish the biotic component of the soil and microbes that release transform and transfer

nutrients. Organic farming has been found to improve the economic situation of farmers through selling of their produce and provision of employment (Prihtanti *et al.,* 2014). Also, organic farming reduces the exposure of people to pesticides and chemicals which have been associated with various health issues and deaths especially in developing countries (Thindiyil *et al.*, 2008). Economically, organic farming has been found to be profitable than conventional farming due to lower input costs and high price of the products (Husnain *et al.,* 2017). Monthly family income of households practicing OF was found to be much higher than households practicing conventional farming (Husnain *et al.*, 2017). Therefore, income earned through OF helps to improve the living standards of farmers. In a study by Parrott *et al.* (2006) organic farming was found to have potential to improve food security through diversification of livestock and crops subsequently diversifying income sources and variety of diets.

Environmental effects mentioned by respondents included soil fertility and restoration (99.7%) and soil conservation at 88.2%, among other effects. According to Altenbuchner (2018), OF plays an important role in improving soil fertility, through reduced exposure to toxic chemicals and lower input costs, which in turn reduces dependency on money lenders. Farming activities affect various aspects of the environment. The study further sought to establish how specific organic farming practices affects the environment and the results are presented in Table 4.8.

Table 4.8 ***Organic Farming Practices that Improve Aspects of the Environment (n=306)***

Farming practice	**Aspect of the environment (percentage)**							
	Soil Fertility	**Soil protection**	**Mitigate climate change**	**Water conservation**	**Reduce surface runoff**	**Energy conservation**	**All of them**	**None of them**
Crop rotation	56.9	7.2	0.3	0.3	0.7	0.0	26.8	22.0
Biological pests management	9.8	31.4	10.5	2.9	4.2	4.9	6.5	29.7.
Use of legumes	41.15	15.05	6.9	4.9	3.6	0.7	18.0	9.8
Cover crop	16.85	14.25	6.5	23.5	8.2	0.3	18.3	12.1
Rotational grazing	14.8	12.6	5.9	5.2	17.6	2.3	12.7	28.8
Livestock-crop diversification	15.0	10.1	7.2	4.9	16.7	7.5	19.0	19.6
Off farm organic wastes	19.45	14.25	8.8	4.2	6.9	5.2	15.4	25.8
Green manure	42.35	11.5	2.9	2.9	4.6	1.3	16.3	18.0
Use of animal manure	50.8	9.3	3.3	2.6	2.6	1.6	23.5	6.2
Mulching	6.7	8.7	3.9	33.0	8.8	2.0	24.8	12.1
Use of crops residue	18.6	11.5	3.3	18.6	11.1	1.3	22.5	13.1

The results indicate that most of the smallholder farmers were of the view that organic farming practices such as crop rotation (56.9%), use of legumes (41.15%), green manure (42.35%) and use of animal manure (50.8%) improved soil fertility. The finding implies that crop rotation, use of legume, green manure and of animal manure adds soil organic matter and nutrient availability by incorporating different crop residues. This concurs with Li *et al.* (2013) that crop rotation, use of animal and cover cropping enhances soil quality, disrupts weeds, insects and disease cycle and affects sequestration of carbon and nitrogen. The respondents indicated that cover crop (23.5%) improved water conservation. Thus, when cover crops are used as an OF method water loss on the farm is reduced. According to Delgado *et al.* (2021), cover crops play a role in prevention evaporation of water from the soil. On the other hand, a section of respondents opined that that crop rotation (22%), biological pest management (30%), rotational grazing (29%) and off-farm organic wastes (26%) did not improve any aspects of the environment. Very few farmers thought that organic farming practices can mitigate climate change and conserve energy. In addition, key stakeholders include in the study indicated that OF practices improved soil texture and enhanced its capacity to hold water due to high organic matter and cover crops. According to El-Hage (2013), organic farming contributes to energy conservation because it reduces the used chemical and fertilizers that use non-renewable source of energy used for their manufacturing. According to Nejadkoorki (2012), organic farming improves various aspects of the environment such as biodiversity conservation, prevention of water, air and soil pollution and climate change as it reduce the use of chemical fertilizers and pesticides. In light of the findings, public awareness on benefits of organic farming need to go beyond health and income. The contribution of organic farming to climate change mitigation and energy conservation should be brought to fore. For instance, use of organic biomass as a substitute for fossil fuel help in reduce GHG emissions and enhance soil carbon sequestration (Goh, 2011).

To determine the relationship between the social, economic and environmental benefits and knowledge and perception towards organic farming practice, correlation analysis between choice of the type of organic method to practice and benefits associated with OF was undertaken as shown in table 4.9.

Table 4.9 ***Relationship between Benefits Associated with OF and Choice of Type of OF (n=306)***

Choice of Type of Organic farming	Benefits associated with OF		
	Economic benefits	**Social benefits**	**Environmental benefits**
Crop rotation	0.154	0.121*	0.132*
Biological Pests Managements	0.10	0.06	-0.03
Use of legumes	0.07	0.10*	-0.012
Cover crop	0.23	-0.08	0.16*
Rotational grazing	0.02	0.09	0.16*
Livestock-crop diversification	0.19	0.02	0.15
Use of crops residue	0.14	0.09	0.04
Use of animal manure	0.20	0.06	0.09
Green manures	-0.08	0.10	-0.07
Water conservation	0.22	0.13*	0.14*

** Correlation is significant at 0.05 levels*

Table 4.9 shows that awareness of the social benefits associated with OF is significantly related with the choice of crop rotation (r=.121) and water conservation (.13) methods of OF. In addition, farmers who were aware of environmental benefits associated with OF positively related to their choice of cover crop (r=.16), rotational grazing (r=.16), water conservation (r=.14) and crop rotation (r=.132). Besides, knowledge and perception on the social and environmental benefits associated with OF significantly influence adoption of crop rotation and water conservation measures of organic farming. A similar finding in China revealed that

there is positive association between apple smallholders farmers' knowledge and perception on environmental benefits of organic farming and choice of some OF method of practice (Ma *et al.*, 2017). The finding concurred with Sharifuddin *et al.* (2018) who showed that the perceived usefulness, perceived ease, and environmental concerns affected positively the organic rice farming in Indonesia.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary

This research study was done to assess smallholder farmers' perception on Adoption of organic farming practices in Kisii central sub-county. The study sampled 306 respondents. Descriptive statistics and inferential statistics were used in the data analysis. The summary of results for each of the objectives is as presented below;

Objective 1: To determine the extent to which Smallholder Farmers' Perception influence adoption of Organic Farming Practices in Kisii Central Sub – County:

Organic farming practices are widespread in Kisii Central sub-County with nearly all farmers (97%) involved. Use of animal manure (60.1%) and crop rotation (59.8%) are the most employed organic farming practices. Crop rotation (59.8%), use of legumes (38.6%),crop cover (34.6%), livestock-crop diversification (47.7%), use of crop residue (42.2%), use of animal manure (60.1%) and green manure (49.3%) forms of OF were employed by the SHF more within a period of 1-5 years. The respondents (34.3%) indicated that they had approximately 6 - 10 neighbours engaging in organic farming practices. Use of animal manure (87.3%) and crop rotation (72%) are the most predominant OF methods. In addition, 52.3% of the respondents have approximately less than 1 acre of land under organic farming. The study established that 52% and 35% of the respondents consider information on organic farming to be easily available and available respectively. A majority of the respondents (68.9%) strongly agreed that organic farming has positive effects on the environment and considered it a form of traditional agriculture (51%). Respondents considered the present demand for organic products to be average (64%) but observed that future demand will significantly increase (84%).

Objective 2: To determine the influence of smallholder farmer's Socio-economic characteristics on Adoption of Organic Agriculture Farming in the study area:

It is evident from the findings of this study that farm size (79%), income (73%), household size (67%) and age (66%) are the lead socio-economic characteristics influencing adoption of organic farming. According to the study, age of farmer influences labour for OF (81%). The household size is pivotal in influencing labour (87%), and type of organic farming (80%).

The study established that availability of information on OF (92%) and knowledge on benefits of organic farming (89%) influence its adoption. Additionally, availability of small farms (80%) and flexibility of women (80%) were the main determinants for women involvement in organic farming. For most Christians, the perception that organic products are natural and health (81%) drives them to its adoption. Households involved in business (74%) are more likely to practice organic farming than the salaried (39%) or those earning wages (45%). There is a positive correlation between education and use of crop residues (r=.113), animal manure (r=.114) and cover crop (r=.121). On the other hand, there is a negative association between smallholder farmers' age and adoption of crop rotation (r=-.179) and use of crop residues (-.163); household size and adoption of biological pests control (r =-.14) and use of animal manure (-.148); education and farm size (r=-.14) and livestock-crop diversification (- .164).

