FACTORS AFFECTING ADOPTION OF ORGANIC FOOD PRODUCTION SYSTEM AMONGST SMALLHOLDER FARMERS IN MURANG'A COUNTY, KENYA

By

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DECLARATION

This Research Project Report is my original work and it has not been presented for award of a degree to any other university.

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Signature…… Date…….

Declaration by the Supervisor:

I confirm that this research project report has been submitted for examination with my approval as a university supervisor.

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Signature…… Date…….

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DEDICATION

I wish to thank the Almighty God and my loving family for their unwavering support and encouragement during my academic pursuits, and I offer this work to them in gratitude.

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ABSTRACT

Organic farming is among the identified sustainable farming systems as it puts into account social, economic and environmental concerns. However, while many countries across the world including Australia, United States, Tanzania and Uganda have shown great interest in organic farming, Kenya still lags behind with approximately 1% of the total farm land using organic farming. The general objective of this study was to investigate factors affecting adoption of organic farming amongst smallholder farmers in Murang'a south region, Murang'a County, Kenya. The specific objectives were (i) to assess the effect of household characteristics on the adoption of organic farming, (ii) to examine institutional support factors which influence the adoption of organic farming and to examine farmers' perceptions towards organic farming in the study area. The target population were 361 organic and conventional farmers obtained from the list of farmers targeted and working with pro-organic farming organisations namely KOAN, ICIPE and OACK from Gatanga, Kandara and Kigumo sub-counties. Proportionate sampling yielded a total of 189 farmers, both organic and conventional, who participated in the survey as respondents. The research employed household surveys and key informant interviews methods. The research used structured questionnaires and interview schedules to collect information from the farmers and key informants respectively. Key informants included representatives from the Ministry of Agriculture and Fisheries, the Department of Agriculture, local NGOs, organic goods stockists, and organic products marketing companies. Questionnaire responses were successfully collected from 152 participants yielding an overall response rate of 80.4%. Data was coded and analysed using Statistical Package for Social Sciences. Quantitative data was analysed descriptively and was presented using percentages and frequency distribution tables. For objective one and two, a logistic regression model was fitted to determine the probabilities and the odds of a farmer adopting not adopting organic farming. Qualitative data was organized into coherent categories in line with research objectives. Farm size (P=0.0, -1.602), experience of the farmer (P=0.017, 0.009), the variety of crops grown (P=0.009, 0.069), were found have a positive effect on farmers' decision to adopt organic farming or not. Organic farming techniques trained, number of organisations training and of training duration (P=0.000, 3.553) have a positive effect on whether to adopt organic farming. The study found higher adoption in techniques where more training was offered. Variety of trainings, variety of training organisations and training duration (P-value is 0.000) were found to influence the extent (partial or whole farm) to which an organic farmer adopts organic farming. Training was also found to be the most effective way of disseminating organic farming information. While majority of the respondents portrayed a positive perception on sustainable benefits of organic farming, they also had a perception that organic farming is labour intensive, does not improve overall crop yields and market value and it's difficult to manage pest. The study recommends that pro-organic organizations should give more focus to farmers with smaller farm sizes and greater farming experience to enhance adoption of organic farming (OF). The pro-organic farming organizations should intensify training on OF, providing accurate information on OF transition period, certification, and markets. The perceptions can be positively influenced if pro-organic NGOs and the government can make improvements in availing adequate information. This can be done by intensifying training and advisory services on organic farm management and markets in order to improve the organic farming adoption.

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LIST OF ACRONYMS AND ABBREVIATIONS

AUC	African Union Commission
EAC	East African Community
EAOPS	East African Organic Products Standard
EU	European Union
FAO	Food and agriculture Organization
ICE	Institute for Culture and Ecology
ICIPE	International Centre for Insect Physiology and Ecology
IFOAM	Federation of Organic Agriculture Movement
KIOF	Kenya Institute of Organic Farming
KTDA	Kenya Tea Development Authority
KOAN	Kenya Organic Agriculture Network
NEPAD	New Partnership for Africa's Development
NGOs	Non-Governmental Organizations
NPCA	Planning and Coordinating Agency
OA	Organic Agriculture
OACK	Organic Agriculture Centre of Kenya
OF	Organic Farming
PELUM	Participatory Ecological Land Use Management
POF	Probability of Organic Farming
PPP	Public-Private Partnership
SACDEP	Sustainable Agriculture Community Development Programmes
UOF	Utility of Organic Farming
UCF	Utility of Conventional Farming
YARD	Youth Action for Rural Development

DEFINITION OF TERMS

Adopter	A farmer that is knowledgeable in organic agricultural practices and employs such practices on his or her land (Willer *et al.,* 2013)
Adoption	Decision to acquire and use organic farming practices (Ton, 2013)
Conventional farming	Agriculture that combines the use of high-yielding cultivars with the use of synthetic chemical inputs (sometimes called external inputs) (Cameron and Trivendi, 2010)
Organic farming	Holistic agricultural production management system, which maintains and improves the state of agroecosystems by fostering biological diversity, cyclical biologic growth, and active soil biological processes (Willer *et al.,* 2013) Organic farming, on the other hand, is defined by Kassie *et al*. (2009) as a way of agricultural production that does not employ the man-made and potentially harmful effects of agricultural chemicals such as synthetic pesticides, herbicide, fertiliser, growth hormones, antibiotic, and gene editing in favour of using ecologically sound practices.
Productivity	Increase in output without increase in inputs (Ton, 2013)
Perception	Subjective judgments which inform appropriate reactions, based on explicit and tacit knowledge about the characteristic (Soubry et al., 2020)

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Agriculture can be termed as the most important occupation on the planet as it is a key pillar to majority of socio-economic development (AgFunder Network, 2019). It is responsible to feed a projected 9.7 billion people by 2050 and employment of more than one billion people (World Bank, 2013). Over dependence on agriculture, particularly in developing nations, has led to purposeful initiatives to enhance agricultural output. Over the course of the last forty years, adoption of modern agricultural farming techniques and the excessive use of synthetic chemical inputs to boost agricultural productivity have resulted in the loss of biodiversity, including pollinators, soil fertility loss, soil salinization, soil erosion, water and air pollution, and genetic erosion (Benton et al., 2021). As a result, agriculture has grown to be a key cause of environmental deterioration (World Wildlife Fund, 2023). This has led to demands for alternative farming methods to achieve the United Nations Sustainable Development Goals, as industrial agriculture continues to be questioned in light of the aforementioned difficulties (Eyhorn *et al.,* 2019).

Sustainable farming practices are being promoted to avert the threats posed by the overuse of chemicals on the environment and human health. Among these, organic agriculture represents one of the most reasonable choices targeted by most countries (Lee et al. 2015; Mishra et al. 2019). Organic farming's rise to prominence in the 21st century may be attributed to its promotion as a proactive strategy for protecting ecosystems and human health while also providing for a more secure and healthy food supply worldwide (Shennan *et al.,* 2017). It is also linked to a number of positive outcomes, including lower rates of poverty, greater food security and gender equality, increased resilience in the face of climate change, easier access to markets (particularly via export commerce), and the provision of other social benefits (Ndukhu *et al.,* 2016).

The term "organic farming" may be interpreted in a wide variety of ways. According to Food and Agriculture Organization, FAO (1999), organic farming is a method of management for agricultural production that prioritizes and improves the health of agricultural ecosystems as a whole, including biological cycles essential to biodiversity and soil biology. Ecological benefits from organic farming are acknowledged by the

FAO (2008). According to Vaarst (2010), resilient ecosystems, enhanced biodiversity, sustainable agriculture practices, and a more harmonious relationship between humans and their natural surroundings are all benefits of organic farming approach. IFOAM (2014) states that organic agriculture is committed to "the long-term sustainability and promotion of plant, animal, soil, ecosystem, and human health". All these definitions present organic farming practices as friendly to the biodiversity, environment, human health and soil.

In recent decades, the advantages of organic farming have led to a growing movement encouraging its widespread adoption. This is, in a large part, due to the positive attention it has received from environmentalists and food safety advocates (Rana & Paul, 2017). This has made consumers to recognize its health and environmental benefits. Therefore, they are increasingly turning to organic products because they believe they are healthier and more eco-friendly (Smith and Paladino 2010; Nguyen et al. 2019). By 2017, only 1.4% of world farmland were management under organic agricultural worldwide (Aghasafari *et al.*, 2020). The 2019 US National Agricultural statistics services (NASS) survey reported that adoption of organic farming recorded 31% increase from that recorded three years before (2016 - 2019). According to Willer *et al.* (2021), Oceania was ranked as the region with the most organic agricultural land (35.9 million hectares), followed by Europe (14.6 million hectares), Latin America (8 million hectares), Asia (6.1 million hectares), North America (3.2 million hectares). Africa seemed to lag behind with only 2.1 million hectares managed organically. In 2019, foods and drinks grown organically sold at €106 billion worldwide (Willer *et al.*, 2021). The global organic food market was worth 201.77 billion USD in 2020 and is expected to be worth 380.84 billion USD in 2025 at a compound annual growth rateof 14.5% (Research and Markets 2021).

Organic farming is a fast-expanding industry in Africa, with a significant correlation to the sociocultural and economic advancement of the continent (FAO, 2017). Further, the European Union agricultural statistics unit (2019), ranks Tunisia as the largest organic farming country in Africa with more than 287,000 hectares adopted for organic farming with, Tanzania, Uganda and Ethiopia closely following. Azam & Shaheen (2018) states that Uganda remains the most promising in terms of increased engagement to organic

products and policies set by the government to safeguard farmers engaging the practices.

Certified organic farming in Africa covers more than 1.5 million hectares mostly involving permanent crops such as cocoa, coffee, nuts, bananas and tropical fruits (Djokoto *et al.,* 2016). However, Suresh, (2017) argues that the potential of organic farming to increase yields substantially is often not used given the poorly laid organic interventions. Despite the recent growth and efforts by most agricultural organizations, implementation remains the main obstacle to increased organic farming practice in Africa (Manta *et al.,* 2022).

It was in the early 1980s when Kenyan NGOs, businesses, and religious and community groups began to promote organic farming. Kenya's OA industry has grown organically, like its counterparts throughout sub-Saharan Africa, with little to no oversight from the government. Muchangi (2016) claims that several initiatives on sustainable agriculture have prompted farmers in Kenya to switch to organic methods of farming. KOAN, the Organic Agriculture Centre of Kenya (OACK), KIOF, ICE, and PELUM are just a few of the groups that have formed to support organic farming. Composting, manure use, thick mulches, and traditional crop mixtures form some of the methods that Kenya has implemented to achieve soil fertility management and extensive use of resources, as noted by the Kenya Organic Agriculture network (KOAN, 2018). Kenya's increasing reliance on organic farming is spurred by rising demand for organic goods in international markets, especially in the European Union (Gikunda et al., 2021).

Organic farming uptake in Kenya has been very low and mostly partial compared to other nations like Tanzania and Uganda. The percentage of land set aside for organic farming in Kenya is rather low despite the increasing consumer preference for organic products in the recent past, with global sales increasing more than threefold (Reganold & Wachter, 2016). The Dutch entrepreneurs report (2020) however records that production or organic food in Kenya is yet to be fully exploited with only 182,000 hectares of land used being used for organic farming. This translates to 0.69 % of total agricultural land in Kenya. The report further highlights that there are few organic farmers in Kenya creating a gap in demand and supply despite the global demand for

organic super foods. While neighbouring countries such as Burundi and Tanzania experienced 57.1% and 58.3% increase respectively, in organic farming production between 2010 and 2011, only 2.6% increase was experienced in Kenya (Willer *et al*., 2013). This slow uptake begs the question of why fewer Kenyan farmers have switched to organic methods of farming. The Kenya Institute of Organic Farming (2020) has been a leader in crafting protective legislation for organic farmers in the face of climate change and other threats to their farms.

In addition to coming up with legislations and creating awareness for intensifying organic agriculture, there is need to examine factors that determine farmers' decision to their choice and extent of adoption of organic farming. Recent studies (Rana et al., 2012; Azam and Banumathi, 2015; Mwangi et al., 2015; Singh et al., 2015; Ndukhu et al., 2016; Njeru's, 2016; Métouolé et al., 2018; Liu et al., 2019) have focused on investigating the factors driving the decision to engage in organic farming while providing contradictory conclusions. This could be due to context and site specific dynamics. Therefore, understanding the factors influencing farmers' intentions toward adoption of organic farming is important for proposing timely and effective interventions. To fill this gap, this study aimed to investigate factors affecting adoption of organic farming in Murang'a County, Kenya. The results of this study are expected to provide deeper insights into promoting organic farming in Murang'a County which can be replicated in other regions in the country.

1.2 Statement of the Problem

The benefits of organic farming to human and environmental health, food security, increased profit margins and access to new markets, restoration of depleted soil nutrients, maintenance of agroecosystems, provision of healthy quality products, and assurance of markets for farmers' produce should serve as strong incentives for its widespread adoption. However, organic farms only make up a small percentage of Kenya's overall farmland (Willer *et al*., 2013). This being the case, there is need for a discussion of the inexcusably low rates of adoption of organic farming in Kenya.

Murang'a County, being one of the areas where organic farming of vegetables and fruits has greatly been promoted by pro-organic farming organizations such as KOAN, OACK, ICIPE, and YARD to mention but a few, has experience low uptake of organic

farming (Ndukhu *et al.*, 2016). According to the Murang'a County Integrated Development Plan (CIDP) 2013-2017, its proximity to Nairobi city provides a huge market for food crops especially fruits and vegetables. This demand has led to intensification of agriculture through overuse of chemicals and fertilisers which poses a great threat to human and environmental health. This has attracted a number of pro-organic farming organizations that are creating awareness and providing technical support on organic farming. However, the uptake of organic farming has remained low.

Various studies have been undertaken to assess the contribution of demographic and household factors, institutional support factors and farmers attitudes and perceptions to the spread of organic farming (Rana *et al*., 2012; Azam and Banumathi, 2015; Mwangi *et al.,* 2015; Singh *et al.,* 2015; Ndukhu *et al*. 2016; Njeru's, 2016; Liu *et al.*, 2019). Nonetheless, there is inconsistency in the findings of correlation of a few of the variables. There are many unanswered questions and contradictory findings in the empirical record. There might be differences in results owing to factors such as sample size, methodology, and site-specific complications like the kind of agriculture practiced and the amount of infrastructure development.

Efforts to encourage organic farming among smallholder farmers will be more successful if they take into account the elements that have been shown to have a real impact on that adoption. Accurate evidence would aid in determining what, how and to whom to promote organic agricultural practices so as to promote its adoption. This will make it possible to formulate plans to boost adoption, which would ultimately benefit Kenyan farmers and consumers by bringing them closer to the benefits of organic agriculture. This study aims to examine the barriers to organic farming expansion in the Murang'a south region of Murang'a County, Kenya.

1.3 Research questions

1. To what extent do household characteristics affect adoption of organic farming practices in Murang'a South region, Kenya?
2. How do institutional support factors affect the adoption of organic farming in Murang'a south region, Kenya?
3. What is the perception of the smallholder farmers in Murang'a south region towards organic farming?