Objective 3: To examine the Socio-economic and Environmental effects of Organic Farming as perceived by Smallholder Farmers in Kisii Central Sub - County

The study established that health benefits (61%) and income (46%) are the main motivational factors influencing adoption of organic farming. Human health (82.4%) and promotion of food quality and safety (74.2%) are the main social benefits of organic farming. While increased income from sales of organic products (81.7%) and increased access to healthy food (72.9%) are identified as economic benefits of organic farming. The most mentioned environmental benefits are soil fertility and restoration (99.7%) and soil conservation at 88.2%. There is a positive correlation between education and use of crop residues (r=.113), animal manure (r=.114) and cover crop (r=.121). In addition, there is a positive relationship between social benefits associated with OF and the choice of crop rotation (r=.121) and water conservation (r=.13) of the OF methods. Farmers who are aware of environmental benefits associated with OF positively related to their choice of cover crop (r=.16), rotational grazing (r=.16), livestock-crop diversification (r=.15), water conservation (r=.14) crop rotation (r=.132) and use of animal manure (r = .09). Lastly, there is a relationship between economic benefits of OF and water conservation (r=.22) than any other type of OF.

5.2 Conclusions

The study has established that information on organic farming is easily available and smallholder farmers are aware of organic farming: methods, effects and products in the study area. Most smallholder farmers practice use of animal manure and crop rotation while few

practice biological pest control. Therefore, the availability of information and awareness, and future prospects of organic farming can be utilized to increase the adoptability of organic farming.

Farm size, income, education, household size and age of the smallholder farmers are the main socio-economic characteristics that significantly influence the adoption of organic farming in Kisii Central Sub-County. On the other hand, gender and religion are not very significant characteristics in the adoption of organic farming.

In Kisii Central sub-County, the smallholder farmers practice organic farming with aim of: achieving good health, increasing their income and conserving the environment.

5.2. Recommendations

Based on the findings of this study, it is recommended that;

- **i.** The agricultural stakeholders of organic farming should take note of the positive rating and perception of organic farming. The regard of a significant increase in the demand for organic products should be a stepping stone to expansion of organic farming and improvement of livelihoods for smallholder farmers.
- **ii.** Promotion of organic farming practices should take into account income, education, household size and age of farmers.
- **iii.** Creation of awareness among farmers on other effects especially environmental benefits of organic farming such as biological pest management, mitigation of climate change and energy conservation.

5.3. Areas of Further Studies

This study identifies a number of areas that require a greater extent research, with the aim to complement the findings.

- **i.** The study assessed farmers' perception on adoption of organic farming; however, it did not assess willingness of the farmers to adopt organic farming practices.
- **ii.** The study did not assess farmers' perception among conventional farmers so that a comparison could be done between the group and organic farmers.

iii. The study is mainly on socio-economic and environmental effects of organic farming a wider focus on other factors should be made in more studies especially on climate.

iv. This study was based on perception of organic farming which is purely qualitative in nature. It is recommended that in-depth quantitative studies be conducted to shed more light on the extent and magnitude of the issues investigated herein to elude the limitations of the study.

v. A content analysis study is recommended to concretize the OF and give the trends and clear cut statistics like from developed countries.

REFERENCES

Abebe, G. K., Bijman, J., Pascucci, S., & Omta, O. (2013). Adoption of Improved Potato Varieties in Ethiopia: The Role of Agricultural Knowledge and Innovation System and Smallholder Farmers' Quality Assessment. *Agricultural Systems, 122*, 22-32.

Abraham, M., & Pingali, P. (2020). Transforming Smallholder Agriculture to achieve the SDGs. *The Role of Smallholder Farms in Food and Nutrition Security*, 173-209.

Adamchak, R. (2021). *Organic Farming.* Encyclopedia Britannica. http://www.britannica.com/topic/organicfarming

Adebayo, S., & Oladele, I. O. (2014). Organic Agricultural Practices among Smallholder Farmers in South Western Nigeria. *Organic Agriculture Towards Sustainability,1*, 51-66.

Adele, H. A. (2014). Social Entrepreneurship in South-Western Nigeria: A study of Selected Non-Governmental Organisations. *LAP Lambert Academic Publishing, Germany. FISBM, 978-3.*

Adesope, O. M., Matthews-Njoku, E. C., Oguzor, N. S., & Ugwuja, V. C. (2012). Effect of Socio-Economic Characteristics of Farmers on their Adoption of Organic Farming Practices. *Crop Production Technologies, 1*, 210-220.

Agarwal, B. (2018). Gender equality, Food Security and the Sustainable Development Goals. *Current Opinion in Environmental Sustainability, 34*, 26-32.

Aiyar, M. S., & Ebeke, M. C. H. (2016). *The impact of Workforce Aging on European Productivity*. International Monetary Fund.

Ajewole, O. C. (2010). Farmer's response to Adoption of Commercially Available Organic Fertilizers in Oyo state, Nigeria. *African Journal of Agricultural Research, 5*(18), 2497- 2503.

Altenbuchner, C., Vogel, S., & Larcher, M. (2018). Social, Economic and Environmental Impacts of Organic Cotton Production on the Livelihood of Smallholder Farmers in Odisha, India. *Renewable Agriculture and Food Systems, 33*(4), 373-385. doi:10.1017/S174217051700014X

Aulakh, C. S., & Ravisankar, N. (2017). *Organic Farming in Indian context: A Perspective*.

Ayuya, O. I., Gido, E. O., Bett, H. K., Lagat, J. K., Kahi, A. K., & Bauer, S. (2015). Effect of Certified Organic Production Systems on Poverty among Smallholder Farmers: Empirical evidence from Kenya. *World Development, 67*, 27-37.

Azam, M. (2015). The influence of Socio-demographic factors in adopting Organic Farming Practices. *International Journal of Interdisciplinary and Multidisciplinary Studies*, *2*(5), 8-17. https://www.ijims.com

Azarbad, H. (2022). Conventional vs. Organic Agriculture–Which One Promotes Better Yields and Microbial Resilience in Rapidly Changing Climates?. *Frontiers in Microbiology 13*, 1-9

Barik, A. K. (2017, November). Organic Farming in India: Present Status, Challenges and Technological breakthrough. In *3rd Conference on bio-resource and stress management international* (pp. 101-110).

Barratt, B. I. P., Moran, V. C., Bigler, F., & Van Lenteren, J. C. (2018). The status of Biological Control and Recommendations for improving uptake for the future. *BioControl*, *63*, 155-167.

Bonabana-Wabbi, J. (2002). *Assessing Factors affecting Adoption of Agricultural Technologies: The case of Integrated Pest Management (IPM) in Kumi District, Eastern Uganda* (Doctoral dissertation) Virginia Tech.

Baumgarten, M. (2012). *Paradigm wars-Validity and Reliability in Qualitative Research*. GRIN Verlag.

Behera, K. K., Alam, A., Vats, S., Sharma, H. P., & Sharma, V. (2012). Organic Farming History and Techniques. *Agroecology and Strategies for Climate Change*, *8*, 287-328.

Bellarby, J., Foereid, B., & Hastings, A. (2008). *Cool Farming. Climate Impacts of Agriculture and Mitigation Potential.* University of Aberdeen, Amsterdam Netherlands.

Bernzen, A., & Kristiansen, P. (2016). Challenges for Organic Agriculture in Australia: Getting a 'Fair Go'. *Postcolonial Justice in Australia: Reassessing the'Fair Go'*. Wissenschaftlicher Verlag Trier. https://hdl.handle.net/1959.11/21455

Boeije, H. (2009). *Analysis in qualitative research*. Sage Publications.

Bouttes, M., Darnhofer, I., & Martin, G. (2019). Converting to organic farming as a way to enhance adaptive capacity. *Organic Agriculture*, *9*, 235-247.

Cant, C., Gerber-Nel, D., Nel, M. & Kotze, T. (2011). *Market Research*, Claremont: New Africa Education.

Chouichom, S., Yamao, M., & Liao, L. M. (2010). *Factors Affecting Farmers' Participation of Organic Rice Farming Promotion in Surin province, North East Thailand. In*

proceedings 16th Asian Agricultural Symposium and 1st international Symposium on Agricultural technology (KMITL), Thailand

Cranfield, J., Henson, S., & Holliday, J. (2010). The Motives, Benefits, and Problems of Conversion to Organic Production. *Agriculture and Human Values*, *27*(3), 291-306.

Crowder, D. W., & Reganold, J. P. (2015). Financial Competitiveness of Organic Agriculture on a Global Scale. *Proceedings of the National Academy of Sciences*, *112*(24), 7611-7616.