1.3 Research Objectives

1.3.1 Overall objective

The overall objective of this study is to investigate factors affecting adoption of organic farming in Murang'a south region, Murang'a County, Kenya

1.3.2 Specific Objectives

i. To assess the effect of household characteristics on the adoption of organic farming in Murang'a South region, Kenya.
ii. To establish institutional support factors which influence the adoption of organic farming in Murang'a South region, Kenya.
iii. To determine farmers' perceptions towards organic farming in Murang'a South region, Kenya

1.5 Justification

Despite efforts to promote organic farming and widespread awareness of its benefits, the rate at which it is adopted remains low. Factors that influence its acceptance also remain scantly understood. This has limited the realization of environmental and socio-economic benefits of organic farming. The contradictory findings in the empirical record (Rana *et al.,* 2012; Azam and Banumathi, 2015; Singh *et al.,* 2015; Njeru's, 2016; Liu *et al.,* 2019; Abebe *et al.,* 2022), and the scanty research on institutional and perceptual considerations towards adoption organic farming has further repressed development of informed strategies for Organic Farming promotion. Better rate of adoption of organic farming among smallholder farmers will be realised if actual factors that affect adoption are studied and identified. Accurate evidence would aid in determining what, how and to whom to promote organic agricultural practices so as to promote its adoption.

This study is therefore critical as it aims at assessing factors influencing adoption of organic farming in Murang'a south region, Kandara, Gatanga and Kigumo sub-counties in Murang'a County. The findings and suggestions of this research will be used by pro-organic organizations who advocate for organic farming in order to target, plan and develop strategies to increase and enhance adoption of organic farming. It will also be important to policy makers and the Non-Governmental Organisations (NGOs), as it will

provide crucial information that will enable them develop mechanisms as well as promote legislations that stimulate adoption of organic farming. The findings of this study will also add to what is already known about barriers and motivations for smallholder farmers' transition to organic farming. The findings can be utilized in future as a springboard for more exploration for enhancement of organic farming practices.

1.6 Significance of the Study

Considering that agriculture is the mainstay of Kenya's economy and majority of rural livelihoods, looking into factors that would make it sustainable is critical. Organic food production system seeks to make agriculture sustainable by ensuring environmental and human health. This research determined factors affecting adoption of organic farming in Murang'a County, Kenya and suggested ways to enhance adoption of organic farming technologies. The study was integral in increasing adoption of organic farming and subsequent reduction of negative effects to the environmental and human health. Therefore, the findings of this research can be helpful to pro-organic organizations, Ministry of Agriculture, Livestock, Fisheries and Cooperatives and donor funding organizations in addressing underlying factors contributing to the low adoption of organic farming technologies. The findings from this study forms a basis and adds knowledge to various stakeholders such as, academicians, researchers and policy makers of the sub-sector in enhancing adoption of organic farming technologies.

1.7 Conceptual framework

Finding out whether or not a farmer has embraced organic farming practices is the first step in this research (Choice of adoption of OF). Aleke *et al*. (2013) stated that the innovation diffusion theory can be used in explaining the adoption of agricultural practices. The choice of organic farming is hypothesised to fit the framework of the innovation diffusion model whereby, farmers knowledge and characteristics, qualities of organic farming, farmer's perception and persuasion will determine its acceptance as explained by Rogers (2003).

The level of adoption which is the second step of this research, may be determined at the confirmation stage of the innovation diffusion theory where utility maximization will be determined hence the farmer will decide to what extent they will adopt organic farming. The subjective views of the farmers towards organic farming contribute to a

utility of organic farming (UOF). When the subjective UOF is higher than the subjective utility of conventional farming (UCF), there is a greater potential for adoption or organic farming.

Various studies have shown that the probability that a farmer will adopt organic farming is a factor of household characteristics, institutional support and the perceptions that a farmer has on organic farming. Adoption of organic farming may be influenced by household characteristics such as farm size, available labour, farmers experience in farming activities and level of satisfaction with the current agricultural method. It was hypothesized that the age, gender, and level of education of the household head have an influence on adoption or lack thereof (Azam and Banumathi, 2015; Pradhan et al., 2017). According to Métouolé et al., (2018), adoption of organic farming is seen to be closely related to institutional elements including training, technical assistance, availability of inputs, and market information. Therefore this conceptual model hypothesis that the level of training and technical support offered by the pro-organic organizations and other stakeholders may affect the choice and extent to which adoption of OF is realised. Organic farming adoption may improve if farmers' perception is positive (Yanakittkul and Aungvaravong 2020;Nguyen et al., 2020)

As noted by Malatu et al., 2021, the impetuses for farm-level adoption differ in space and time. Adoption is influenced by factors varying from economic to non-economic which are important in moulding farmers' attitudes about new technology and its eventual acceptance. This factors may also lead a trained farmer to adopt and continue practicing or adopt and later abandon. This conceptual framework shows the interaction of these factors that may lead to adoption or non-adoption of organic farming.

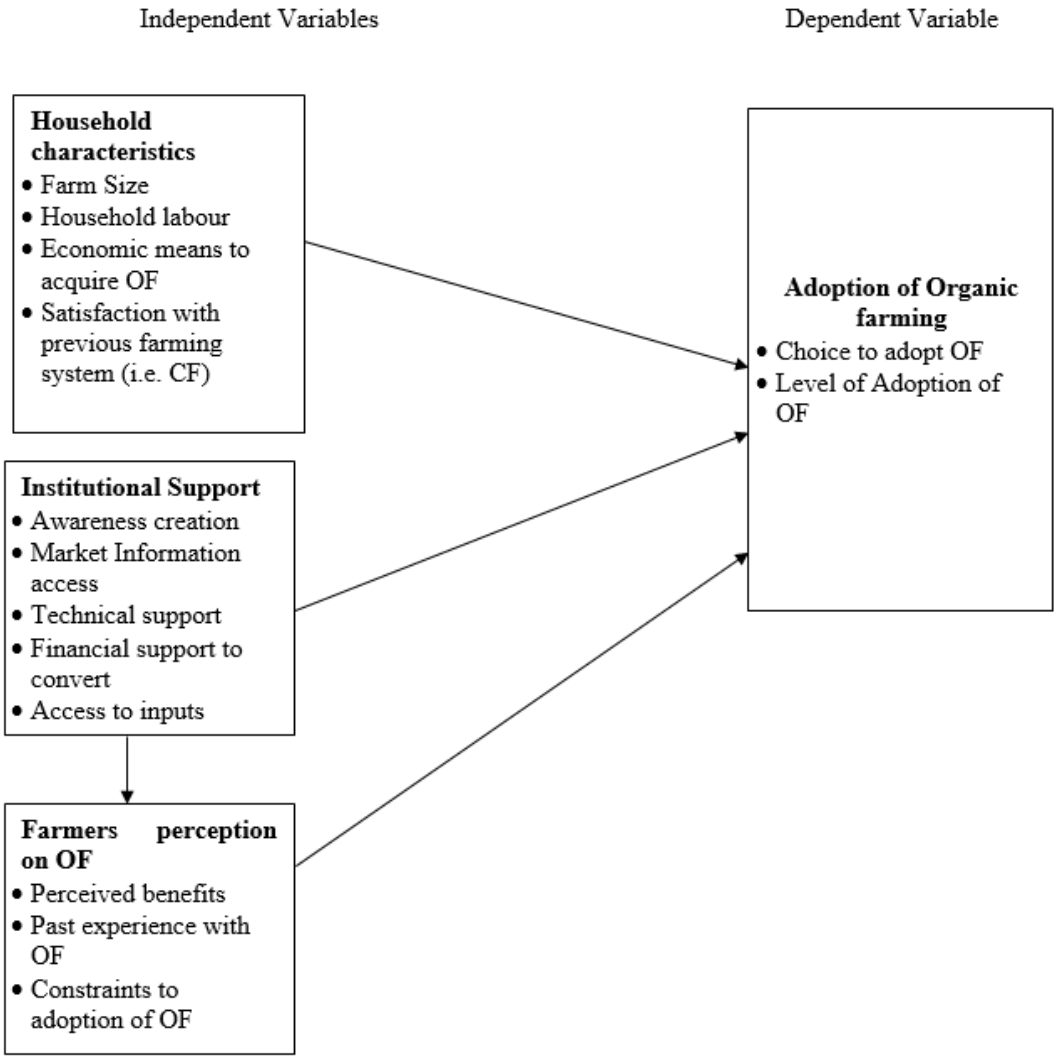

Figure 1.1: Conceptual Framework

Source: Author, 2022

CHAPTER TWO: LITERATURE REVIEW

2.1 Innovation diffusion theory

This study is grounded on the innovation diffusion theory. Rogers (2010) describes innovation diffusion theory as the way by which an invention is communicated through certain channels among members of a social system. The information passed in this communication is mainly about new ideas. Rogers (2010) argues that it is not the existence or uselessness of a concept that makes it new, but rather the individual's perception, knowledge, persuasion, and choice to adopt. That's why it's fair to call advances in agricultural technology inventions. The innovation adoption hypothesis investigates the factors that determine acceptance of new ideas. According to the notion of innovation adoption, the qualities of an invention either assist or block the adoption of the innovation depending on how the traits interact with one another (Wangenheim, 2012). Robinson *et al.* (2009) states that the likelihood of a technology's, products, or service's adoption rises as it evolves to better serve its prospective users.

Rogers' diffusion theory identifies four components of innovation adoption process. These include the innovation, communication channels for spreading information regarding the innovation, the social system around the adopters/non-adopters of the innovation, and the time taken by people to move through the adoption process. How these four components interact helps in understanding reasons as to why an individual decides to adopt or not adopt an innovation (Straub, 2009). Rogers (2003) outlines five phases potential adopters take in the innovation diffusion theory process. Firstly, the potential adopters seek information/knowledge about the innovation and how it functions. Secondly, they require persuasion which helps them to frame an opinion regarding the innovation. Thirdly, they decide whether to adopt or not adopt the innovation. Fourthly, they implement the innovation, and lastly, in the confirmation stage, they try to find support of their decision to adopt the innovation. During this stage, they choose either to continue using the innovation as they realize its advantages or they may change their decision and reject the innovation.

Rogers (2010) further outlines five attributes that may determine if an innovation is adopted or not. These include; relative benefit, compatibility, intricacy, triability, and observability. The possibility for higher profits, better social standing, a reduction in

personal discomfort, and more incentives in the workplace were all inferred to fall under the umbrella term of relative advantage. Rogers defines compatibility as the degree to which a new development works in the existing environment. Trialability refers to ability of potential adopters to test out the innovation on a limited scale without making significant upfront expenditures of either time or money. Before making the decision to adopt, potential adopters like to first see the innovation being used by their peers and have an understanding of the advantages it offers. The perceived difficulty with which a given innovation may be understood is used as a criterion for classifying its complexity. Hence, when comparisons are made, the new technology should be better than the older one, which at the end, convinces an individual to decide for or against adoption.

The innovation-decision process connects a particular person's (or any other unit of decision-making) first exposure to an invention with subsequent evaluation, preference formation, adoption/rejection decision making, implementation, and confirmation. Adoption and non-adoption are often predicated on the notion that farmers and families are confronted with a choice between two extreme options (either to adopt or not to adopt), and that the two choices are depending upon distinguishable qualities. Farmers choice on whether to adopt or not is anchored on maximizing the utility of an innovation. Assuming that this is the case (utility maximization), farmers will adopt the new farming practices if the utility derived from the new farming practice (organic farming) is more than the utility derived from the old farming practice (conventional farming) (Kassie *et al*., 2009). Optimizing this utility may also include taking into account factors such as the advantages to health, the worries about the environment, the food security, and the risks (Napier, 2000). According to Aleke *et al*. (2013), the innovation adoption theory can be used in explaining the adoption of agricultural practices. In this application, new agricultural practices are considered innovations. This process is susceptible to the effect of a broad range of variables, such as those pertaining to households, institutional support, and perceptions towards organic farming.

Organic farming practice stretches back to traditional farming practices initiated over the millennia globally (Manta *et al.,* 2022). The modern approach which has seen the

development of organic farming overtime integrates the economic aspects (output, input and marketing) with technical aspects (agronomy, soil, farm management). Digal & Placencia (2019) argue that the wide embrace for organic farming stretch back to the 'World Food Summit Plan of Action (1999)', which resolved to seek alternative farming practices from those which depended on chemical fertilizers and pesticides. Giessen (2021) remains optimistic that organic food market will continue to expand regardless of the increased demand for livestock products and growing global population.

The advantages of organic farming have led to a growing movement to encourage its widespread adoption. Organic food has become more popular as customers recognize its health and environmental benefits (Nguyen *et al.,* 2019). By 2017, only 1.4% of world farmland were management under organic agricultural worldwide (Aghasafari *et al.,* 2020). According to Willer *et al.* (2021), Oceania was ranked as the region with the most organic agricultural land (35.9 million hectares), followed by Europe (14.6 million hectares), Latin America (8 million hectares), Asia (6.1 million hectares), North America (3.2 million hectares). Africa seemed to lag behind with only 2.1 million hectares managed organically. In 2019, foods and drinks grown organically sold at €106 billion worldwide (Willer *et al.,* 2021). According to Schreer & Padmanabhan (2020), North America, Asia, South America and Oceania continues to welcome chemical – free food produced in organic farms. The 2019 US National Agricultural statistics services (NASS) survey reported that adoption of organic farming recorded 31% increase from that recorded three years before (2016 - 2019). Meemken & Qaim (2018) highlight that projections of organic agriculture would increase by 9 % by 2025. Farmers practicing intensive cultivation in Asia and Oceania have also aligned with the increasing demand of organic foods with organic production booming in the industrial sector (willer *et al*., 2018). Asian countries such as India, china, Taiwan and Thailand continue to revise their official versions of organic standards with continued increase in organic production.

The Food and Agricultural organization of the United Nations (FAO) maps organic farming as a fast growing sector in Africa with strong association to sociocultural and economic development in the continent (FAO, 2017). This can be attributed to the efforts to mainstream organic agriculture in Africa. The African Union Commission

has been spearheading an organic farming effort called the Ecological Organic Agriculture Initiative (EOA-I) (AUC). Ecological Organic Agriculture (EOA) will be integrated into African national, regional, and continental food production systems as part of this program. This project aims to integrate OA into Africa's national agricultural production systems by 2025 as a means of boosting the continent's agricultural output along the route to development. It was decided during the 2011 African Union Summit that organic farming will be encouraged across the continent. The Summit agreed that the AUC, NEPAD and NPCA would give rise and give advice a consortium of global organizations in establishing an African organic agricultural foundation based on proven methods presently in use and providing guidance to encourage the growth of sustainable organic agriculture.

A study by European Union agricultural statistics unit (2019), ranks Tunisia as the largest organic farming country in Africa with more than 287,000 hectares adopted for organic farming. Tanzania, Uganda and Ethiopia follow closely showing positive adoption trends. Azam & Shaheen (2018) states that Uganda remains the most promising in terms of increased engagement to organic products and policies set by the government to safeguard farmers engaging the practices. Certified organic farming in Africa covers more than 1.5 million hectares mostly involving permanent crops such as cocoa, coffee, nuts, bananas and tropical fruits (Djokoto *et al.*, 2016). However, (Suresh, 2017) argues that the potential of organic farming to increased yields substantially is often not used given the poorly laid organic interventions. Despites the recent growth and efforts by most agricultural organizations, implementation remains the main obstacle to increased organic farming practice in Africa (Manta *et al.*, 2022).