Crutchfield, S.R., Robert, Godan, E. & Kuchler, F. (2000). *Labelling Genetically Modifies Food. An Economic Appraisal(pp 1-9).* https://www.semanticscholar.org/paper/Labeling-Genetically-Modified-Foods%3A-An-Economic-Golan-Kuchler/b2f8e0665796cde3f6bfcc46519f6cd3bf5a1a6c

Davies, J., Spear, D., Chappel, A., Joshi, N., Togarepi, C., & Kunamwene, I. (2019). Considering Religion and Tradition in Climate Smart Agriculture: Insights from Namibia. *The Climate-Smart Agriculture Papers: Investigating the business of a productive, resilient and low emission future*, 187-197. doi.org/10.1007/978-3-319-92798-5

de Lauwere, C. C., Schoorlemmer, H. B., Smit, A. B., Roelofs, P. F. M. M., & Poelman, A. A. M. (2004). *Onderzoek naar verbeterpunten in het ondernemerschap van geïntegreerde en biologische telers: vertrekpunt voor verdere professionalisering= Research to improve agricultural entrepreneurship of integrated and organic farmers: start for further professionalization* (No. 002). Agrotechnology & Food Innovations.

Delgado, J. A., Mosquera, V. H. B., Alwang, J. R., Villacis-Aveiga, A., Ayala, Y. E. C., Neer, D., ... & López, L. O. E. (2021). Potential use of cover crops for soil and water conservation, nutrient management, and climate change adaptation across the tropics. *Advances in Agronomy*, *165*, 175-247.

Digal, L. N., & Placencia, S. G. P. (2019). Factors affecting the adoption of organic rice farming: the case of farmers in M'lang, North Cotabato, Philippines. *Organic Agriculture*, *9*, 199-210. https://doi.org/10.1007/s13165-018-0222-1

Doss, C. R., Mwangi, W. M., Verkuijl, H., & De Groote, H. (2003). *Adoption of Maize and Wheat Technologies in Eastern Africa: A Synthesis of the Findings of 22 Case Studies*. CIMMYT.

Delgado, J. A., Mosquera, V. H. B., Alwang, J. R., Villacis-Aveiga, A., Ayala, Y. E. C., Neer, D., ... & López, L. O. E. (2021). Potential use of Cover Crops for Soil and Water Conservation, Nutrient Management, and Climate Change Adaptation across the Tropics. *Advances in Agronomy*, *165*, 175-247.

El-Hage Scialabba, N. (2013). Organic Agriculture's Contribution to Sustainability. *Crop Management*, *12*(1), 1-3.

Fairweather, J.R. (1999). Understanding how Farmers choose between Organic and Conventional Production: Results from Newzealand and Policy Implication. *Agriculture and Human Values*, *16*(1), 51-63.

Falvey, J. L. (2005). Religion and Agriculture: Sustainability in Christianity and Buddhism. *The Institute for International Development*. http://www.iid.org

FAO (2017). The Future of Food and Agriculture. Trends and Challenges. http://www.fao.org

FAO (2021). Organic foods – Are they safer? Food Safety Technical Toolkit for Asia and the Pacific No. 6. Bangkok

Ferreira, F., Mendes-Moreira, P., & Botelho, G. (2020). Is Organic Agriculture a Potential Public Health Indicator? Evidence from literature. *Open Agriculture*, *5*(1), 914-929.https://www.doi.org/10.1515/opag-2020-0088

Gikunda, R. M., Lawver, D. E., Baker, M., Boren-Alpizar, A. E., & Guo, W. (2021). Extension Education Needs for Improved Adoption of Sustainable Organic Agriculture in Central Kenya. *American Journal of Geographic Information System 2021*, *10*(2), 61-71. DOI: 10.5923/j.ajgis.20211002.01

Global Environmental Management Education Centre [GEM] (2007). Organic Farming in Kenya: A Growing Demand for Consistent Supply. http://orgprints.org/14043/1/14043.pdf

Godswill, A. G., Somtochukwu, I. V., Ikechukwu, A. O., & Kate, E. C. (2020). Health Benefits of Micronutrients (vitamins and minerals) and their Associated Deficiency Diseases: A Systematic Review. *International Journal of Food Sciences*, *3*(1), 1-32.

Goh, K. M. (2011). Greater mitigation of Climate Change by Organic than Conventional Agriculture: A Review. *Biological Agriculture & Horticulture*, *27*(2), 205-229.

GoK (2010). Agricultural Sector Development Strategy 2010 – 2020. https://agra.org/wp-content/uploads/2017/12/agra-kenya-final.pdf

GoK (2012). The Independent Electoral and Boundaries Commission. Preliminary Report on the first review relating to the delimitation of boundaries of constituencies and wards. https://www.iebc.or.ke/uploads/resources/WHXao7x83D.pdf

GoK (2013). Agricultural Act Cap 318. www.kenyalaw.org

GoK (2014). Government Ministry of Agriculture, Livestock Fisheries and Cooperative Development. Kisii County Agricultural Report. https://www.kisii.go.ke/index.php

GoK (2016). Kenya Gazatte notice Number 6307. The Independent Electoral and boundary Commission. https://www.iebc.or.ke/uploads/resources/XFHwhfQuU2.pdf

GoK (2017). Kenya Climate Smart Agriculture Implementation Framework 2018-2027. http://www.ke.undp.org

GoK (2017). National Food Security and Nutrition Policy (NFSNP) 2017-2022

GoK (2020). Kenya National Bureau of Statistics Economic Survey smallholder. https://www.knbs.or.ke/download/economic-survey-2020/

Gomiero, T., Pimentel, D., & Paoletti, M. G. (2011). Is there a need for a more Sustainable Agriculture?. *Critical Reviews in Plant Sciences*, *30*(1-2), 6-23.

Guesmi, B., Serra, T., Kallas, Z., & Roig J. M. G. (2012). The Productive Efficiency of Organic Farming: The Case of Grape Sector in Catalonia. *Spanish Journal of Agricultural Research*, *3*, 552-566. doi:10.5424/sjar/2012103-462-11

Holcomb, T. R., Holmes Jr, R. M., & Connelly, B. L. (2009). Making the most of what you have: Managerial ability as a source of Resource Value Creation. *Strategic Management Journal*, *30*(5), 457-485.

Holt-Giménez, E. (2019). Capitalism, Food, and Social Movements: The Political Economy of Food System Transformation. *Journal of Agriculture, Food Systems, and Community Development*, *9*(A), 23-35.

Huang, Y., Edirisinghe, I., & Burton-Freeman, B. M. (2016). Low-income Shoppers and Fruit and Vegetables: What do they think?. *Nutrition Today*, *51*(5), 242-250.

Husnain, M. I. U., Khan, M. & Mahmood, H. Z. (2017). An Assessment of Public and Private Benefits of Organic Farming in Pakistan. *Journal of Animal & Plant Sciences*, 27(3), 996-1004. https://www.researchgate.net/publication/318262764_An_assessment_of_public_and_private_benefits_of_organic_farming_in_Pakistan

IFOAM (2011). Regional Cooperation for Organic Standards and Certification Capacity in East Africa. OSEA Phase II. 13 pp.

IFOAM (2020). Organic Agriculture and Food security. Organic International. https://www.ifoam.bio/sites/default/files/2020-03/foodsecurity2015web.pdf

IFOAM and FiBL (2009). The World of Organic Agriculture: Statistics and Emerging Trends 2009. International Federation of Organic Agriculture Movements (IFOAM), Bonn & Research Institute of Organic Agriculture FiBL

IFOAM and FiBL (2016). *The World of Organic Farming: Statistics and Emerging Trends 2006*. International Federation of Organic Farming Movements (IFOAM), Bonn & Research Institute of Organic farming FiBL

IFOAM and FiBL (2017).*The World of Organic Farming: Statistics and Emerging Trends 2017*. International Federation of Organic Farming Movements (IFOAM), Bonn & Research Institute of Organic farming FiBL

IFOAM and FiBL (2018).*The World of Organic farming: Statistics and Emerging Trends 2006*. International Federation of Organic farming Movements (IFOAM), Bonn & Research Institute of Organic farming FiBL, Frick, pp.

IFOAM and FiLB (2021). The World of Organic Agriculture: Statistics and Emerging Trends 2021. http://www.organic-world.net/yearbook/yearbook-2021.html

IFOAM and FiBL (2022).*The World of Organic farming: Statistics and Emerging Trends 2022*. International Federation of Organic farming Movements (IFOAM), Bonn & Research Institute of Organic farming

IFOAM (2014). *The IFOAM Norms for Organic Production and Processing, Version 2014*.