According to Muchangi (2016), farmers in Kenya are now shifting to organic farming following numerous campaigns on sustainable agriculture. Similarly, the Kenya Organic Agriculture network (KOAN, 2018) notes that Kenya has adopted the use of various technologies to realize soil fertility management and extensive use of resources such as composting, manure utilization, heavy mulches and traditional crop mixture and heavy mulches. The growing adoption of organic farming in Kenya is mainly due to the growing demand for organically produced foods by external markets specifically The European Union (Gikunda *et al.*, 2021). However, according to the Dutch entrepreneurs study (2020), only 182,000 hectares of land are now being utilized for

organic farming in Kenya, which limits the country's ability to produce organic food to its full potential. This is 0.69% of Kenya's total agricultural land. The paper also points to Kenya's lack of organic farmers as another problem harming Kenyan organic farming, despite the demand for organic super foods on a worldwide scale.

The Kenya Institute of Organic Farming (2020), which has played a key role in formulating legislation to protect organic farmers from the effects of climate change and other factors that adversely influence their fields, has also tackled this issue. Pornpratansombat *et al.* (2005) outlined the adoption decision-making process as a hierarchical system. The hierarchical processes include; product knowledge, gathering and analyzing information, assessing, buying, and reviewing after the sale. The significance of information and education has been underlined as a key contributor to converting conventional farming to organic practices as it is the initial trigger of the farmers opinion form. Numerous factors, such as demographics and economics, public opinion, and consumer behaviour and choice, have been the subject of research into their impact on the spread and popularity of organic farming (Bellon & Lamine, 2009; Sattler & Nagel, 2010). This is illustrative of the complexity of the factors that impact farmers' decision-making settings and processes. Kafle, (2011) and Lamine & Belton, (2009) in their studies found that several factors affect the decision to convert, including the farmer's age, level of education and professional expertise gained, income, farm characteristics, availability of information, and social networks. These components may be broken down into two groups: individual traits and institutional resources.

2.2 Household Characteristics and adoption of organic farming

It is hypothesized that farmers' propensity for organic farming and openness to new agricultural technology is strongly influenced by their personal qualities (Weltin *et al.*, 2017). Sur (2019) divides families by to age, education, gender, how they feel about organic farming, and how much money they make outside of farming.

In Lee's (2017) research on organic farming, he discovered that the economic and social circumstances of farm families were crucial. The adoption of organic farming in Africa is strongly influenced by household dynamics (Djokoto *et al.*, 2016). Organic farming families were found to be younger, more educated, and more likely to include women,

according to research by Barton (2018). Household age, education level, and number of hours worked per week on the farm were revealed to be major variables of organic farming adoption by Kuan *et al.*(2021). Lee (2017) argues that human capital at household level, such as the percentage of senior or middle-aged individuals, has a large beneficial influence on the likelihood that a family would embrace organic agricultural practices. Younger farmers with lower incomes, and less social connections are less likely to practice organic farming, according to research published in 2017 by Obuoyo. Sapbamrer & Thammachai (2021) also found that young farmers and women are among the demographics with the greatest potential for transitioning to organic agricultural practices. Gikunda *et al. (*2021) found that the average age of organic farming household heads was 54 years which was higher than the national norm.

According to Azam and Banumathi (2015), farmers' ages are a more significant factor in the spread of organic farming. On the other hand, Njeru (2016) and Singh et al. (2015) found that age was not a significant influence in farmers' success. According to Asmare & Mekonnen (2019) on organic farming adoption in Ethiopia, Gender ranks top in socio-cultural norms and values that influence farm activities. Gender affects adoption of organic farming as men have more control and access of farm lands and production resources as set in their societal values (Adebiyi *et al.,* 2019). According to research by Njeru (2016), more women than males are transitioning to organic agricultural practices. He attributed this to the inherent nurturing roles of women.

Organic farming is largely labour intensive because it encourages mechanical weed management such as weeding instead of using herbicides (Issaka et al., 2016). For nutrient management, organic farming advocates the use of crop leftovers, cover cropping, and compost rather than the easily accessible chemical fertilizers that can be purchased in stores. These methods require a significant amount of manual labour. The considerable amount of labour that is required has often been cited as a significant obstacle to the widespread implementation of organic management (Bachmann, 2011). The impact of high labour requirements is greatly felt during peak periods such as during weeding time especially in areas with uniformity with respect to crops grow as well as the cropping systems (Jouzi *et al.,* 2017).

Household resources are often used by small-scale farmers to meet labour demands. Labour constraints are a known barrier to farmers adopting new technologies, especially those that require a lot of manual labour (Kpadonou *et al.*, 2017; Krah *et al.*, 2019). Household size is significant in the adoption process, with larger households having a greater capacity to ease labour constraints during transitions to new farming methods (Suresh, 2017). The cost savings from not having to hire outside labour is a major factor in the decision to embrace organic farming, and this cost savings is directly related to the number of people living in the home (Sapbamrer & Thammachai, 2021). Households spend more money during times of high demand for workers due to inadequate resources (Bolwig *et al.*, 2009). Larger homes, however, may more quickly embrace technology since the labour needed for its first implementation is more readily accessible (Sodjinou *et al.*, 2015). This is particularly true for labour-intensive technology. Läpple & Rensburg (2021) illustrate, in contrast, that having more people living in a home makes it more difficult to make independent judgments, which would result in the property becoming unproductive.

The size of a farm is also a known determinant of how quickly new technologies are adopted. Holden (2014) and Tanga *et al.* (2015) argue that small farms are managed better as compared to the larger ones. This is due to the fact that smaller farmers had more incentive to embrace technology and make the most efficient use of available land than their bigger counterparts. According to Adebiyi *et al.* (2013), it is more effective to target farmers with larger farms since they are more inclined to implement cocoa farm rehabilitation practices. Since adopting technology often resulted in labour savings, Mignouna *et al.* (2011) discovered a positive correlation between farm size and adoption of automated harvesting systems. While Njeru (2016) reported that land size did not have a statistically significant influence on the adoption of organic farming among farmers, Rana & Paul (2017) indicated that farm size and farm experience were positively connected with the adoption of organic farming. It was also claimed by Liu *et al.* (2019) that larger farms and more years of agricultural expertise were inversely related to organic farming.

Income from sources other than farming has been shown to improve agricultural practices, since it may be used to alleviate the credit problems that plague many rural African families (Adebiyi *et al.*, 2019). Similarly, families with greater off-farm income

use organic instruments at a more intense level and spend more money on them than do those with no off-farm income. Conversely, research by Templer *et al.* (2018) shows that low-income families do better at transitioning to organic farming than do high-income households. Legal land ownership, higher agricultural income, older household heads, better social networks between households, bigger family sizes, gender equality, and more access to knowledge are all factors that Ndukhu *et al.* (2016) found to be connected with organic agriculture.

2.3 Institutional Support and adoption of organic farming

As per this study, institutional support refers to support offered through training and other on-farm extension services/technical support, financial support, marketing information and market development, standards and quality control, social networks, research and information services and policy awareness and support.

Padel (2001) argues that organic farming in developed countries has often expanded from within. This shows that collaborative efforts and new networks among farmers have been more important to the growth of organic farming. Yet the growth of organic farming in underdeveloped countries is influenced both from above (by NGOs working with farmers) and below (by farmers helping farmers). Most organic farmers, according to Issa and Hamm (2017), are new to farming and so rely on government and other institutions for encouragement and guidance as they strive to adopt organic farming techniques. Such institutions include Government, NGO and private agricultural research institutions, donors, certification and inspection bodies, farmer association and organizations (Djokoto *et al.*, 2016). Manta *et al.* (2022) terms reliable institutional support system as the determining factors for successful adoption of organic farming as they are able to facilitate access of different components that farmers lack. According to Palšová (2019), initial financing of input production and certification, capacity building, technology and marketing are critical roles adopted by institutions capable which may see a trajectory in adoption of organic farming by at least 12.5 % between years 2017-2025.

Complex institutional support for natural farming development is vital in the development and adoption of Organic farming. Peters (2017) asserts that the increase in organic food sales by 521.85 billion Yuan in the year 2021 including 2.91 billion U.S

dollar- worth of organic food was dependent on the clear institutional arrangement stretching from local to country lead agencies. A study done by the E.A.P GREEN Programme (2020) presents a framework of institutional involvement in the development of organic farming in Ukraine. These include state regulation, objects and subjects of organic farming, infrastructure and financial directions. Bazylevych *et al.* (2017) support these findings by establishing a correlation analysis between Ukrainian institutional support and export of organic products.

Information dissemination is mostly dependent on extension agencies and farmer organizations (Mwangi *et al.,* 2015). Farmers benefit from extension programs by learning how to solve problems and by expanding their understanding of emerging technology (Muller et al., 2012). Multiple studies, including Mignouna *et al.* (2011), Sserunkuuma's (2005), and Akudugu *et al*. (2012), have shown a correlation between adoption of new technology and access to extension services. It is hypothesized that adoption rates may be raised if information were disseminated to farmers using the innovation diffusion framework (Pauw *et al.,* 2012). The Kenya Organic Agriculture Network (KOAN) has put organic farming on the map in Kenya, as noted by Digal & Placentia, (2019). KOAN has collaborated with several government agencies, including the Kenya Agriculture Livestock Research Organization (KARLO), the Ministry of Industrialization, public universities, and the Ministry of Agriculture, Livestock, and Fisheries (MOALF). The PPP has also been crucial to the expansion of organic farming in Kenya (Gikunda *et al.,* 2021).

According to Rahmawati & Rusimah, (2021), once a farmer is familiar with information on organic farming technology, in the awareness stage, those interested progress to the information seeking stage then evaluation stage where they begin to seriously assess. The process of the length of evaluation conducted by farmers is quite diverse. In the trial phase, the farmers apply the technology on their land in various proportions. At the adoption stage, generally farmers accept to apply technology, there is a small proportion who do not continue the adoption.

The extent to which organic farming is widely practiced may also be affected by the extent to which its supporters are well-connected. When it comes to organic farming, Lobley *et al.* (2005) argue that the farmer's "social space," or the ability to ask for and

receive input from others, is a crucial factor in both decision-making and creativity. According to Mignouna *et al.* (2011), being a part of a social group increases one's social capital by facilitating the free flow of information, idea and trust. Farmers in the same community share their thoughts on how to best implement a new technical development. Social network effects, as described by Pauw *et al.* (2012), have a major impact on how people make choices; in the context of agricultural success, farmers helping farmers is a common practice. According to Katung & Akankwasa's (2008), more farmers participated in community-based groups, which increased their likelihood to adopt the corm-paired banana method because of their participation in social learning about the technology. Despite the fact that being part of a group encourages people to try new things, this might backfire if free-riding is common inside the group.

Another challenge to adoption is inadequate access to markets and the scarcity of necessary production materials. Groups of farmers, such as cooperatives and associations, may share the cost of inputs by taking use of economies of scale (Holmstead, 2015). However, Tanui *et al.* (2018) found no link between co-op membership and increased use of modern technologies. One barrier to organic farming's growth is a general lack of understanding of the organic market (Łuczka & Kalinowski, 2020). The certified organic export market has grown in recent years, with the European Union attracting the lion's share of products grown organically (Research and Markets, 2021). Unfortunately, the East African market for organic products remains small. Advanced marketplaces may be found in Uganda, Kenya, and Tanzania (Willer, 2012).

Facilitating organic cultivation and management requires strong organic agriculture policy and research (Reganold & Wachter, 2016). The development and implementation of novel agricultural methods and technology are frequently aided by government-sponsored research and policy efforts. A lack of regulations supporting organic farming creates an unfavourable legislative climate, which is a key barrier to the widespread adoption and resurrection of organic farming (Dixit et al., 2022). The African Union Commission has launched a continental organic farming effort called the Ecological Organic Agriculture Initiative (EOA-I) (AUC). Ecological Organic Agriculture (EOA) will be integrated into African national, regional, and continental food production systems as part of this program (African Union Commission, 2019).

This project aims to boost the continent's agricultural output by integrating OA into agricultural production systems in African nations by 2025. Governments throughout East Africa are enacting measures to encourage organic farming (IFOAM, 2012). Obuoyo (2017) argues that poor institutionalization of organic farming in many agricultural policies may come from insufficient attempts to actively engage National and County administrations.

Adoption may be boosted by providing easier access to loans. According to Awotide *et al.* (2016), enhanced rice adoption rates in Nigeria were highest among farmers who had easy access to loans. Simtowe & Zeller (2006) concurs with this explaining that this is due to the fact that when a family has access to credit, they are able to eliminate income diversification tactics that reduce risk. However, they are ineffective and instead focus their attention on investments that are higher risk but more effective. Authorities must work to enhance the current smallholder credit systems so that more smallholders, especially those from female-headed households, have access to finance. This can call for designing specialized loan packages to meet the requirements of certain demographics (Muzari *et al.,* 2013). The Kenyan government, for instance, has established a program (the UWEZO fund) that provides young people and women with access to loans at zero percent interest (UWEZO fund). As a result of this, more women will be able to gain economic independence and participate in the growth of their communities via the use of agricultural technology.

Private firms (commercial farmers, merchants & retailers, Small Holder Groups, intermediate size producer organizations, commercial farmers) and development partners (SDC, SIDA, FAO, DFID, GTZ) have worked together to improve the organic farming sector, as noted by Digal & Placentia (2019). There has been a rise in extension officer and farmer training in organic agricultural techniques, suggesting that Kenya is making strides in mainstreaming organic agriculture in its institutional training programs (Ndukhu *et al.,* 2016). Obuoyo (2017) notes that most African countries are still struggling with poor implementation strategies, overlapping roles, and conflicts. These challenges hinder the connection between farmers and other supporting partners. A case of Ethiopia shows that inadequate dialogue and poor communication among institutions, extension agents and organic farmers has seen reduced provision of organic technologies to farmers (Zerssa *et al.,* 2021).

2.4 Farmers Perceptions and adoption of organic farming

Niles *et al.* (2018) states that in order to adapt agriculture to climate change, societal-level changes in knowledge, beliefs, and practices are necessary. Whether or not organic farming is adopted is heavily influenced by how farmers feel about it. Different organic farming techniques may make farmers to generate varied views of the purpose of organic agriculture and varied perception of organic food production (Karami & Keshavarz, 2010). Consequently, while some farmers may look at organic farming as a way to ensure clean production, and others view it as a market niche hence form perceptions accordingly (Pinna, 2017). When farmers have a favourable impression of organic farming and conditions like cost and availability of labour are favourable, they are more inclined to switch to it. Farmers' perspectives on organic agriculture are influenced by a number of factors including, consumer demand for organically produced foods, the cost differential between organic and conventional farming, the health benefits to humans and the environment, and the sheer amount of extra work that goes into organic farming (Nnamonu & Ali, 2013).

One of the most significant variables in determining how farmers feel about organic farming is the amount of information and knowledge they have about it. According to Lowry & Brainard (2019), organic farming necessitates farmer participation in organic programs. In a similar vein, the technical expertise and complexity of organic agricultural processes have a role in shaping the perception and level of understanding of organic agriculture from area to region (Hayden *et al.*, 2018). Olutokunbo & Ibikunle (2011) found that farmers' views on organic farming were significantly influenced by the types of information they were exposed to. Kaliba *et al.* (2000) stated that a farmer's opinion on an innovation is heavily influenced by the farmer's familiarity with the innovation, as well as the farmer's socioeconomic status and the prevailing agro ecological conditions. According to Knickel et al. (2009), the knowledge that farmers have on newly developed agricultural technology may be expedited with the assistance of extension agents and other sources of farm information. An individual's age, communication channels, educational level, and incentive for adoption are some of the human qualities that might influence how they evaluate an innovation's merits (Okon and Idiong, 2016). The adoption behaviour will be influenced by how these characteristics of the invention are perceived.