Issa, I. and Hamm, U. (2017). Adoption of Organic Farming as an Opportunity for Syrian Farmers of Fresh Fruit and Vegetables: An Application of the Theory of Planned Behaviour and Structural Equation Modelling. *Sustainability*, *9*(11). https://doi.org/10.3390/su9112024

Jahroh, S. (2010, June). Organic Farming Development in Indonesia: Lessons Learned from Organic Farming in West Java and North Sumatra. *ISDA 2010* (pp. 11-p). Cirad-Inra-SupAgro.

Jayasuriya, N. A. (2016). Sri Lankan Consumer attitudes towards healthy meals. *Journal of Marketing and Consumer Research Journal*, *24*.

Kamau, J. W., Stellmacher, T., Biber-Freudenberger, L., & Borgemeister, C. (2018). Organic and Conventional Agriculture in Kenya: A typology of Smallholder Farms in Kajiado and Murang'a counties. *Journal of Rural Studies*, 57, 171-185.

Kandji, S.T. (2006). Drought in Kenya: Climatic, Economic and Socio-Political Factors. http://www.worldagroforestry.org/downloads/publications/PDFs/NL06291.pdf

Kariyasa, K. & Dewi, A. (2011).Analysis of Factors Affecting Adoption of Integrated Crop Management Farmer Field School (Icm-Ffs) in Swampy Areas. *International Journal of Food and Agricultural Economics, 1*(2), 29-38

Karki, L., Schleeenbecker, R., & Hamm, U. (2011). Factors influencing a conversion to organic farming in Nepalese tea farms. *Journal of Agriculture and Rural Development in the Tropics and Subtropics, 112*(2), 113-123.

Kassam, A., Friedrich, T., Derpsch, R., & Kienzle, J. (2015). Overview of the worldwide spread of Conservation Agriculture. *Field Actions Science Reports. The Journal of Field Actions, 8,* 1-11.

Katayama, N., Osada, Y., Mashiko, M., Baba, Y. G., Tanaka, K., Kusumoto, Y., Okubo, S., Ikeda, H., & Natuhara, Y. (2019). Organic Farming and Associated Management Practices Benefit Multiple Wildlife Taxa: A Large-Scale Field Study in Rice Paddy Landscapes.

Kuada, J. (2012). *Research methodology: A Project Guide for University Students*. Samfundslitteratur.

Kenya Organic farming Network (KOAN). 2014. Strategic Plan 2010 – 2014. https://www.koan.co.ke/wp-content/uploads

Kenya Institute for Public Policy Research and Analysis (KIPPRA) (2018). Policy Monitor: Realizing the "Big Four" Agenda through Energy as an Enabler. http://kippra.or.ke/wp-content/uploads/2017

Khor, M. (2009). *The Food Crisis, Climate Change and the Importance of Sustainable Agriculture*. Third World Network (TWN).

Kiplimo, L. B., & Ngeno, V. (2016). *Understanding the Effect of Land Fragmentation on Farm Level Efficiency: An Application of Quantile Regression-Based Thick Frontier Approach to Maize Production in Kenya* (No. 310-2016-5374).

Kisii County Integrated Development Plan 2018-2022. https://www.kisii.go.ke/index.php/news-and-events/county-downloads

Kledal, R., Oyiera F., Njoroge W. , & Kiarii E. (2010). Organic Food and Farming in Kenya

Krause, H. M., Fliessbach, A., Mayer, J., & Mäder, P. (2020). Implementation and Management of the DOK Long-term System Comparison Trial. In *Long-term Farming Systems Research* (pp. 37-51). Academic Press.

Kuada, J. (2012). *Research methodology: A Project Guide for University Students*. Samfundslitteratur.

Kumba, K. J., & Francis, W. J. (2015). The Influence of Agricultural Land Use on Household Food Security Situation in Kisii Central Sub-County. *Journal of Economics and sustainable Development*, *6*(6-13).

Kwame, F., & Jayne, S.T. (2020). The Myth of Africa's Aging Farmers. *Rural 21, 54*(3-14)

Lambrecht, I., Vanlauwe, B., & Maertens, M. (2016). Integrated Soil Fertility Management: From Concept to Practice in Eastern DR Congo. *International Journal of Agricultural Sustainability*, *14*(1), 100-118.

Lamine, C., Navarrete, M., & Cardona, A. (2014). Transitions towards Organic Farming at the Farm and at the local scales: The Role of Innovative Production and Organisational Modes and Networks. *Organic Farming, Prototype for Sustainable Agricultures: Prototype for Sustainable Agricultures*, 423-438.

Lang, M. K. (2018). The Role of Religion in Agriculture: Reflections from the Bamenda Grassfields of Cameroon since Pre-colonial Times. *Journal of African Studies*, *7*(2), 54-73.

Lapple, D., & Van Rensburg, T. (2011). Adoption of Organic Farming: Are There Differences between Early and Late Adoption? *Ecological Economics*, *70*(7), 1406-1414. https://doi.org/10.1016/j.ecolecon.2011.03.002

Lauwere, C. C., Drost, H., De Buck, A. J., Smit, A. B., Balk-Theuws, L. W., & Buurma, J. S., Prins, H., (2004, August). To Change or Not to Change? Farmers' Motives to Convert to Integrated or Organic Farming (or not). In *XV International Symposium on Horticultural Economics and Management 655* (pp. 235-243).

Lavison, R. (2013). *Factors Influencing the Adoption of Organic Fertilizers in Vegetable Production in Accra*, Msc Thesis, Accra Ghana

Li, Q., Yang, F., Zhang, W., Yin, F., Zhao, X., & Liu, J. (2013). Analysis of the Environmental Benefits of Organic Agriculture. *Advanced Materials Research*, 610-613, 3206-3211. doi: 10.4028/www.scientific.net/AMR.610-613.3206

Ma, W., Ma, C., Su, Y., & Nie, Z. (2017). Organic farming: Does acquisition of the farming information influence Chinese apple farmers' willingness to adopt?. *China Agricultural Economic Review*.

Mauceri, M., Alwang, J., Norton, G. Barrera, V. (2005). Adoption of Integrated Pest Management Technologies: A Case Study of Potato Farmers in Carchi, Ecuador;

Selected Paper prepared for presentation at the American Agricultural Economics Association Annual Meeting, Providence, Rhode Island.

Makone, M. S., Basweti, A. E., & Ngeywo, C. J. (2015). Farmers' Response to Organic and Inorganic Fertilizer Utilization on Maize Cropping Systems in Kisii County, Kenya. *International Journal of Plant & Soil Science*, *1*, 26-33.

Manida, M., & Nedumaran (2021). *Organic Farming - Current Status and Opportunities for Future Development*

Meemken, E. M., & Qaim, M. (2018). Organic Agriculture, Food Security, and the Environment. *Annual Review of Resource Economics*, *10*, 39-63.

Meena, R. P., Meena, H. P., & Meena, R. S. (2013). Organic farming: Concept and Components. *Popular Kheti*, *1*(4), 5-14.

Métouolé Méda, Y. J., Egyir, I. S., Zahonogo, P., Jatoe, J. B. D., & Atewamba, C. (2018). Institutional Factors and Farmers' Adoption of Conventional, Organic and Genetically Modified Cotton in Burkina Faso. *International Journal of Agricultural Sustainability*, *16*(1), 40-53.

Midmore, P., Padel, S., Mc Calman, H., Isherwood, J., Fowler, S., & Lamkpin, N. (2001). Attitude towards Conversion to Organic Production Systems. A Study of Farmers in England

Mignouna, D. B., Manyong, V. M., Rusike, J., Mutabazi, K. D. S., & Senkondo, E. M. (2011). *Determinants of Adopting Imazapyr-Resistant Maize Technologies and its Impact on Household Income in Western Kenya.*

Mirela, T. & Dejan, J., (2014). Applicability of Diffusion of Innovation Theory in Organic Agriculture.

Mohamed Haris, N. B., Garrod, G., Gkartzios, M., & Proctor, A. (2018). *The Decision to Adopt Organic Practices in Malaysia; A Mix-Method Approach* (No. 2111-2018-4134).

Moore, K. J., Collins, M., Nelson, C. J., & Redfearn, D. D. (Eds.). (2020). *Forages, Volume 2: The Science of Grassland Agriculture*. John Wiley & Sons.

Muchangi, C. T. (2016). Influence of Farmer's Characteristics, Agricultural Extension and Technology Specific Factors on Adoption of Organic Farming Technologies in Embu West Sub County, Embu, Kenya (Doctoral dissertation, University of Nairobi).

Mukasa, A. N., & Salami, A. O. (2015). *Gender Productivity Differentials among Smallholder Farmers in Africa: A cross-country comparison*. Abidjan: African Development Bank

Mwangi, M., & Kariuki, S. (2015). Factors Determining Adoption of New Agricultural Technology by Smallholder Farmers in Developing Countries. *Journal of Economics and Sustainable Development*, *6*(5-17).

Mwaura, F. (2007). Organic agriculture in Kenya: An Integrated Assessment for Policy Advocacy.

Naika, R., Sivapragasam, C., & Patoju, S. K. S. (2020). Impact of Organic Farming on Sustainable Livelihood of Farmers. *Building Sustainable Communities: Civil Society Response in South Asia*, 361-375.

Ndungu, S. K. (2015). *Economic Analysis of Smallholder Organic Vegetable Production System in Kiambu and Kajiado counties of Kenya* (Doctoral dissertation, Kenyatta University).

Nechaev, V., Mikhailushkin, P., & Alieva, A. (2018). Trends in Demand on Organic Food Market in the European Countries. *MATEC Web of Conferences,* 212(07008), 1-10.

Nejadkoorki, F. (2012). Environmental Benefits of Organic Farming. *2012 International Conference on Applied Life Science*. https://www.InTech-Environmental_benefits_of_organic_farming.pdf

Nelson, G. L. M., Abrigo, G. N. A., De Guzman, R. P., Ocampo, J. A., & De Guzman, L. E. P. (2019). Organic Farmers in the Philippines: Characteristics, Knowledge, Attitude and Practices. *Journal of Nature Studies*, *18*(2), 26-43.

Newey, W. K., & McFadden, D. (1994). Large Sample Estimation and Hypothesis Testing. *Handbook of Econometrics*, *4*, 2111-2245.

Njeru, M. K. (2016). Factors influencing Adoption of Organic Farming among Farmers in Nembure Division, Embu County-Kenya. *Am Int J Contemp Res*, *6*(4), 90-96.

Obaga, B. R., & Mwaura, F. O. (2018). Impact of farmers' Participation in Banana Value Addition in Household Welfare in Kisii Central Sub-County. *International Academic Journal of Social Sciences and Education*, *2*(1), 25-46.

Obedy Eric, G. (2012). *Factors Affecting Adoption and Intensity of Use of Organic Soil Management Practices in Maize Production in Bungoma County, Kenya* (No. 634-2016-41504).

Odendo, M., Obare, G., & Salasya, B. (2009). Factors Responsible for Differences in Uptake of Integrated Soil Fertility Management Practices amongst Smallholders in Western Kenya. *African Journal of Agricultural Research, 4*(11), 1303-1311.

Omonona, B. T., Oni, O. A., & Uwagboe, A. O. (2006). Adoption of Improved Cassava Varieties and its Welfare Impact on Rural Farming Households in Edo State, Nigeria. *Journal of Agricultural & Food Information, 7*(1), 39-55.

Orsini, S., Padel, S., & Lampkin, N. (2018). Labour Use on Organic Farms: A Review of Research since 2000. *Organic Farming, 4*(1), 7-15. doi:10.12924/of2018.04010007.

Ozor, N., & Nyambane, A. (2021). Institutional Framework for Ecological Organic Agriculture Development in Kenya. African Technology Policy Studies Network (ATPS) Technopolicy Brief No. 58

Padel, S. (2001). Conversion to Organic Farming: A Typical Example of the Diffusion of Innovation? *Sosiologia Ruraolis, 41*(1), 41-61

Palaniappan, S. P., & Annadurai, K. (2018). *Organic farming theory & practice*. Scientific publishers.

Park, D., Lim, S. R., Yun, Y. S., & Park, J. M. (2008). Development of a new Cr (VI)-Biosorbent from Agricultural Biowaste. *Bioresource Technology, 99*(18), 8810-8818.

Parrot, N., & Marsden, T. (2002). 'The real Green Revolution: Organic and Agro ecological farming in the London. *Green Peace Environment Trust,*(1), 1-6.

Parrott N. & Elzakker V. (2003). Organic and Like-Minded Movements in Africa: development and status. *Organic and Like-Minded Movements in Africa: Development and Status.*

Parrott, N., Olesen, J. E., & Høgh-Jensen, H. (2006). Certified and Non-Certified Organic Farming in the Developing World. In *Global Development of Organic Agriculture: Challenges and Prospects* (pp. 153-179). Wallingford UK: CABI Publishing.

Pascal, P., & Mwende, E. (2009). A Garden in a Sack: Experiences in Kibera, Nairobi. *Urban Agric. Mag, 21,* 38-40.

Patidar, S., & Patidar, H. (2015). A Study of Perception of Farmers towards Organic Farming. *International Journal of Application or Innovation in Engineering & Management, 4*(3), 269-277.

Paull, J. (2014). "Lord Northbourne, the man Who Invented Organic Farming, a Biography." *Journal of Organic Systems, 9,* 31 – 53.

Prihtanti, T. M., Hardyastuti, S., Hartono, S., and Irham (2014). Social-Cultural Functions of Rice Farming Systems. *Asian Journal of Agriculture and Rural Development, 4* 341-351.

Qiao, Y., Martin, F., Cook, S., He, X., Halberg, N., Scott, S., & Pan, X. (2018). Certified Organic Agriculture as an Alternative Livelihood Strategy for Small-Scale Farmers in China: A case study in Wanzai County, Jiangxi Province. *Ecological Economics, 145,* 301-307.

Rahm, M. R., & Huffman, W. E. (1984). The adoption of Reduced Tillage: The Role of human Capital and Other Variables. *American Journal of Agricultural Economics, 66*(4), 405-413.

Rittinon, C., & Uruyos, M. (2017). Effect of Leadership on Organic Farming Adoption decision. *Applied Economics Journal*, *24*(1),23-37. https://so01.tci-thaijo.org/index.php/AEJ/article/view/99817

Roberts, R. K., English, B. C., Larson, J. A., Cochran, R. L., Goodman, W. R., Larkin, S. L., ... & Reeves, J. M. (2004). Adoption of Site-Specific Information and Variable-Rate Technologies in Cotton Precision Farming. *Journal of Agricultural and Applied Economics*, *36*(1), 143-158.

Romanelli, C., Cooper, D., Campbell-Lendrum, D., Maiero, M., Karesh, W. B., Hunter, D., & Golden, C. D. (2015). Connecting Global Priorities: Biodiversity and Human Health: A State of Knowledge Review. World Health Organistion/Secretariat of the UN Convention on Biological Diversity.

Rogers, E. M. (2010). *Diffusion of Innovations*. Simon and Schuster.

Safdar, M., Fathelrahman, E., & Tasbih Ullah, R. U. (2016). The Significance of Consumer's Awareness about Organic Food Products in the United Arab Emirates. *Sustainability*, *8*(9), 833-845.

Salami, A. & Mukasa, N. A. (2015) Gender Productivity Differentials among Smallholder Farmers in Africa: A Cross Country Comparison. http://www.afdb.org/

Sapbamrer, R., & Thammachai, A. (2021). A Systematic Review of Factors Influencing Farmers' Adoption of Organic Farming. *Sustainability*, *13*(7), 3842-3858.

Savala, C. E. N., Omare, M. N., & Woomer, P. L. (2003). *Organic Resource Management in Kenya: Perspectives and Guidelines. Forum for Organic Resource Management and Agricultural Technologies. Forum for Organic Resource Management and Agricultural Technologies.* Nairobi, Kenya.

Sayre, L. B. (2009). Thomas A. Rumney, The Study of Agricultural Geography: A Scholarly Guide and Bibliography. *Journal of Agricultural and Environmental Ethics*, *22*(5), 487-494.

Scialabba, N.E.H. (2007). Organic farming and Food Security. International Conference on Organic Farming and Food Security.

Seenirajam, G. (2021). A Study on Attributes of the Organic Agriculture in India. *Agriculture and Food: E-Newsletter*, *3*(5-15).

Setboonsarng, S., & Gregorio, E. E. (2017). Achieving Sustainable Development Goals through Organic Agriculture: Empowering Poor Women to Build the Future.

Sharifuddin, J., Mohammed, Z., & Terano, R. (2018). Paddy Farmer's Perception and Factors influencing Attitude and Intention on Adoption of Organic Rice Farming. *International Food Research Journal*, *25*, 135-145

Sharma, G. (2009). Consumers' Willingness to Pay for Organic Products: A Case from Kathmandu valley. *Journal of Agriculture and Environment, 10.* 12-22

Sharma, A. K., & Sharma, A. K. (2012). *A Handbook of Organic Farming*. Agrobios.