A study done by Issa & Hamm (2017) observe that the constraints and disadvantages of small-farmer adoption of organic farming including; household labour, income and debt, education level and age significantly contributed to the overall perception to organic farming by farmers. In this view, (Kalyani, 2021) further state that the benefits attached to organic farming as opposed to conventional practices informed the general farmers' perception on adoption of organic practices. According to Leitner & Vogl (2020), the growing popularity of organic food in the United States is due to rising demand fuelled by the views and ideals of shoppers and regional producers. Similarly, a different study conducted in Thailand found that farmers' positive attitudes toward organic farming were correlated with increases in both their knowledge and their earnings (Petcho *et al*., 2019). In addition, Bader (2020) notes that organic farmers in Saudi Arabia tend to have a more positive outlook on the widespread acceptance and critical relevance of organic agriculture because of their access to networks and trainings.

However, Kalyani (2021) argues that consumer perception is as important as farmers' perception and that the two cannot be separated in assessing adoption of organic farming. According to Renault *et al.* (2021), European Union farmers' decisions to use organic farming methods are entirely up to them and depend on the rules in place. In this view, Issa & Hamm (2017) further states that in order to comply with the additional tasks that the union's demands of organic farmers, farmers' perception is key in the implementation of these policies and the quality of impact of organic certification which impact growth or organic agriculture.

Food security in Africa is an important issue, and agro-ecological methods and organic farming have the ability to make a difference (Oyedele *et al.*, 2018). However, most farmers on the continent have not changed their minds about organic farming as a result of the important indigenous knowledge and cultural traditions. In their research, Okon and Idiong (2016) found that farmers' individual perspectives on the advantages of organic farming varied widely depending on their own circumstances. Uhunamure *et al.* (2021) provide more confirmation that some farmers choose organic farming for the external advantages of social justice and market access, while others adopt it for the internal benefits of revenue and enhanced farm image.

Eyinade & Akharume (2018) on assessing South Africa organic agriculture practices further records that favourable perception is a good ground for the growth of organic farming in the province. Organic farming in Africa is yet to hit its potential while addressing identified challenges which have seen failure to fully integrate socio-economic and institutional factors (Oyedele *et al.,* 2018). The identified gaps therein have limited farmer's perceptions and willingness to undertake organic practices hence slowing the rate of adoption in the continents.

Tankam & Djimeu (2020) determined that perception towards organic technologies in Central Kenya is preconditioned by farmers' socioeconomic status coupled with soil fertility problems. According to Muhamadi & Boz (2021), various factors influencing how Kenyan farmers perceive organic agriculture are categorized into economic (household monthly income and farm size), social (age, gender, and level of education of farmers) and institutional (agricultural group membership and access to credit). Muhamadi & Boz (2021) further highlights that farmers are more profit oriented as opposed to their view on environmental considerations. Training and education of farmers lead to a positive perception to organic farming and increased adoption of organic technologies (Ndukhu *et al*. 2016).

Muchangi (2016) however records that majority of farmers perceived improved soil fertility as a result of increased use of inorganic fertilizers while noting that simple organic procedures such as application of manure was labour intensive. In view of this, Wambugu *et al.,* (2018) adds that households' access to external labour and investing on farming enterprises attracted farmers as they perceive it as profitable as opposed to simple organic farm procedures.

2.5 Organic agriculture in Kenya

Not until the 1980s did organic farming in Kenya have its formal start. In the beginning, organic farming was seen as a poor mans' practice, which may have led to the low promotion of the organic business among smallholder farmers (Taylor 2006). Initially, organic farming was a movement spearheaded by private firms, NGOs, and community groups. Kenya's OA industry has grown organically, like its counterparts throughout sub-Saharan Africa, with little to no oversight from the government. Muchangi (2016) claims that several initiatives on sustainable agriculture have prompted farmers in

Kenya to switch to organic methods of farming. KOAN, the Organic Agriculture Centre of Kenya (OACK), KIOF, ICE, and PELUM are just a few of the groups that have formed to support organic farming. Composting, manure use, thick mulches, and traditional crop mixtures are only a few of the methods that Kenya has implemented to achieve soil fertility management and extensive use of resources, as noted by the Kenya Organic Agriculture network (KOAN, 2018). Kenya's increasing reliance on organic farming is spurred by rising demand for organic goods in international markets, especially in the European Union (Gikunda *et al.,* 2021).

Organic farming uptake in Kenya has been very low and mostly partial compared to other nations like Tanzania and Uganda. The size of farmland apportioned to organic farming in Kenya is rather low despite the increasing consumer demand for organically produced foods in the recent past, with global sales increasing more than threefold (Reganold & Wachter, 2016). This concern has also been addressed by the Kenya Institute of organic farming (2020) who have been active in formulating policies to cushion organic farmers from vagaries of climate change and other challenges that affect their lands. This poor adoption rate calls for an understanding of the reasons why Kenyan farmers are not embracing organic farming at rapid rate.

Involved in the process of certifying organic goods are 27 domestic organic agricultural certification firms and 5 overseas certification agencies. The IMO (Germany), EcoCert (France), Ceres (USA) and Soil Association (UK) are only few of the worldwide organizations that provide certification services (Switzerland). In 2005, Encert, an organic produce certification body was established to service the national market. East African Community (EAC) launched the East African Organic Products Standard (EAOPS) in May 2007 as the official standard for organic agriculture production in the countries of East Africa, following a consultative process that began in 2005 with the goal of harmonizing organic standards that were already in place in the region. The 'Kilimohai' brand was established in collaboration with the EAOPS with the goal of assisting in the promotion of and contributing to the growth of regional commerce on organic goods (Kledal, *et al.,* 2009). There are currently enterprises that are classified as manufacturing organic goods for local and worldwide markets, and huge grocery outlets and restaurants are offering organic products and cuisines.

Development of organic agriculture continues to be underfunded by government agencies especially in education and in research (Mwaura, 2007). There has been no explicit or official policy support from the government for the growth of the organic business. The Kenya Organic Agriculture Network (KOAN) is an umbrella group that has been around since 2004 and is responsible for representing all organic groups in Kenya (Naqvi & Kaukab, 2010). Among the policies presently being created is the National Organic Agriculture Development Policy. Policies on soil fertility and food security have been revised to include organic agricultural techniques (Government of Kenya, 2020).

2.6 Summary of literature review and identification of research gap

Literature review focused on what variables contribute to the rise in popularity of organic farming. The literature review has found out that farmers' perception on organic farming determines their adoption or not adopting the farming practice. Farmers' perception is in turn dependent on access to information which they use to weigh between utility of organic farming and utility of conventional farming. A number of criteria have been recognized as being significant, including satisfaction with present, agricultural practices, labour requirement relative to its availability, availability of organic inputs, accessibility of information about organic farming techniques, and price and availability of markets of the organic produce. The fundamental barrier to wide-scale adoption of low-input agriculture technologies has been the substantial quantity of physical work required. Inadequate information on the techniques, markets and price of the commodities, an absence of a positive attitude, and the high cost of the practice are the key reasons for its lack of acceptance.

Literature has shown a rise in demand for organic agricultural products, with countries such as Australia, United States, European countries, Tanzania, Ethiopia and Burundi showing great interest in organic agricultural production . However, Kenya is lagging way too behind in organic production with very little growth of the same. Despite data suggesting limited acceptance and little expansion of organic farming in Kenya, there is little study emphasis on the same. This is despite the fact that the literature is rich in research efforts into the variables impacting the adoption of organic farming. A variety of factors, such as insufficient training in organic farming technology solutions, prohibitive accredited fees, slow market expansion, the absence of an official organic

agriculture legislation, and ineffectual post-harvest preparation, may contribute to the low rate at which organic production practices are adopted. The available data shows that these factors may apply differently based on site specific dynamics. This suggests that the reasons for low adoption rates may not be generalised. Organic farming may be profitable in the long run, albeit the extent to which this is true varies by region and crop. This research sought to address this knowledge vacuum by investigating the factors affecting adoption of organic farming in Murang'a County, Kenya, with a focus on the Murang'a South region. The advantages of organic farming may be realized throughout the nation if the findings of this research are replicated. This research will also fill in some of the blanks in our understanding of what influences the spread of agricultural practices.

CHAPTER THREE: METHODOLOGY

3.1 Study Area

The three sub-counties of Murang'a County, Kenya were selected for the research study: Gatanga, Kandara, and Kigumo sub-counties (Fig 3.1). Murang'a County is one of Kenya's 47 counties, and it can be found in the country's central highlands. A total of 2,558.8 square kilometres, it is surrounded by the counties of Kirinyaga, Embu, and Machakos to the east and Nyeri and Kiambu to the north. It is located at coordinates 36° East and 37° 27′ East, or 0° 34′ South and 1° 7′ West. The eastern part of the county is at an elevation of 914 meters above sea level (ASL), while the western part is located on the 3,353-meter-high slopes of the Aberdare Mountains. Kiharu, Mathioya, Kangema, Gatanga, Kandara, Kigumo, and Maragua are the seven sub-counties that make up the County. The region experiences bimodal rainfal and varies between 400 mm and 1600 mm. Areas with a high and medium probability of rainfall in Gatanga, Kandara and Kigumo sub-counties are highly populated.

The Murang'a South district development plan 2008-2012, reports that agriculture dominates the economy of Murang'a South and supports about 80% of the population livelihood. It also employs approximately 75% of the population. Agricultural activities are based on production of food crops, horticulture and industrial crops. Upper highland humid and upper highland per humid agro-ecological zones like those found in the Gatanga, Kandara and Kigumo sub-counties are where the majority of these important food crops are produced (MoALFC, 2021). The locations have considerable agricultural potential due to their favourable rainfall and quality of soil. Tea, coffee, avocados, mangoes, macadamias, and horticulture crops are only some of the important industrial crops grown in. Tomatoes, cabbage, kale, spinach, and french beans are all examples of horticultural crops, whereas maize, beans, bananas, sweet potatoes, and cassava are all examples of food crops. Murang'a County Integrated Development Plan (CIDP) 2013-2017 shows that the average farm size for households is 1.4 acres. The raising of livestock also contributes significantly to the economy. Cattle, pigs, goats, lambs, rabbits, and chickens make up the bulk of the county's livestock. Exotic cattle are found in the county's upper highland and upper midland areas, while native cattle are concentrated in the lower midland.

According to Ng'ang'a *et al.* (2020), Murang'a was among the three regions in the Central Highlands of Kenya delineation as the most suitable for utilization of most organic resources. However, environmental degradation has been prevalent in the region as people pursue improving agricultural production. This has been due to over use of chemicals and fertilizers, clearing of natural vegetation, cultivation of riparian reserves and planting of blue gum which is deemed environmentally unfriendly to crops and consumes a lot of water. This has as a result attracted a lot of attention from several pro-organic farming organizations among them ICIPE, KOAN, OACK, Biovision Trust, YARD and PELUM, Real Impact and organic product companies such as Organic Technologies. Their main focus is to promote sustainable land use practices in a bid to curb environmental degradation, address health concerns associated with high synthetic chemical inputs; as well as eradicating poverty through increasing agricultural productivity. One of these sustainable land use practices being promoted is organic farming.

The three sub-counties provided a suitable target population to study factors affecting adoption of organic farming food production system among the small-holder farmers. This is due to their agroecological factors and ongoing organic farming activities.

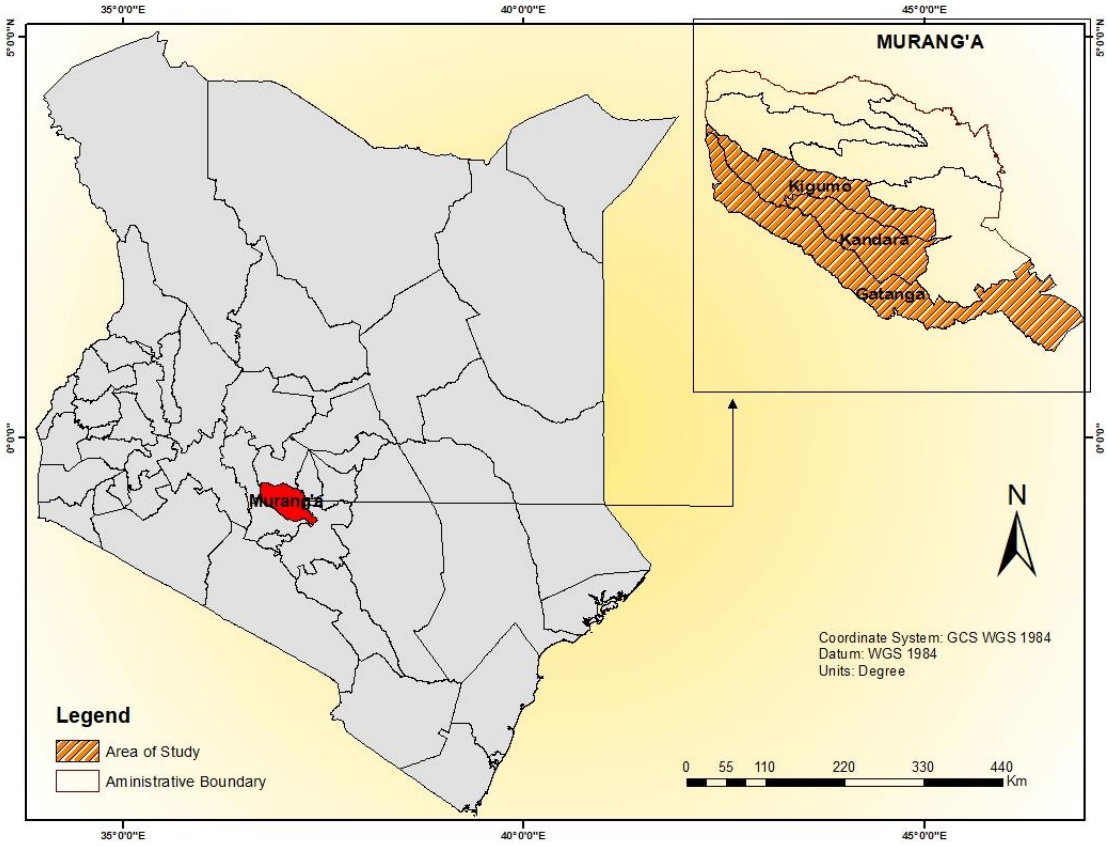

Figure 3.1: Map of Murang'a County and the Study Area

3.2 Study Design

The study utilized a cross-sectional survey design to determine factors that affect adoption of organic farming among smallholder farmers in Murang'a County, Kenya. A cross-sectional study is an observational research design where data is collected from many different individuals at a single point in time. The design was used because it is good in describing characteristics that occur in a given community and explore the relationship between variables. Cross-sectional survey is advantageous in that it is flexible, can address many areas of human behaviour and conditions, and can apply to many populations. Cross-sectional surveys are used mostly in social science studies to gather data on the occurrence of behaviours, knowledge, attitudes, and respondent opinions (Connelly, 2016).

Farmers that utilize organic and conventional agricultural practices were surveyed. Data on household characteristic variables, institutional support factors, and farmers' perceptions of organic farming were collected via a survey conducted to the appropriate

sample size using self-administered, structured questionnaires developed. When provided to household heads, they were expected to respond, but if the head was not available, other members of the home with thorough knowledge or active participation in agricultural activities were invited to respond. In addition, in-depth interviews with key informants were done so as to get their informed opinion of organic agriculture in the Murang'a south region.

3.3 Population

Small-holder farmers in Gatanga, Kandara and Kigumo sub-counties constituted the target population for this study. To define the target population further, 361 farmers were selected from the farmer groups identified and working with three pro-organic farming organizations in Gatanga, Kandara and Kigumo sub-counties namely KOAN, ICIPE and OACK respectively (Table 3.1). The study targeted both the organic and conventional farmers in the selected three sub-counties in Murang'a south region. The organic farmers were further refined to those who had practiced it for at least two seasons. The conventional farmers selected were those who had been targeted by the pro-organic farming organisations (OACK, ICIPE and KOAN) but had not practiced any form of organic farming. The pro-organic farming organizations provided the following sampling framework.

Table 3.1: Target population distribution

Farmer group	OACK	ICIPE	KOAN	Target Population Distribution
Organic farmers	54	72	90	216
Conventional farmers	35	45	65	145
Total	**89**	**117**	**155**	**361**

3.4 Sampling procedure

In order to evenly divide their sample size across organic and conventional farms, the research employed a proportional sampling method to estimate how many farmers from each category should be contacted.

The simple random sampling was used to select 189 organic and conventional small holder farmers so that each and every one in the target population has an equal chance of inclusion. Purposive sampling was used where 9 key informant were selected deliberately in order to provide important information that could not be obtained from other choices(Taherdoost, 2016).

3.5 Sample size

A sample size constitutes a fraction or part of the population and helps in learning more about the population. Using the method for finding the sample size from a limited population, we were able to determine the appropriate size of the sample to draw from:

$$n = \frac{N}{1 + (N \times e^2)}$$

nn
is the size of the sample

NN
is the size of the population

ee
is the allowable error

The population of farmers in Murang'a south region targeted in this study was 361. The sample size of the households to be selected in the study is thus calculated as follows:

$$n = \frac{361}{1 + (361 \times 0.05^2)}$$

$$n = 189 \text{ farmers}$$

The total sample size of 189 was split between conventional and organic farmers, with each group's representation reflecting its share of the total population. The sample's proportionate distribution is shown in Table 3.2.

Table 3.2: Sampling distribution

Farmer group	Population	Sampling Distribution			
		OACK	ICIPE	KOAN	Total
Organic farmers	216	28	38	47	113
Conventional farmers	145	18	24	34	76
Total	**361**	**46**	**62**	**81**	**189**

The research also targeted 9 key informants to collect their opinions on adoption of organic farming (Table 3.3).

Table 3.3: Key informants' distribution.

Institution	No. of Interviewees
Ministry of Agriculture and Fisheries Department of Agriculture in Kigumo Kandara and Gatanga Sub-Counties	3
OACK	1
YARD	1
Field Officer ICIPE	1
Field Officer Biovision	1
Organic products stockists and companies buying organic products from farmers	2
Total	**9**

3.6 Instruments

To obtain primary data, the research study employed two types of data collection instruments namely; research questionnaires and Key informant Interview schedules. Field observations was also done. Secondary sources of data were also used to help in firming up the research findings.

3.7 Data Collection procedure

Household surveys and in-depth interviews with key informants were used to generate the quantitative and qualitative data sets, respectively, for the research. Organic and

conventional farmers were given standardized questionnaires for the household surveys to obtain quantitative data on institutional support factors, household characteristic variables, and farmers' perceptions of organic farming.

Detailed interviews were conducted with 9 key informants from the Ministry of Agriculture and Fisheries, the Department of Agriculture in the Kigumo, Kandara, and Gatanga Sub-Counties, the OACK director, the Field Officer of the International Center for Integrated Pest Management (ICIPE), the Field Officer of Biovision, organic product stockists, companies that buy organic products from farmers (such as KOFFINAF), and macadamia nut enthusiasts.

In order to guarantee the accuracy and precision of the data collected, a pilot study was conducted in Kigumo sub-county. Five questionnaires were given to five respondents to assess their reliability. The pilot study allowed the research to identify and address all ambiguities, redundancies and inadequacies of the questionnaire before actual data collection commenced. Participants in the pilot research will not be included in the final tally.

3.8 Data analysis

The data collected was both of quantitative and qualitative nature. Quantitative data was systematically processed and turned into numerical codes indicating measurements of variables. After coding the data, it was loaded into SPSS (Statistical Package for the Social Sciences) for further analysis using descriptive statistics. This was provided with percentages and tables showing the frequency distribution of the data. Further analysis was done using the logistic regression model. The logistic regression analysis model came in handy to explain relationship between the dependent binary variable (adoption of organic farming) and independent variables in objective one and two. Qualitative data was organized into coherent categories as follows: labour demand, labour supply, capital requirement, time taken and availability of inputs. The research studied these categories and retrieved factors that arose from the responses.

3.9 Reliability and validity

Reliability and validity are means of showing and communicating the rigour of research processes and the trustworthiness of research findings (Roberts and Priest, 2006).

3.9.1 Reliability

Reliability is the degree to which measures are free from error and therefore yield consistent results (i.e.the consistency of a measurement procedure). If a measurement device or procedure consistently assigns the same score to individuals or objects with equal values, the instrument is considered reliable (Lakshmi and Mohideen, 2013). The consistency of questionnaire was tested through pre-test method where research tools were administered to same people in the study area under identical conditions. This procedure revealed the questions that were ambiguous and could lead to different interpretations were adjustments accordingly to meet performance standards before being used for the actual data collection.

3.9.2 Validity

Validity refers to the accuracy and meaningfulness of inferences made based on results obtained. It is asking a relevant question framed in the least way (Mugenda and Mugenda, 2002). Field (2005) basically defines validity as "measure what is intended to be measured".. Validity was tested through piloting to ensure that the data being captured is reliable in representing the specific content of a particular concept in this case organic farming. Piloting was done in the study location but the subjects were avoided during the actual research.

CHAPTER FOUR: RESULTS AND DISCUSSION

This chapter presents and discusses the study's results that are pertinent to the research objectives provided at the start, including demographic and household characteristics of organic and conventional farmers, institutional support for organic farming, and farmers' attitudes of organic farming. The aforementioned criteria were compared between organic and conventional farmers to see whether there was a discernible difference in the utilization of organic farming methods.

4.1 General information

4.1.1 Response rate

The research aimed to gather responses from a total of 189 farmers in the Murang'a south region. However, only 152 participants were able to effectively provide their responses, which resulted in an overall response rate of 80.4% (Table 4.1).

Table 4.1: Response rate

	Target population	**Sample**	**Response**	**Response rate**
Organic farmers	216	113	90	79.6%
Conventional farmers	145	76	62	81.6%
Total	361	189	152	80.4%

According to Richardson (2005), an appropriate and acceptable response rate is one that is more than fifty percent (50%) of those who are asked to participate in a survey. The response rate of 80.4% was regarded adequate.

4.1.2 Households' Demographic characteristics

Demographic characteristics are important to be researched in studies as they provide information about the participants in the study. Because of their consistent impact on the dependent variable across studies, researchers often utilize demographic data as control variables. The respondents in the study were asked to give some general information regarding the gender, educational levels, and age of the farmers that practiced either organic or Conventional farming technologies.

4.1.2.1 Gender and age

Gender and age of the farmers were considered as important determinants of adoption or non-adoption of OF. These factors have a bearing on access to factors of production in agriculture and can therefore influence the decisions to adopt different technological options under conventional or organic farming systems.

Of the 152 farmers who took part in the research (Table 4.1), 59% (n=90) engaged in organic farming, whereas 41% (n=62) relied on conventional methods. 68% and 60% of the farmers who engaged in organic and conventional farming respectively were women, as shown in Table 4.2 Organic farming is mostly done by women, according to the report.

Table 4.2: Gender of farmers

		Gender of respondent		**Total**
		Male	**Female**	
Type of Farmer	Conventional	40 %	60 %	100 %
	Organic	32 %	68 %	100 %
		Value	Df	P-value. (2-sided)
Pearson Chi-Square		.946a	1	.331

The Pearson Chi-square test of the contingency table (p=0.331) showed no statistically significant correlation between farmers gender and adoption of organic farming. This implies that there is no likelihood that one gender practices organic farming more than other. Further analysis showed that majority of farmers surveyed were between the ages of 40 and 60. This indicates that most young people did not participate in agricultural activities while being in a prime age range for agricultural output. Age distribution data for organic and conventional farmers is also included. These results suggest that farmers under the age of 40 are more likely to practice conventional farming than organic farming, whereas farmers aged 40 and over have a higher likelihood to undertake organic farming (Fig. 4.1). However, the chi-square test shows that there is slight difference in the proportion of farmers that engage in organic farming on the basis of age (Table 4. 3). P-value for the statistic is.291, which is more than 0.05. This shows

that there is no statistically significant correlation between age groups and the prevalence of organic farming.

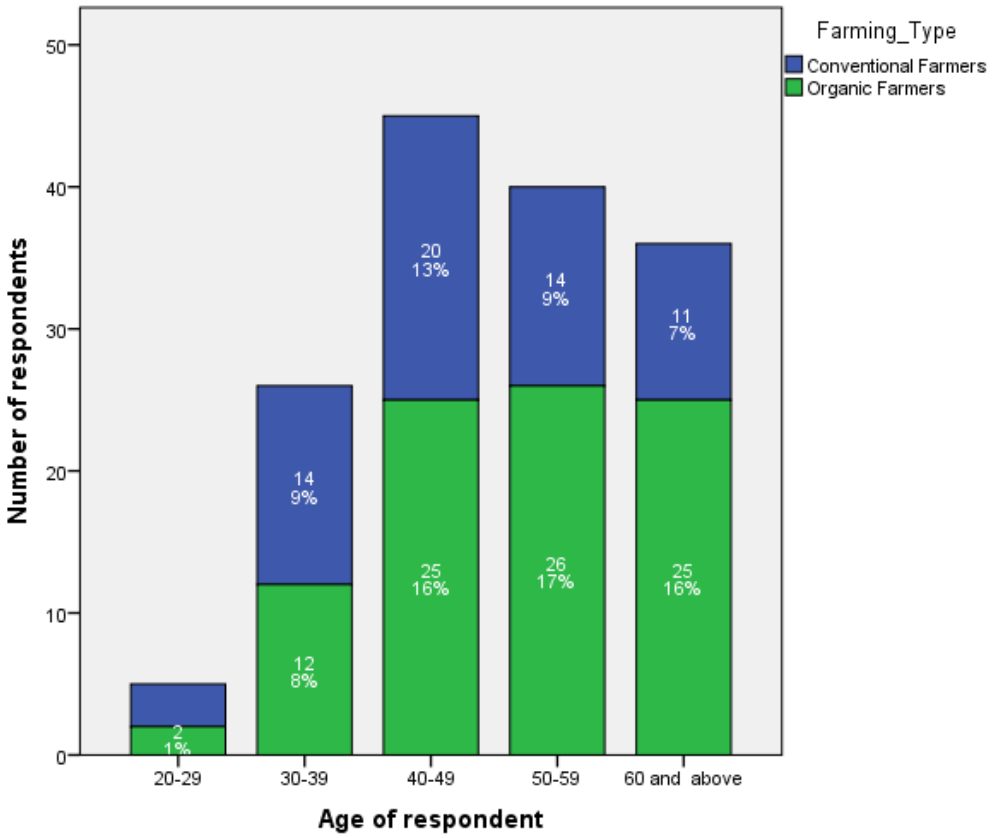

Figure 4.1: Distribution of organic and conventional farmers by age group

Table 4.3: Association between age and organic farming

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.964[a]	4	.291

The findings were contrary to those of Njeru (2016) and Métouolé et al. (2018), who concluded that women have higher propensity to organic farming compared to men because of their caring duties. The study findings are in line with those of Ndiema *et al.* (2002), whose study showed no considerable connection between farmers' adoption of superior seed varieties and their gender. According to an interview with a key informant, this may be due to the fact that women farmers often have less resources at their disposal than their male counterparts. His argument was that conventional

farming's reliance on synthetic chemicals and fertilizers makes it more expensive than organic farming; which makes use of widely accessible inputs like manure and mulch. The health advantages of organic farming have reportedly made it easier to persuade female farmers to switch to the practice. Compared to women, men need more convincing of the advantages of organic farming over conventional farming before making the switch. Farmer interviews showed that after seeing initial success with organic farming on small trial plots, male farmers expanded their operations.

Though descriptively, more younger farmers were practicing conventional farming as compared to organic farming, there was no statistically significant age-related difference in the prevalence of organic agricultural practices. These results on age and adoption of organic farming contradicts those of Obuoyo (2017) where younger farmers were found to be less involved in organic agriculture. Liu et al. (2019) found that the likelihood of adoption of organic farming practices dropped considerably as farmers got older. This was associated to risk averseness and demands the time and efforts to assimilate organic knowledge and methods. Gikunda et al. (2021), also reported that on average, the household heads who had embraced organic farming methods were relatively old with an average of 54 years. Sapbamrer & Thammachai (2021) observed that young farmers and women are among the target demographics who may be more inclined to embrace organic farming. An interview with an officer from the Ministry of Agriculture in Gatanga revealed that majority of youth, especially those who had attained secondary school education did not consider farming as their economic activity option. They rather pursued other activities such as motor bike business, small-scale trade, casual labour and other white-collar jobs. Few who were in agriculture were those who have engaged in agriculture earlier from their household settings and therefore had the liking and experience. It was therefore unsurprising that only a few youths were found to be members of organic farming groups.

4.1.2.2 Education

Farmers' average years of schooling are shown in Table 4.4. Results suggest that most farmers have completed elementary school. Twenty percent of those polled had completed post-secondary education. According to the data, 38% of organic farmers had completed elementary school, 31% had completed middle school, and 9% had

completed high school or above. The Chi-square test's p-value (0.678 at df = 2) was considerably higher than the alpha value (p=0.05), indicating that education level has no meaningful effect on whether or not a farmer chooses organic or conventional farming.

Table 4.4: Type of farmer Vs level of formal education

Type of farming		Non-formal	Primary	Secondary	Tertiary	Total	Pearsons Chi-square value	df	p-value
Conventional	Percent	16	34	39	11	100		2	0.680
Organic	Percent	22	38	31	9	100	0.773		

[* Alpha value 0.05 (5% level of significance), N=152]

Educating farmers is important because it increases their ability to learn from and use the data they collect (Adolwa *et al.,* 2012). Even though the vast majority of organic farmers had completed just basic school, a sizeable minority (22%) were illiterate. Most of the advocated organic farming methods were not technically advanced and had been in use in Africa for centuries before the agrarian revolution.