Simin, M. T., & Janković, D. (2014). Applicability of Diffusion of Innovation Theory in Organic Agriculture. *Economics of Agriculture*, *61*(2), 517-529.

Singh, M. (2021). Organic farming for Sustainable Agriculture. *Indian Journal of Organic Farming*, *1*,1-8.

Skoufogianni, E., Solomou, A., Molla, A., & Martinos, K. (2016). Organic Farming as an Essential Tool of the Multifunctional Agriculture. *Organic Farming: A Promising Way of Food Production*, *4*(5), 29-45.

Smith, L. G., Williams, A. G., & Pearce, B. D. (2015). The Energy Efficiency of Organic Agriculture: A Review. *Renewable Agriculture and Food Systems*, *30*(3), 280-301.

Sodjinou, E., Glin, L. C., Nicolay, G., Tovignan, S., & Hinvi, J. (2015). Socio-economic Determinants of Organic Cotton Adoption in Benin, West Africa. *Agricultural and Food Economics*, *3*(12), 1-22. doi:10.1186/s40100-015-0030-9.

Soytong, K., Song, J. J., & Tongon, R. (2021, June). Agricultural Inputs for Organic Agriculture. In *International Seminar on Promoting Local Resources for Sustainable Agriculture and Development (ISPLRSAD 2020)* (pp. 523-532). Atlantis Press.

Spaling, H., & Vander Kooy, K. (2019). Farming God's Way: Agronomy and Faith Contested. *Agriculture and Human Values*, *36*, 411-426.

Suwanmaneepong, S., Wongtragoon, U., & Kerdsrisem, C. (2020). Farmers' Adoption of Organic Rice Production in Chachoengsao Province, Thailand. *Journal of Agricultural Extension, 24*(2), 70-79. https://dx.doi.org/10.4314/jae.v24i2.8

Taylor, A. (2006). *Overview of the Current State of Organic Agriculture in Kenya, Uganda and the United Republic of Tanzania and the opportunities for regional harmonization*. San Francisco, CA, USA: UN.

The Organic Farmer (TOF). 2014. Magazine for Sustainable Agriculture in East Africa. No. 112. https://www.infonet-biovision.org/tof_magazine_issue

Thompson, S. K. (2012). Stratified sampling. *Sampling*, (Vol. 755). John Wiley & Sons, Inc.

Traoré, N., Landry, R., & Amara, N. (1998). On-farm Adoption of Conservation Practices: The Role of Farm and Farmer Characteristics, Perceptions, and Health Hazards. *Land Economics*, 114-127.

Tress, B., & Tress, G. (2001). Capitalising on Multiplicity: A Trans-Disciplinary Systems Approach to Landscape Research. *Landscape and Urban Planning*, *57*(3-4), 143-157.

Tsvetkov, I., Atanassov, A., Vlahova, M., Carlier, L., Christov, N., Lefort, F., ... & Atanassov, I. (2018). Plant Organic Farming Research–Current Status and Opportunities for Future Development. *Biotechnology & Biotechnological Equipment*, *32*(2), 241-260.

Uhunamure, S. E., Kom, Z., Shale, K., Nethengwe, N. S., & Steyn, J. (2021). Perceptions of Smallholder Farmers towards Organic Farming in South Africa. *Agriculture*, *11*(11), 1157.

Ullah, A., Shah, S. N. M., Ali, A., Naz, R., Mahar, A., & Kalhoro, S. A. (2015). Factors Affecting the Adoption of Organic Farming in Peshawar-Pakistan. *Agricultural Sciences*, *6*(06), 587-593. http://dx.doi.org/10.4236/as.2015.66057

Ullah, A., Mishra, A. K., & Bavorova, M. (2023). Agroforestry Adoption Decision in Green Growth Initiative Programs: Key Lessons from the Billion Trees Afforestation Project (BTAP). *Environmental Management*, *71*(5), 950-964.

United Nations Environmental Programme (UNEP) (2015). Sustainable Agriculture and the Sustainable use of Agricultural Biodiversity: Concept, Trends and Challenges. 14th meeting. Convention on Biodiversity. https://www.cbd.int/doc/meetings/sbstta/sbstta-14/information/sbstta-14-inf-34-en.pdf

United Nations Environmental Programme- United Nations Conference on Trade and Development- Children's Brain Tumor Foundation (UNEP-UNCTAD CBTF). (2011).

Organic Farming in East Africa. Geneva and New York: United Nations. https://www.cbd.int/doc/meetings/sbstta/sbstta-14/information/sbstta-14-inf-34-en.pdf

Vigar, V., Myers, S., Oliver, C., Arellano, J., Robinson, S., & Leifert, C. (2019). A Systematic Review of Organic Versus Conventional Food Consumption: Is there A Measurable Benefit on Human Health?. *Nutrients*, *12*(1), 7-39.

Waller, B. E., Hoy, C. W., Henderson, J. L., Stinner, B., & Welty, C. (1998). Matching Innovations with Potential Users, A Case Study of Potato IPM Practices. *Agriculture, Ecosystems & Environment*, *70*(2-3), 203-215.

Willer, H., & Yussefi, M. (2007).*The World of Organic farming, Statistics and Emerging Trends*. International Federation of Organic farming Movements, IFOAM, Germany and Research Institute of Organic farming, FiBL, Switzerland.

Willer, H., & Kilcher, L. (2013). The World of Organic Agriculture. *IFOAM, Bonn/Germany & FiBL, Frick, Switzerland*.

Willer, H., & Lernoud, J. (2017). *The World of Organic Agriculture. Statistics and Emerging Trends 2017* (pp. 1-336). Research Institute of Organic Agriculture FiBL and IFOAM-Organics International.

Willer, H., & Lukas, K. (2010). *The World of Organic Farming, Statistics and Emerging Trends*. Bonn and Frick: FIBL and IFOAM.

Willer, H., Rohwedder, M., & Wynen, E. (2009). Organic Agriculture Worldwide: Current Statistics. *The World of Organic Agriculture. Statistics and Emerging Trends*, 25-58.

Williams, P. R., & Hammitt, J. K. (2000). A Comparison of Organic and Conventional Fresh Produce Buyers in the Boston area. *Risk Analysis*, *20*(5), 735-746.

Willer, H., Helga, Jan Trávníček, Claudia, M., & Bernhard Schlatter (Eds.) (2021). The World of Organic Agriculture. Statistics and Emerging Trends. Research Institute of Organic Agriculture (FiBL), Frick and IFOAM – Organics International, Bonn.

Yussefi M., & Willer H. (2006). *The World of Organic Farming: Statistics and Emerging Trends.*

APPENDICES

Appendix A: Questionnaire for smallholder farmers

My name is Vivian Areri, a Masters student of the Department of Geography at Egerton University. I am conducting a research whose main purpose is to determine the perception of the smallholder farmers' adoption of organic farming in Kisii Central Sub - County, Kisii County, Kenya. This research is purely for academic purposes. It is my sincere hope and request that you will kindly provide the necessary answers to the respective questions here presented. The information that you give shall be treated confidentially and will only be used for academic reasons. I appreciate for taking your time to respond to this questionnaire.

Date……..

Name (optional) …….. Questionnaire Number: ……..

Location from (Tick)

i. Birongo [ ] ii. Ibeno [ ]

Sub-location from (Tick)

i. Birongo [ ]	ii. Biombe [ ]	iii. Bomwagi [ ]	iv. Kabosi
v. Kiemenyinga [ ]	vi. Kirwa [ ]	vii. Chirichiro [ ]	viii. Nyamecheo

SECTION 1: Socio-Economic Characteristics of the Respondent

1. Farmer's Gender (Tick)
   i. Male [ ] ii. Female [ ]
2. Age bracket in years (Tick)
   i. Below 25years [ ] ii. 25-35 years [ ]
   iii. 36-45 years [ ] iv. 46-55 years [ ]
   v. Over 55years [ ] vi. Not aware [ ]
3. Level of highest education attained (Tick)
   i. No formal education [ ] ii. Primary [ ]
   iii. Secondary [ ] iv. College [ ]
   v. University [ ]
4. Religion of farmer.
   Seventh Day Adventist [ ] Protestant [ ] Catholic [ ] Muslim [ ] Other …….
5. Household size (Tick)

i. 1-3 members [ ] ii. 4-6 members [ ] iii. 7-9 members [ ] iv. More than 10 members [ ]

6. Size of your farm (Tick)
   i. Less than 0.5 acres [ ] ii. 0.6 acres – 1 acres [ ]
   iii. 1.1 acres – 1.5 acres [ ] iv. More than 1.5 acres [ ]
7. Involvement in farming (Tick)
   i. Full time [ ] ii. Part time [ ]
8. Sources of income.
   (a) Business ☐
   (b) Jua Kali ☐
   (c) Farming ☐
   (d) Formal employment ☐

Other (Specify)…….