The research findings coincide with those of Njeru (2016), Khanna (2001), and Nyaupane and Gillespie (2009), who all concluded that farmers' education levels had little impact on their adoption of new agricultural methods. However, these theories run counter to findings from several empirical studies, which have shown the importance of education in the dissemination of agricultural technology. Target groups with a higher education level were shown to be more inclined to embrace organic farming by Sapbamrer & Thammachai (2021). Both Barton (2018) and Kuan *et al.* (2021) identified education level as a crucial element in the conversion to organic farming. In contrast to the results of this research, they claimed that organic farming communities tend to have more educated residents. Similarly, Lee (2017) argues that a higher percentage of college-educated people has a beneficial impact on the likelihood that a community would embrace organic agricultural practices. One such study is Amudavi's (1993) investigation, which concluded that increasing students' exposure to and understanding of technology resulted in wider dissemination of that technology. Some

potential explanations for this variety in the empirical data include differences in the types and rates of technology adoption (Gardner and Rausser, 2001).

4.2 The effect of household characteristics on adoption of organic farming in Murang'a south region

This section presents the results for the second objective on effects of household characteristics on adoption of organic farming. It analysis the household characteristics such as, level of adoption of organic farming, farm sizes, crops cultivated and animals maintained, and labour needs for farm operations, as well as an evaluation of the connection between these variables and adoption of organic farming, are discussed.

4.2.1 Adoption of organic farming

Of the sampled respondents, the 62 conventional farmers were not practicing any organic farming at all while 90 were practicing organic farming at different levels. From the 90 farmers, (55.56%) were only partially practicing organic farming (Partial) while the remaining 40 (44.44%) were fully fledged organic (Whole farm) farmers as shown in Figure 4.2. Partial organic farmers subjected a section of their farmland on organic farming or integrated use of organic farming techniques with some conventional ones. Whole farm organic farmers had put all their land on organic farming.

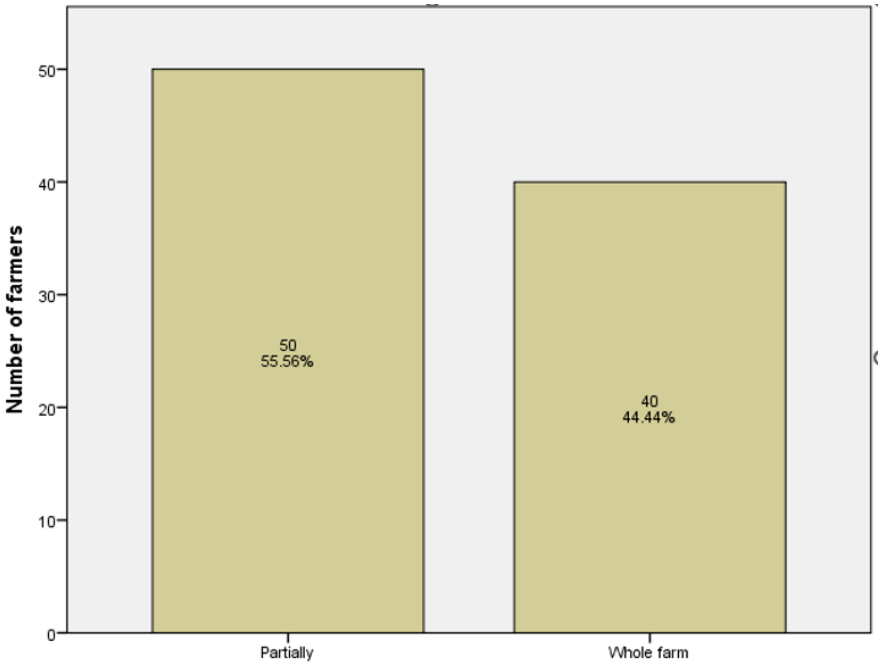

Figure 4.2: Level of adoption of organic farming

Key informant interviews showed that organic farming is not widely practiced, with most farmers only using it in their kitchen gardens for health reasons while using synthetic soil fertility and pest management techniques in their commercial operations. It was also revealed that there was widespread property subdivision in the studied locations; as a result, smaller-scale landholders were more likely to pursue organic farming on their whole farms than their larger-scale counterparts. Household income was another important aspect; low-income families often chose organic agricultural methods. The results are consistent with the study by Khaledi *et al.* (2010) that suggest that farmers having smaller plots of land were skewed to organic farming throughout their whole farm. Easy-to-implement organic techniques were widely embraced, whereas those that need more in-depth knowledge and expertise were adopted by a smaller percentage of respondents (Shivam *et al.*, 2019).

4.2.2 Farm sizes

As shown in figure 4. 1 there were 70 farmers among those studied who had only up to 2 acres of farming land of which majority (66 farmers) practiced organic farming. As the size of farm land increases the number of those practicing organic farming decreases while those practicing conventional farming increases such that all the farmers with over 10 acres of farm lands practice conventional farming. This shows even if the

number of farmers practicing organic farming increase, the farm sizes in which organic farming is practiced is still smaller. A chi-square test was carried out to confirm the significance in the changes in farming method adopted with increase in farm land. The p-value of the chi-square statistic as shown in table 4. 1 is less than 0.05 implying a significant association between farm size and adoption of organic farming.

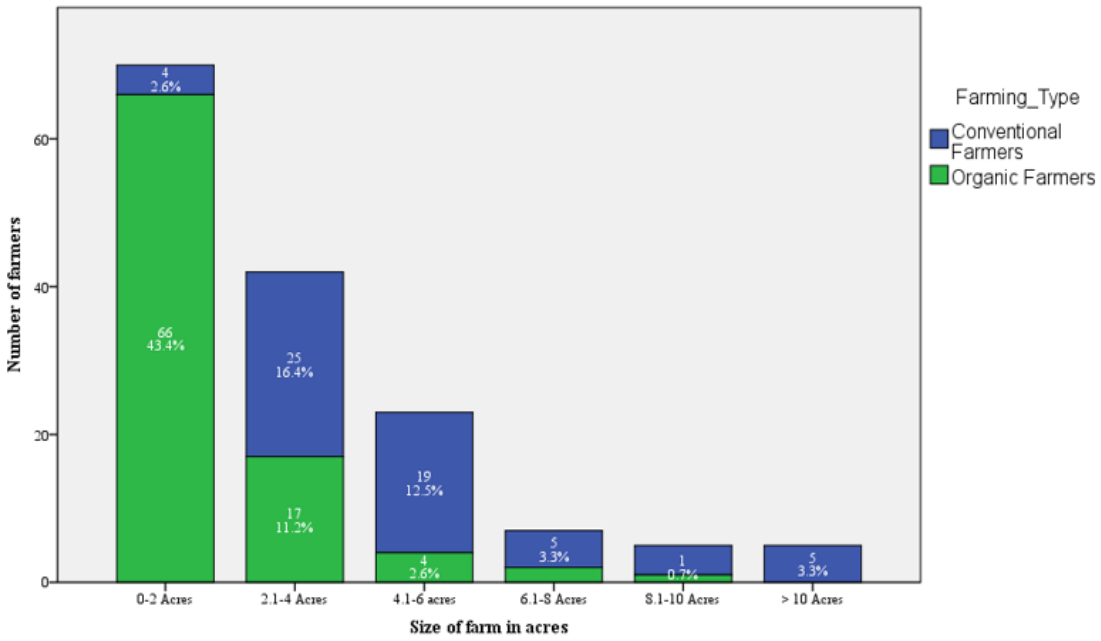

Figure 4.3: Farm sizes under organic and conventional farming

Table 4. 1 Association of Farm sizes and farming method

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	71.577[a]	5	.000

Logit regression model was done in order to find out whether or not the size of household farm is a major factor that impacts the choice of adopting organic farming. Table 4.6 shows that P-value of the coefficient of farm size is 0.000 which is less than 0.05 implying a significant coefficient (-1.602) of farm size in the equation at 5% level of significance. The significant negative coefficient implies a reduction in the odds of a farmer adopting organic farming with increases in the sizes of the farms owned. The Cox and Sell R-square statistic shows that up to 35.3% of the variation in the odds of farmers adopting organic farming to conventional farming is explained by the varying farm sizes of the farmers.

Table 4.6: Effect of farm size on Adoption of organic farming

Model Summary						
	-2 Log likelihood		Cox & Snell R Square			
	139.243a		.353			
	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Size of farm	-1.602	.274	34.306	1	.000	.201
Constant	1.885	.314	35.935	1	.000	6.586

In addition, logit regression model was built for the organic farmer sub-sample to see whether farm size has any bearing on the level at which organic farming is practiced on individual farms. Table 4. 7 displays a Cox and Snell R-square of 0.018, which indicates that differences in farm size explain just 1.8% of the variance in the probability of the farmer embracing organic farming partially or whole farm. With a p-value higher than 0.05, the coefficient of farm size in this model is not significant at the 5% level of significance. This further implies that a farmer's likelihood to adopt organic farming practices partially or whole farm has nothing to do with the size of their farm.

Table 4.7: Effect of farm size on the level of adoption of organic farming among organic farmers

Model Summary						
	-2 Log likelihood		Cox & Snell R Square			
	121.993a		.018			
	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Size of farm	-.380	.311	1.492	1	.222	.684
Constant	-.084	.238	.125	1	.724	.919

Two models controlling for farm size revealed that smallholder farmers are more likely to transition to organic methods, but organic farmers don't base how thoroughly they

incorporate organic practices into their operations on the size of their farms. The findings of Ruzzante (2021), who investigated the role that farm size may have in the spread of different agricultural technologies, are consistent with these observations. The results are in line with the findings of Rana & Paul (2017), who observed that the larger the farm, the more likely it was to switch to organic methods of farming. The results showed that farm size accounted for just 35.3% of the variation in organic farming preferences. The remaining 64.6% of the variation can't be explained by farm size alone, therefore it can't be used to argue for or against organic farming.

Feder *et al*. (1985) claim that factors including risk aversion, financial constraints, wealth, and access to information moderate the effect farm size has on technology adoption. All of these things are relevant. As a result, there are several elements that will play into farmers' choices on whether or not to use organic practices. Adeola's (2010) findings that farmers with small farm sizes were more receptive to embracing new technology and making the most of the space they had available are supported by the results of the current research. But Njeru's (2016) research on the parameters affecting farmers' adoption of organic farming indicated that land size had no statistically significant influence. Similarly, Liu et al. (2019) concluded that larger farms and farmers with more expertise were less likely to switch to organic methods. From our examination of the 90 respondents who had made the switch to organic farming, we learn that the size of the farms had no role in whether or not the transition was partial or total. Mungai *et al*. (2016) looked at the elements that influence farmers' choices to switch to organic farming, and they discovered that land size had no effect in this shift. The findings of this research may help explain why.

4.2.3 Livestock kept and Crops grown

Other household characteristics assessed were the crops grown and animals kept. Each house hold had a variety of crops they grow in their farms and animals they keep. The type and number of animals kept and crops grown is significant in adoption of some OF techniques such as use of manure and composting. The intention was to determine if the variety or the types of crops and animals influenced the farmers' choice to adopt organic farming and the extent to which they do it if adopted.

Livestock Kept

On average, the farmers were found to keep at least 2 types of animals. Some farmers however kept more of than or less than 2 types of animals. The maximum number of animals kept by a farmer was 5 with some being purely in crop farming. The distribution of the number of variety of animals kept by the farmers is presented in Figure 4. 6. The number of the variety kept seems normally distributed about the mean of 2 not skewed on either side.

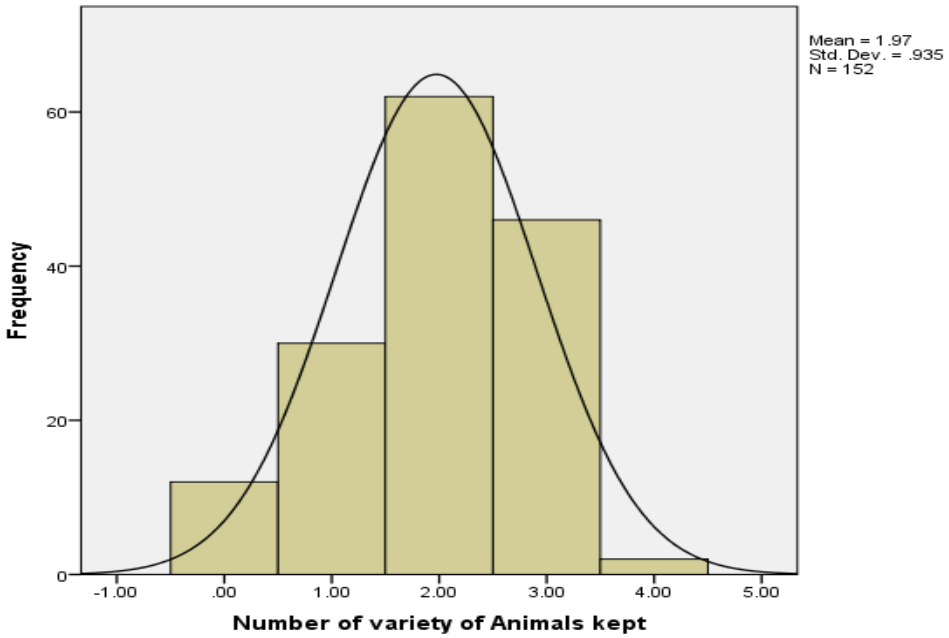

Figure 4.4: Histogram on variety of animals kept by both organic and conventional farmers

Chi-square tests on the association between farming type and the animals kept was carried out for each animal as shown in Table 4. 8. The results show all p-values of the chi-square statistics to be greater than 0.05 implying no significant association between each particular type of animals reared and the farming type adopted. The overall chi-square also showed insignificant association between animal types and farming techniques. There were also no specific animal types favoured by organic farmers.

Table 4.8: Chi-square tests of farming type and the animals kept

Animal		Value	df	Asymp. Sig. (2-sided)
chick	Pearson Chi-Square	1.604c	1.000	0.205
cow	Pearson Chi-Square	.018d	1.000	0.894
pig	Pearson Chi-Square	.300e	1.000	0.584
rabbit	Pearson Chi-Square	.790f	1.000	0.374
shoat	Pearson Chi-Square	.014g	1.000	0.907
Overall	Pearson Chi-Square	2.698[a]	1	0.100

Chi-square analyses reveal that the option to embrace or not adopt organic farming is not substantially influenced by the sorts of animals maintained. The results of this study are inconsistent with those of Sapbamrer & Thammachai (2021) who found a correlation between higher livestock units and higher adoption. On the other hand, Läpple & Rensburg (2021) found that higher livestock units meant lower adoption. This could be due to the fact that the number of animals kept per variety was small hence not adequate to provide the required biomass to support organic farming without supplementation with synthetic inputs.

Crops grown

The variation and distribution of the number of crops grown (variety) is portrayed by the histogram in Figure 4. 7. On average, the farmers grow 6 different types of crops while the maximum number a farmer was found to grow was 14 and the minimum was 2. The histogram shows skewness to the right implying that more farmers grow a smaller variety and only a few farmers actually grow more than the average.

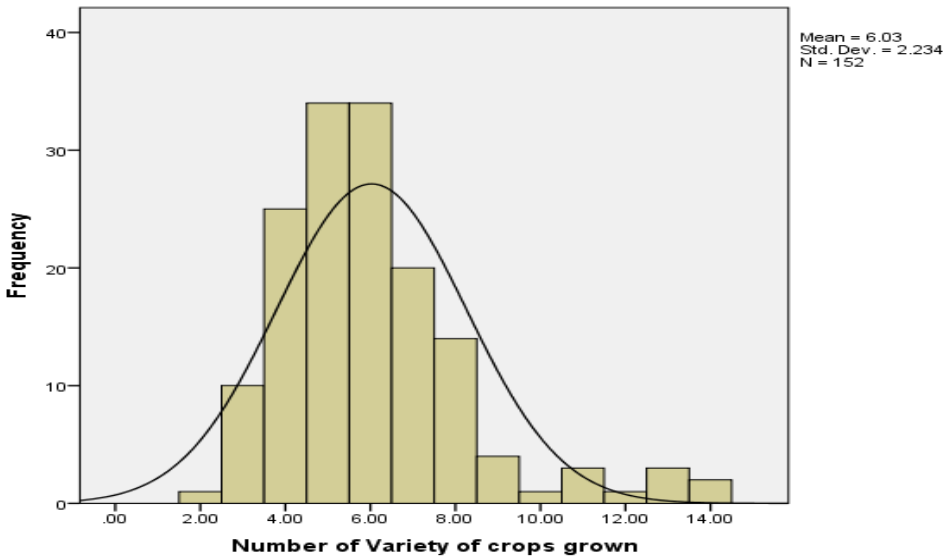

Figure 4.5: Variety of crops grown by both organic and conventional farmers

A logit regression model was used to ascertain whether the variety of crops raised on a household farm had any bearing on the likelihood of its owners making the transition to organic farming. Table 4.9 displays the results of the logit regression analysis. The coefficient of crop diversity is 0.069, and its P value is 0.009, which is less than 0.05, suggesting that it is statistically significant at the 5% level of significance. The coefficient is significantly positive, suggesting that farmers who cultivate a wide range of crops are more likely to embrace organic farming practices.

Table 4.9: Effect of crops grown on choice of Adoption of organic farming

Model Summary						
	-2 Log likelihood		**Cox & Snell R Square**		**Nagelkerke R Square**	
	203.594a		.046		.061	
	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Variety of Crops Grown	.069	.026	6.848	1	.009	1.071

For the purpose of determining whether or not the types of crops farmed have a significant impact on whether or not farms employ organic farming practices on a

partial or whole farm basis, a logit regression model was also fit to the organic farmer sample set. Results reported in Table 4.10 reveal a Cox and Snell R-square of.031, indicating that variations in crops cultivated on the farm only account for 3.1% of the variance in the probabilities of the farmer embracing organic farming in any capacity. This model's coefficient on crop diversity is not significant at the 5% level since its p-value is larger than 0.05. This implies that the level at which organic farmers adopt organic farming is independent of the number of crop options available to them.

Table 4. 10: Effect of crops grown on the level of Adoption of organic farming

Model Summary						
	-2 Log likelihood		**Cox & Snell R Square**		**Nagelkerke R Square**	
	121.895a		.031		.042	
	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Variety of Crops Grown	-.054	.032	2.793	1	.095	.947

The study found that there was no correlation between the number and variety of crops grown and the prevalence of organic farming practices. However, Organic farming methods were demonstrated to be more popular when there was a wide variety of crops grown. It was observed that many farmers who grew a wider variety of crops partitioned their larger holdings into smaller plots, making the partial organic farmers. These crops grown organically for the farmer's own use, while the rest of the farm is used for commercial production using chemical fertilizers and pesticides. This could be explained by the findings of Schneeberger *et al.* (2002) who found that the cash crop producers shunned organic farming due to technical challenges in cropping, additional labour requirements, fear of decreased incomes and marketing challenges. According to Singh *et al.* (2015), observation was made that it was impossible for certain farmers to cultivate specific crops without using the usage of pesticides.

These results were backed by key informant interviews that confirmed that even though the farmers were trained on organic farming, there were crops like tea and coffee where the national marketing bodies requires them to add a certain amount of fertilizers. The

organic farming is therefore mainly done on crops that grow on small plots. These include vegetables such as spinach, kales and carrot. These are used for household consumption and local markets. Some other crops that are easier to grow organically include arrow roots and avocado from which some farmers are reaping good profits.

4.2.4 Farming Experience

As can be seen in Figure 4.6, majority (21.1% of all farmers surveyed) had between 16 and 20 years of farming experience, with 11.2% engaging in organic farming and 9.9% in conventional farming. Farmers with more than 31 years of experience farmed organically at a higher rate than those with less than 7 years of expertise.

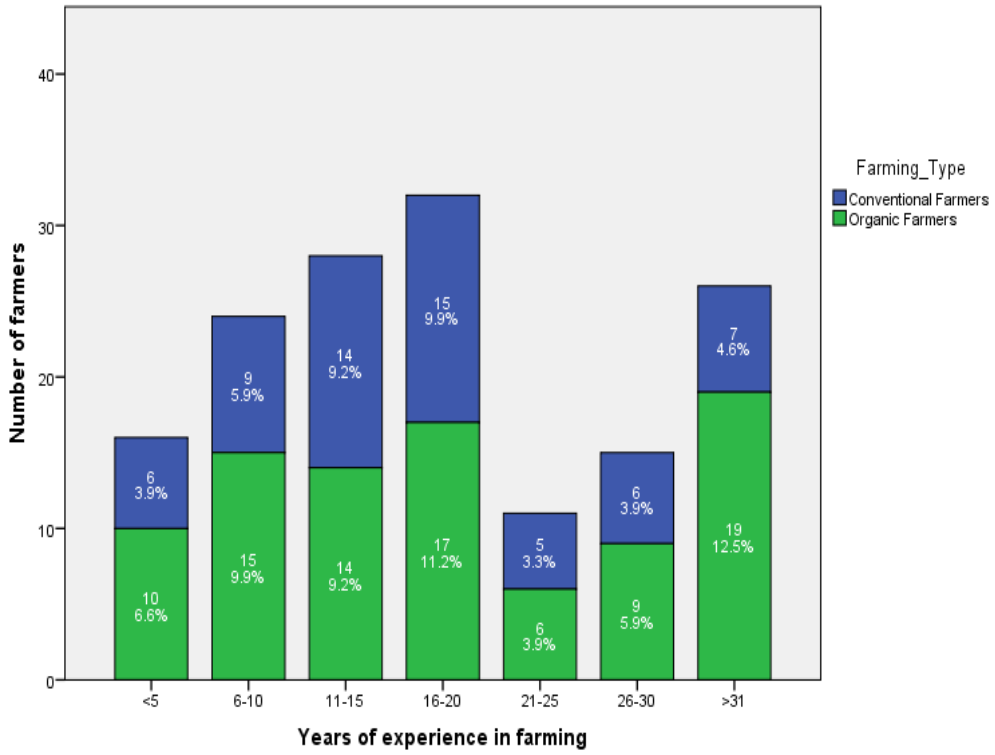

Figure 4.6: Farming Experience

A further analysis in Table 4.11 shows the results of a logit regression analysis measuring the influence of farmers' levels of experience on their decisions to switch to organic or conventional farming. The coefficient of farmers' experience (0.090) is statistically significant at the 5% level of significance, with a P-value of 0.017 (less than 0.05). The statistically significant coefficient indicates that the likelihood of a

household adopting organic farming practices increases as farming experience increases, independent of the kind of farming used by the farm.

Table 4.11: Effect of Experience in farming on the choice of Adoption of organic farming

Model Summary						
	-2 Log likelihood		**Cox & Snell R Square**		**Nagelkerke R Square**	
	204.864a		.038		.050	
	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Farmers Experience	.090	.038	5.660	1	.017	1.095

Another logit regression model was constructed to evaluate if the farmers' experience with organic farming also influences the level of adoption of organic farming (partial/whole-farm) (Table 4. 12). The P-value for the experience coefficient is 0. 359, which is bigger than 0.05 and indicates that the coefficient is not significant at the 5% level of significance. This implies that raising their degree of adoption of organic farming does not necessarily enhance their chances of doing so as they gain expertise in the practice.

Table 4.12: Effect of experience in organic farming on the level of Adoption of organic farming

Model Summary						
	-2 Log likelihood		**Cox & Snell R Square**		**Nagelkerke R Square**	
	122.795a		.009		.013	
	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Experience	.337	.368	.842	1	.359	1.401
Constant	-.937	.808	1.346	1	.246	.392

According to the findings, farmers' level of expertise has a crucial role in determining whether or not they transition to organic farming practices. There was no statistically

significant correlation between organic farmers' degree of expertise and their choice to raise their adoption rates of organic farming practices. This agrees with the findings of Rana & Paul (2012), who showed that having prior farm experience was correlated with a greater likelihood of switching to organic farming methods. Contrariwise, Liu *et al.* (2019) claimed that farmers with more expertise were less likely to switch to organic practices.

The study observed that in the first year of organic farming, there are more farmers practicing organic farming on a whole farm scale contrary to the next phase between 1-5 years. This could mean that, on introduction to organic farming more farmers adopt whole farm but revert to partial farming after the first year. Farmers attributed this to unmet immediate expectations in terms of yields, challenges in labour requirements, marketing challenges as well as challenges in pest and disease management. This was supported by the interviewed key informant who stated that while converting to organic farming, production is usually low in the first three years. He also reported that, since the study area is a tea growing zone, the Kenya Tea Development Authority (KTDA) policy on use of synthetic fertilizers which requires farmers to use specified amount of synthetic fertilizer on their tea farms affects whole farm conversion into organic farming.

After five years of organic farming, the data also indicated a rise in full farm conversion. This might imply that farmers have begun reaping the full benefits of organic farming at this time and have so decided to embrace whole-farm organic farming. This was corroborated by a report from a key informant interviewee who asserted that the high labour requirements in organic farming were only felt during the initial/conversion period and that once the soils had attained the natural balance, the amount of labour and inputs needed significantly decreased while yields rose. However, this has to be studied and documented so that it may be used as support for the use of organic farming. These findings are also echoes those of an ongoing Long-Term System Comparison Trials (SysCom) study being conducted in Kenya by the Research Institute of Organic Agriculture, Switzerland, with partners such as ICIPE, KARLO, Kenyatta University, and some organic NGOs. This study's findings indicate that after the transition period, which is the first three years of adopting organic farming, the system begins to show a slight improvement in yields and soil conditions.

4.2.5 Techniques of Organic Farming Practiced

Figure 4. 7 shows the number of organic farmers utilizing and not using various organic agricultural practices. Not all organic farmers practiced all the OF techniques. So Figure 4.7 shows the level to which the techniques are practiced. i.e. by those organic farmers practicing and those not practicing each technique. Majority (85) of organic farmers were found to be using mulch and compost manure in their operations. Thirty-eight of the 85 farmers who mulched did so across the whole farm, while 47 only did so in part. Similarly, only 39 of the 85 farmers who composted waste did so throughout the entire farm, while 46 only did so in part.

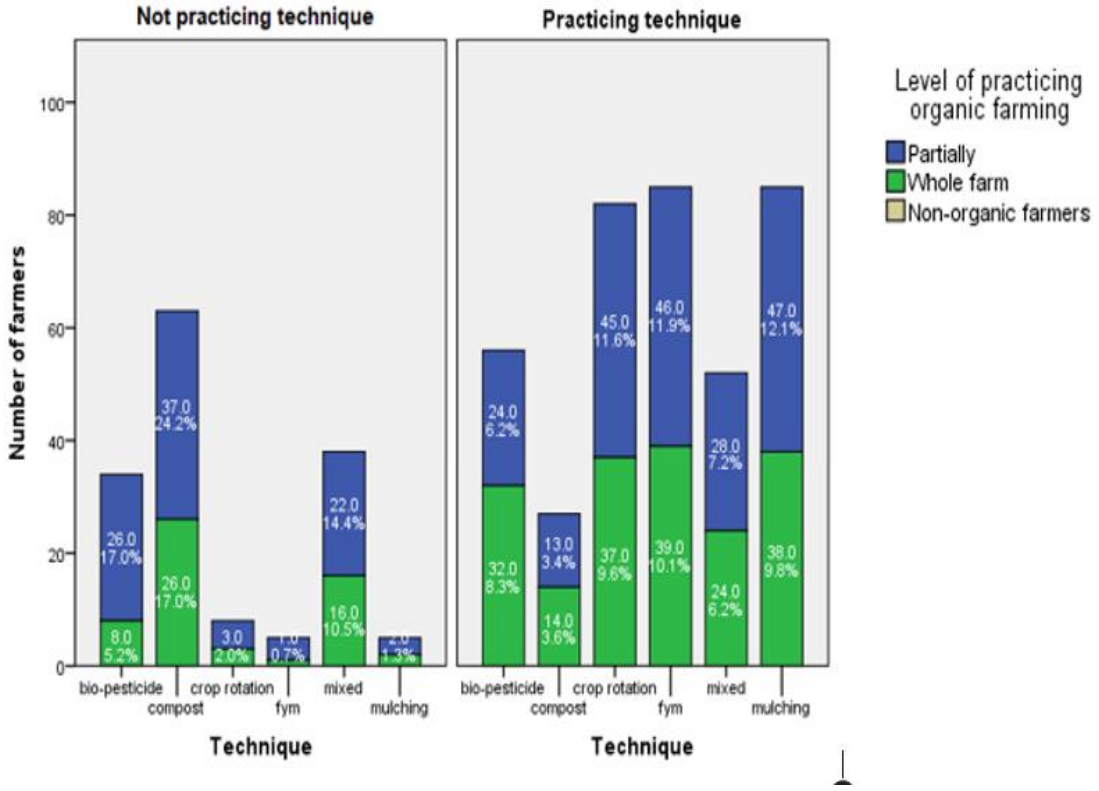

Figure 4.7: Farming techniques

Table 4.13 displays the results of Chi-square tests that were run to see whether or not there was a correlation between the percentage of farmers who had adopted organic farming practices and the specific organic farming methods they used. All chi-square p-values were larger than 0.05, indicating that there was no statistically significant relationship between the methods and the rate of organic farming adoption.

Table 4.13: Association between techniques adopted and farming method

	Value	df	Asymp. Sig. (2-sided)
Not using technique	4.213[b]	5	.519
Using technique	2.872[c]	5	.720
Overall	.000[a]	5	1.000

A logit regression model was used to ascertain whether the number of methods utilized is a major influence in the decision to implement organic farming. Tabulated in table 4.14 are the outcomes of the logit regression analyses. The coefficient of methods diversity in the model is 0.327, which is not statistically significant at the 5% level of significance due to its high P-value of 0.056.

Table 4. 14: Effect of organic farming techniques used on the level of Adoption

Model Summary						
	-2 Log likelihood		Cox & Snell R Square		Nagelkerke R Square	
	119.808a		.042		.056	
	B	S.E.	Wald	df	Sig.	Exp(B)
Variety_of_techniques	.327	.171	3.647	1	.056	1.386
Constant	-1.639	.779	4.429	1	.035	.194

Composting and farm yard waste management, Mulching /cover crops, crop rotation, companion planting, mixed cropping, and the application of bio-pesticides were found to be the most often used organic farming practices among organic farmers in the research region. Farmers interviewed credited the widespread use of organic farming practices including crop rotation and mulching/cover crops to their relative simplicity. Most farmers also used vegetables like pumpkins and beans as mulch, alternating the two crops. Farmers demonstrated a sophisticated understanding of crop rotation, cover crop mulching, and other methods for reusing nutrients.