SECTION 2: Organic Farming Practices

1. Do you practice organic farming? (Tick)
   Yes [ ] No [ ]
2. Which of the following organic farming do you employ on your farm and for how long? (Tick)

		1 – 5 years	6–10 years	More than 10 years	Not applicable
i.	Crop rotation	[ ]	[ ]	[ ]	[ ]
ii.	Biological Pests Managements	[ ]	[ ]	[ ]	[ ]
iii.	Use of legumes	[ ]	[ ]	[ ]	[ ]
iv.	Cover crop	[ ]	[ ]	[ ]	[ ]
v.	Rotational grazing	[ ]	[ ]	[ ]	[ ]
vi.	Livestock-crop diversification	[ ]	[ ]	[ ]	[ ]
vii.	Use of crops residue	[ ]	[ ]	[ ]	[ ]
viii.	Use of animal manure	[ ]	[ ]	[ ]	[ ]
ix.	Green manures	[ ]	[ ]	[ ]	[ ]
x.	Water conservation	[ ]	[ ]	[ ]	[ ]
xi.	Off farm organic wastes	[ ]	[ ]	[ ]	[ ]

3. Do any of your neighbors practice organic farming? (Tick)

   YES [ ] NO [ ]
4. How many farmers do you know who practice organic farming? (Tick)

   i. Less than 5 [ ] ii. 6 – 10 [ ] iii. 11-15 [ ] iv. More than 15 [ ]
5. Which of the following organic farming methods are pre-dominant in your area?

   i. Crop rotation [ ] ii. Use of crops residue [ ]
   iii. Biological Pests Managements [ ] iv. Use of animal manure [ ]
   v. Use of legumes [ ] vi. Green manures [ ]
   vii. Cover crop [ ] viii. Water conservation [ ]
   ix. Rotational grazing [ ] x. Off farm organic wastes [ ]
   xi. Livestock-crop diversification [ ]
   xii. Others (specify)…….
6. What is the approximate acreage of your farm under organic farming? (Tick)

   i. Less than one (1) acre [ ] ii. 1 acre [ ]
   iii. 2 acres [ ] iv. 3 acres [ ]
   v. More than 3 acres [ ]

SECTION 3: Perception and Adoption of Organic Farming

1. How available is information on organic farming practices in your area?
   i. Easily available [ ] ii. Available [ ] iii. Not easily available [ ] iv. Hardly available
2. Where did you get the information about organic farming? (Tick)
   i. School [ ] ii. Agricultural seminars and trainings [ ]
   iii. Agricultural officers [ ] iv. Neighbours [ ]
   v. Community Based organizations [ ] vi. Non-Governmental Organizations [ ]
3. is information on organic farming passed from one person to another? (Tick)

Word mouth [ ] TV/radio [ ] Telephone [ ] Internet [ ]
Barazas [ ] Churches [ ]

4. How strongly would you agree with the following statements (Tick)

	Strongly agree	**Agree**	**Disagree**	**Strongly Disagree**	**Don't know**
Organic farming has positive effects on the environment	[ ]	[ ]	[ ]	[ ]	[ ]
Organic farming has negative effects on the environment	[ ]	[ ]	[ ]	[ ]	[ ]
Organic farms are more profitable than inorganic farms	[ ]	[ ]	[ ]	[ ]	[ ]
Organic farming is a form of traditional agriculture	[ ]	[ ]	[ ]	[ ]	[ ]
Organic products are readily available in the market	[ ]	[ ]	[ ]	[ ]	[ ]
Most organic farms are small scale	[ ]	[ ]	[ ]	[ ]	[ ]

5. In your opinion what is the present demand for organic farm products?

   Low [ ] Average [ ] High [ ]

6. What is your assessment of the demand for organic products in the future? (Tick)

i. Increase significantly [ ] ii. Decrease a little [ ] iii. Stay the same [ ]
iv. Don't know [ ]

7. How do you view organic farming practices compared to conventional farming? (Tick)

i. Very Easy [ ] ii. Easy [ ] iii. Difficult [ ]

8. What motivated you to practice organic farming? (tick where appropriate)

i. Health benefits of organic products [ ]
ii. Neighbours' influence [ ]
iii. Income from organic products [ ]
iv. Public awareness of organic farming [ ]
v. Poverty [ ]

9. Do the benefits associated with organic farming influence your knowledge and perception towards organic farming? (Tick)

i. Social benefits Yes [ ] No [ ]
ii. Economic benefits Yes [ ] No [ ]
iii. Environmental benefits Yes [ ] No [ ]

10. Do the benefits associated with organic farming affect your choice of what type of farming to practice?

Yes [ ] No [ ]

11. What is your extent of practice of the following organic farming methods? (Tick)

	Most preferred	Preferred	Least preferred
i. Crop rotation	[ ]	[ ]	[ ]
ii. Biological Pests Managements	[ ]	[ ]	[ ]
iii. Use of legumes	[ ]	[ ]	[ ]
iv. Cover crop	[ ]	[ ]	[ ]
v. Rotational grazing	[ ]	[ ]	[ ]
vi. Livestock-crop diversification	[ ]	[ ]	[ ]
vii. Use of crops residue	[ ]	[ ]	[ ]
viii. Use of animal manure	[ ]	[ ]	[ ]
ix. Green manures	[ ]	[ ]	[ ]
x. Water conservation	[ ]	[ ]	[ ]
xi. Off farm organic wastes	[ ]	[ ]	[ ]

SECTION 4: Smallholder Farmers' Socio-economic Characteristics on Adoption of Organic Farming Practices

1. Which of the following farmer's socio-economic characteristics influence the adoption of organic farming practices? (Tick where appropriate)

   Age Yes [ ] No [ ]
   Gender Yes [ ] No [ ]
   Education Yes [ ] No [ ]
   Household size Yes [ ] No [ ]
   Income Yes [ ] No [ ]
   Religion Yes [ ] No [ ]
   Employment Yes [ ] No [ ]
   Farm size Yes [ ] No [ ]

2. Which of the following statements are true on how age categories influences the adoption of organic farming practices (tick where appropriate)

i. Efficiency of young and older organic farmers are lower than middle age
   Yes [ ] No [ ]

ii. The farmer's managerial ability on organic farming increases with increase in age
   Yes [ ] No [ ]

iii. The farmer's experience on organic farming increases with his/her age
   Yes [ ] No [ ]

iv. Age of farmers affect labour force engaged in agricultural production

   Yes [ ] No [ ]

3. How do household sizes influence the adoption of organic farming practices? (tick where applicable)

i. Family members are source of organic farm labour hence reducing the cost of production Yes [ ] No [ ]

ii. Household size influence the type of organic farming method to be employed

Yes [ ] No [ ]

iii. Large household size encourages a variety of organic farming to be practiced

Yes [ ] No [ ]

4. Do the following education factors influence the adoption of organic farming practices? (tick where applicable)

a. Training on organic farming increases the farmers' knowledge on adoption of organic farming practices Yes [ ] No [ ]

b. Time taken to acquire knowledge on organic farming affects the farmers interest to adopt organic farming methods Yes [ ] No [ ]

c. Formal and informal education affects the farmers' likelihood of adopting organic farming practices Yes [ ] No [ ]

d. Availability of information on organic farming influences the farmers' choice of organic farming practices Yes [ ] No [ ]

e. Knowledge on the benefits of organic farming influences the farmer to adopt organic farming practices Yes [ ] No [ ]

5. Which of the following statements are true on the influence of gender on the adoption of organic farming?

i. More women are involved in farming than men hence more women adopt organic farming easily Yes [ ] No [ ]

ii. Organic agriculture is mostly done on small-scale hence more women who own small farms easily adopt it Yes [ ] No [ ]

iii. More female smallholder farmers are flexible in the adoption of organic farming practices than men Yes [ ] No [ ]

iv. More male than female are involved other occupation thus, women tend to concentrate on small – scale organic farming practices Yes [ ] No [ ]

6. Tick where appropriate on the various ways in which income influences the adoption of organic farming

i. Other sources of income of the farmer play an important role in adoption of organic farming Yes [ ] No [ ]

ii. High income from the organic products influences the adoption of organic farming practices Yes [ ] No [ ]

iii. High cost on conventional farming methods promotes the adoption of organic farming practices Yes [ ] No [ ]

7. Which of the following statements are true on the influence of religion on the adoption of organic farming?

   i. Most religious groups advocate for the adoption of organic farming practices

      Yes [ ] No [ ]

   ii. Most religious leaders convey information on organic farming practices hence the adoption Yes…. No……

   iii. Most Christians regard organic products as natural and healthy hence leading to the adoption Yes…. No……

8. Do the following occupations influence the adoption of organic farming in Kisii Central?

   i. Business Yes…. No……

   ii. Salary employment Yes…. No……

   iii. Wage employment Yes…. No……

SECTION 5: Socio-economic and Environmental Effects of Organic Farming

1. Which of the following positive social effects have you realized from organic farming? (Tick)

   i. Improved human health [ ]
   ii. Improved livelihood and welfare [ ]
   iii. Promotion of food quality and safety [ ]
   iv. Protection against diseases [ ]
   v. Ensuring food security [ ]

2. Have you realized any economic benefits from organic farming? (Tick)

   Yes ……. No …….

   If YES, which of the following economic benefits have you realized?

   i. Increased income from sales of organic products [ ]
   ii. Reduced expenditure on chemicals farming [ ]
   iii. Creation of employment [ ]
   iv. Increased access to healthy food [ ]

3. How in your view do the following mitigate food security? (tick where appropriate)

   i. Increased organic farm output Yes …. No ……..
   ii. Diversify crops Yes …. No ……..
   iii. Improved nutrients contents Yes …. No ……..

4. Which of the following aspects of the environment does organic farming promote?

i. Soil fertility and restoration [ ]
ii. Mitigate climate change [ ]
iii. Reduce surface run off [ ]
iv. Water conservation [ ]
v. Energy conservation [ ]
vi. Soil conservation [ ]

5. Which of the following organic farming practices improve the aspects of the environment? (tick)

	Soil fertility	Soil protection	Mitigate climate change	Water conservation	Reduce surface run off	Energy conservation
Crop rotation	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Biological Pests Managements	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Use of legumes	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Cover crop	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Rotational grazing	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Livestock-crop diversification	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Off farm organic wastes	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Green manures	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Use of animal manure	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Mulching	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Use of crops residue	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

Appendix B: Key Informant Interview Schedule

This interview guide is prepared for the purpose of collecting relevant data for an academic research on the perception of smallholder farmers towards organic farming practices in Kisii Central Sub - County, Kisii County, Kenya.

General information

Name of the respondent ……

Designation of Key informant …….

1. What is the total number of smallholder farmers in Kisii Central Sub - County? ……..
2. What is the total number of smallholder farmers practicing organic farming in:
   Birongo location ……..
   and Ibeno location ……..
3. What are the socio-economic characteristics of organic farmers in Kisii sub-county?
   …….
   …….
   …….
   …….
   …….
   …….
4. What are the major organic farming practices by smallholder farmers in Birongo and Ibeno location, Kisii Central Sub - County?
   Birongo location:
   ……
   ……
   …..
   Ibeno location: ……
   ……
   …..
5. (a) Which is the most preferred organic farming practice in the study area?
   ……..
   a. Why is (a) above preferred? …….....
   ……
   ……
   ……
6. What is the approximate size of organic farms in Kisii Central Sub - County?

v. Less than 0.5 acres [ ] vi. 0.6 acres – 1 acres [ ]
vii. 1.1 acres – 1.5 acres [ ] viii. More than 1.5 acres [ ]

7. What are the socio-economic and environmental effects of organic farming practice in Kisii Central Sub - County?
   Socio-economic effects:
   ……
   ……
   ……
   ……

Environmental effects

……
……
……
……

8. Which of the following organic farming services are offered to the farmers?
   Extension services [ ]

   Training and education [ ]

   Marketing of organic products [ ]

   Others specify ……
   ……
9. How have the organic farming services offered to the farmers changed their perception on organic farming?
   ……
   ……
   ……
   ……

Appendix C: Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **149467**

Date of Issue: **25/November/2020**

RESEARCH LICENSE

This is to Certify that Ms.. VIVIAN MORAA ARERI of Egerton University, has been licensed to conduct research in Kisii on the topic: ASSESSMENT OF SMALLHOLDER FARMERS' PERCEPTIONS ON ADOPTION OF ORGANIC FARMING PRACTICES IN KISII CENTRAL SUB - COUNTY, KISII COUNTY, KENYA for the period ending : 25/November/2021.

License No: **NACOSTI/P/20/7550**

149467

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

Appendix D: Certificate of Publications of Papers

INTERNATIONAL JOURNAL OF
INNOVATIVE RESEARCH AND DEVELOPMENT

ISSN 2278 – 0211 (Online) www.ijird.com

The Board of

International Journal of Innovative Research & Development

Is hereby awarding this certificate to

Vivian M. Areri, Dr. Humphreys W. Obulinji & Charles W. Recha

In recognition of the publication of the paper entitled

Influence of Smallholder Farmers' Socio-economic Characteristics on and Perceived Benefits of Organic Agriculture Farming

Published in IJIRD Journal, Volume 11, Issue 12, December, 2022

DOI No.: 10.24940/ijird/2022/v11/i12/DEC22008

IJIRD

S.S.Das

Dr. S. S. Das
Editor in Chief

IOSR Journals
International Organization of Scientific Research
Australia | Qatar | India | New York | Malaysia

Certificate

Office Code :	M1867	Date :	2022-12-24
MIC No. :	2854	Status :	Published

Article Details

This is to certify that following paper has been published in IOSR Journals.

Article Title	:	Smallholder Farmers Practice and Perception of Organic Farming in Kisii Central Sub County, Kisii County, Kenya
Author's Name	:	Vivian M. Areri , Humphreys W. Obulinji ,Charles W. Recha
Journal Name	:	IOSR Journal of Agriculture and Veterinary Science
ISSN	:	2319-2380
Publisher Name	:	International Organization of Scientific Research
Journal Url	:	www.iosrjournals.org
Publishing Model	:	Open Access Publishing
Review Type	:	Blind Peer Review Process
Journal Type	:	Indexed Refereed Journal
Volume No.	:	15
Issue No.	:	12
Article DOI	:	10.9790/2380-1512023343

Signature
Editorial Manager
IOSR Journals
support@iosrmail.org

Appendix E: Snapshots of Abstract Page of the Publications

IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 15, Issue 12 Ser. II (December 2022), PP 33-43
www.iosrjournals.org

Smallholder Farmers' Practice and Perception of Organic Farming in Kisii Central Sub - County, Kisii County, Kenya

Vivian M. Areri [1], Humphreys W. Obulinji [1] Charles W. Recha[2]
[1]*Department of Geography Egerton University, P.O Box 536 Njoro, Kenya*
[2]*Department of Geography, Environment and Development Studies, Bomet University College, Kenya*

Abstract
Organic farming (OF) is known to contribute to: healthy living, increase in farm income, and safe and sustainable environments. It is in view of the benefits that OF systems are encouraged across countries in Sub-Saharan Africa, including Kenya. This paper investigates smallholder farmers' practice and perception of organic farming in Kisii Central Sub – County, Kenya. The study employed descriptive survey research design where a total of 306 respondents were interviewed. Results show that nearly all (97%) of smallholder farmers are practicing OF with use of animal manure (87%), crop rotation (72%) and cover crops (55%) as the predominant practices. The high number of farmers practicing OF can be attributed to information on OF farming being easily available (52%); strong agreement on positive effects of OF farming on environment (69%), and the anticipated future demand for OF products (84%). This study recommends that promoters of organic farming should take note of the positive rating and perception of organic farming.

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT

ISSN 2278 – 0211 (Online)

Influence of Smallholder Farmers' Socio-economic Characteristics on and Perceived Benefits of Organic Agriculture Farming

Vivian M. Areri
Researcher, Department of Geography, Egerton University, Kenya
Dr. Humphreys W. Obulinji
Lecturer, Department of Geography, Egerton University, Kenya
Charles W. Recha
Lecturer, Department of Environment and Development Studies,
Bomet University College, Kenya

Abstract:
The decision to adopt an agricultural technology is categorized into characteristics specific to farmers and their households and socio-economic factors. The difference in factors influencing the smallholder farmers' adoption of Organic Farming (OF) practices varies across the world. Thus, this paper investigates the influence of smallholder farmers' socio-economic characteristics on the adoption of OF in Kisii Central, Kisii County. The study adopted mixed-method research that involved a household survey and key informants. The results indicate that the major socio-economic characteristics influencing smallholder farmers' adoption of organic farming were farm size (79%), income (73%), family size (67%), and age (66%). In addition, there is a positive correlation between education and the use of crop residues (r=0.113), animal manure (r=0.114), and cover crop (r=0.121). The study recommends that promoters of OF consider specific socio-economic characteristics of the farmers in adopting OF.

Keywords: *Smallholder farmers, socio-economic characteristics, organic agriculture*