Farmer acceptance of composting and farmyard manure, although being mentioned as among the labour-intensive approaches, may be linked to the abundance of animal dung

and crop/weeds leftovers on the farms. Local farmers have long used this method, which has the added benefit of being cheaper, to maintain soil fertility. Consistent with these findings, Macharia *et al.* (2014) research in Kenya's Central Highlands found that the vast majority of families maintain livestock herds. Domestic use of manure and manure with fertilizer is promoted when households have cattle (Mugwe *et al.*, 2009). This interpretation agrees with the results of Shivam *et al*. (2019) research evaluating the degree to which farmers have adopted organic farming methods for crop production. The research indicated that more farmers embraced simple organic methods that didn't need a lot of training or expertise, whereas those that were more complex were accepted by a lower percentage of farms. About 80% of families in the central highland of Kenya employed animal manure, which was linked to ownership of livestock and monetary restrictions that impede the availability of synthetic fertilizer by Kimani *et al.* (2004) and Macharia *et al.* (2014).

However, it was discovered that the composting was not being done properly. Covering the manure and letting it sit for at least three weeks would have helped it decompose further and made it fit for usage. If done, nitrogen would have been contained in the manure even as it degraded. The comparative benefit of organic farming in terms of yields, the farmer's expertise in undertaking a specific method, and the farmer's concern on human and environmental health were also listed as variables that impact the choice to adopt various techniques.

4.2.6 Household size and labour requirements

Table 4. 15 shows that the average household size of farmers is similar to that of non-farmers (3.69). Neither organic nor conventional farmers had noticeably smaller average household sizes, as shown by the t-test. Regardless of agricultural style, the typical household size is 4 people, and only 2 of those people assist out on the farm. On the average, conventional and organic farms each employ 1 person. According to the t-test, there is no statistically significant difference (p=.827) in the total number of employed employees between the organic farmer and the conventional farmer, even if the number of means laborers engaged by the organic farmer is somewhat greater.

Table 4.15: Household size and farm labour requirements

	Conventional Farmers		Organic Farmers		
	Mean	Std. Deviation	Mean	Std. Deviation	T-test
Number of people in a house hold	3.69	2.132	3.69	2.181	(t=-.013,p=.990)
Number of households that help in farm work	2.06	1.143	2.06	1.284	(t=-.044,p=.965)
Number of workers hired	1.24	1.155	1.29	1.384	(t=.220,p=.827)

Table 4.16 displays the results of a logit regression model that was constructed to examine whether or not household size plays a major role in determining whether or not to embrace organic farming. The impacts of a farmer's household size, number of household members doing farm work, and the number of hired hands were analysed. All of these factors' coefficients have p-values higher than 0.05, indicating that they have no effect on whether or not a farmer decides to adopt organic farming. According to the Cox and Sell R-square statistic, the differences in household size across farmers only account for 0% of the variance in the probability that farmers would adopt organic farming or conventional farming.

Table 4. 16: Effect of house-hold size on the choice of Adoption of organic farming

Model Summary						
	-2 Log likelihood		Cox & Snell R Square		Nagelkerke R Square	
	205.473a		.000		.000	
	B	**S.E.**	**Wald**	**Df**	**Sig.**	**Exp(B)**
HH size	.000	.095	.000	1	.999	1.000
HH members working	-.012	.167	.005	1	.944	.988
Hired workers	.030	.131	.054	1	.817	1.031
Constant	.358	.372	.928	1	.336	1.431

The value placed on organic farming methods is not significantly affected by factors like size of a farmer's household or the availability of cheap labour. The results of this research contradict those of Sapbamrer & Thammachai (2021) and Peter (2008), who revealed that the number of people in a home had a significant role in whether or not they adopted organic farming. Since the manpower needed for the first stages of technology adoption is commonly accessible, even larger homes may quickly embrace these advancements (Sodjinou et al., 2015). Contradictory findings may be due to the fact that most farms in the research region are rather small, and their proprietors therefore seldom need outside help.

4.3 The Institutional support factors that influence the adoption of organic farming

4.3.1 Available institutions supporting organic farming

The study identified five groups that are significant in promoting adoption of organic farming. NGOs were reported to be the most significant (40%) players in promoting organic farming, followed by neighbours who have already adopted organic farming (32%), Farmer groups (21%), private institutions (5%) and government (2%). Some of the NGOs found to be promoting organic farming include; Kenya Institute of Organic Farming (KIOF), Organic Agriculture Centre of Kenya (OACK), Youth Action for Rural Development (YARD), Fairtrade, ICIPE-Biovision, Rainforest alliance and Sustainable Agriculture Community Development Programmes (SACDEP). Figure 4.

10 below shows training to be the most service offered, with NGOs leading the way with 70%. Farmer groups also offered training which could be as a result of training of Trainers (ToTs) by the NGOs. The government seemed to lag behind in support for organic farming, only providing technical advice (25%) and training on a lower scale (5%).

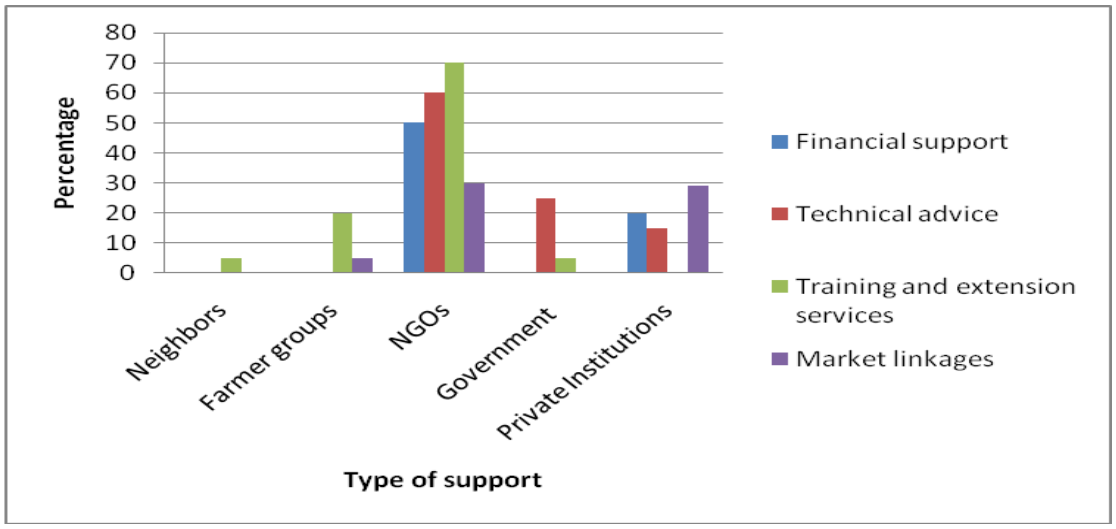

Figure 4.8: Type of support offered by different actors

Presence or absence of institutions that support adoption of any technology would greatly determine the rate of its adoption. This is due to availability and accessibility of financial support, technical advice, training, and market linkages services. The results clearly indicate that NGOs are playing significant role in providing all the four critical support services that enable adoption of organic farming, while on the other hand, there is insufficient backing from the government towards promoting organic farming. This may explain the low rate of adoption of organic farming since NGOs support alone which is based on the project duration and donor funding may not be sufficient.

4.3.2 Training versus adoption of organic farming techniques

This study sought to determine the techniques of organic farming that were trained on to determine whether there is any relationship between training offered and the techniques that the organic farmers were adopting. The most adopted organic farming techniques among the respondents were composting and farm yard manure handling (94%), Mulching /cover crops (93%) and crop rotation (91 %) while companion

planting was the least adopted at 30%, as shown in Figure 4.9. The results show some relationship between training and adoption of organic farming techniques with cases such as in composting and manure handling adoption superseded training. The results further showed that there was higher adoption in techniques where more training was offered. Where little training was offered for instance, in double digging (4%), there was no adoption of the technique.

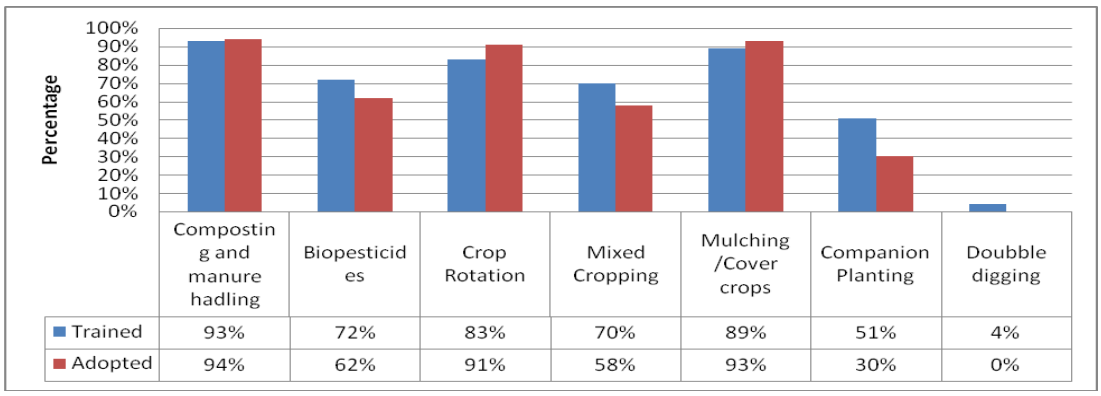

Figure 4.9: Organic farming techniques trained Vs. Adopted among organic farmers in the study area

The variation and distribution of the number of trainings (variety) is portrayed by the histograms in figure 4. 10. On average, majority of the organic farmers have had over 5 trainings while some had none. A small number of farmers had up to 15 trainings. It was also observed that on average, majority of the conventional farmers had 0 variety of trainings while some few had up to 5 trainings but had chosen not to adopt organic farming.

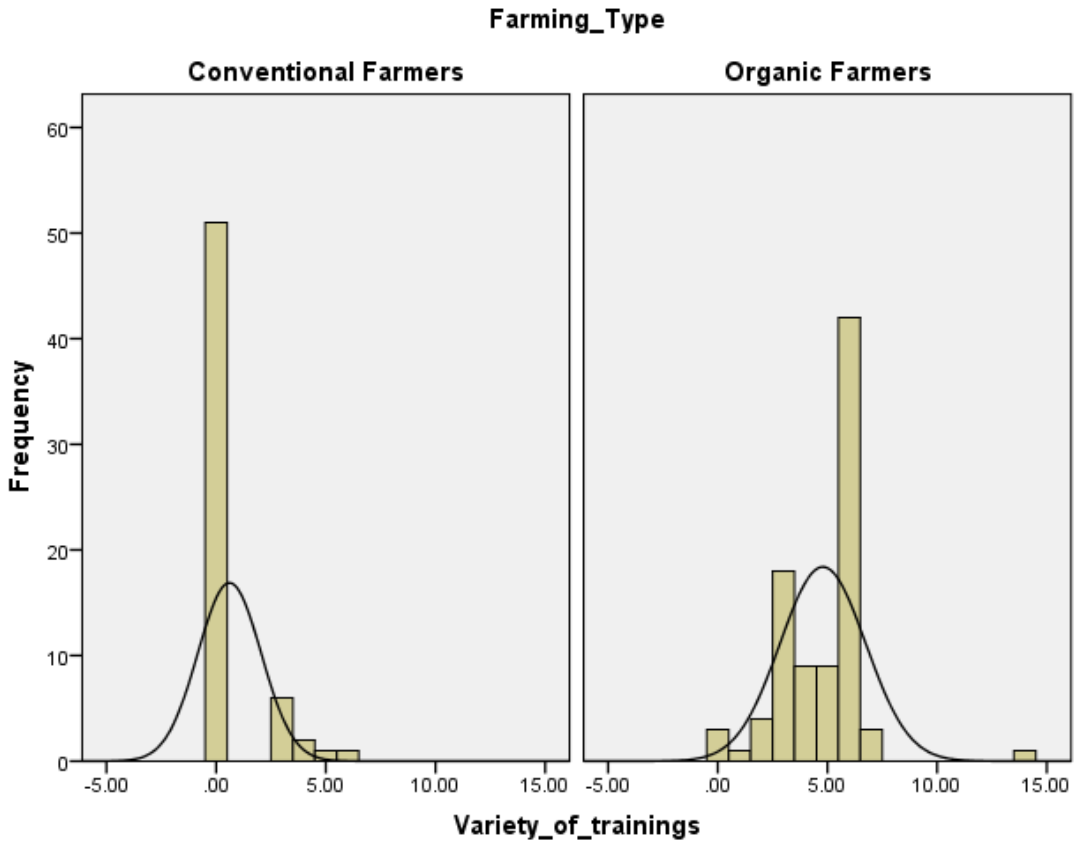

Figure 4. 10: Variety of trainings offered on organic farming among the organic and conventional farmers in the study area

Table 4.17 presents the results of the study's use of logit regression to ascertain whether exposure to a range of training options is a significant predictor of participants' decisions to transition to organic farming. Results from the Cox and Snell model demonstrate that differences in training methods and organizations account for just 0.4% of the variance in farmers' choice on whether to adopt organic farming practices. P-values larger than 0.05 indicate statistically insignificant coefficients at the 5% level of significance for both the number of training methods and training institutions included in this model. This suggests that the likelihood of farmers choosing organic farming over conventional agricultural methods cannot be influenced by just providing more options for training and education.

Table 4.17: Effect of training techniques on the level of Adoption of organic farming

Model Summary						
	-2 Log likelihood		Cox & Snell R Square		Nagelkerke R Square	
	123.327a		.004		.005	
	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Variety_of_org_trained	-.214	.395	.294	1	.588	.807
Variety_of_trainings	-.012	.110	.011	1	.916	.988
Constant	.091	.701	.017	1	.896	1.096

A logit regression model was also fitted for the sample sub-set of organic farmers to assess if the variety of trainings and training organisations also influence their level of adoption of organic farming in terms of partial or full adoption in the entire farms (Table 4. 18). The P-values of the coefficients of variety of training organisations and variety of organic farming techniques are less than 0.05 implying that significant coefficient in the equation at 5% level of significance. The significant coefficients imply an increase in the odds of already practicing organic farmers to improve their levels of adoption to the whole farm rather than only partially adopting organic farming. The Cox and Sell R-square statistic shows that up to 55.9% of the variation in the odds of farmers adopting organic farming in the whole farm explained by the training organisations and variety of organic farming techniques trained.

These results are in agreement with Métouolé et al. (2018), who state that engagement of farmers in training enables them to increase their knowledge through formal and informal education, hence enable them to apply the information. Singh et al. (2017) also pointed out that training programs run by academics, pro-organic government and non-governmental organizations help farmers to learn cultivation practices and proper techniques for organic production. In his study, he also reported that engagement in more than one training would increase organic farming by 13% and decrease inorganic farming by 11%.

Table 4.18: Effect of training techniques on the level of Adoption of organic farming

Model Summary						
	-2 Log likelihood		Cox & Snell R Square		Nagelkerke R Square	
	80.037a		.559		.755	
	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Variety_of_org_trained	1.610	.640	6.317	1	.012	5.001
Variety_of_trainings	.712	.186	14.595	1	.000	2.038
Constant	-2.567	.488	27.653	1	.000	.077

4.3.3 Training duration

The study observed that majority of organic farmers (52%) had only received training for less than a month. Less than half of the organic farmers interviewed had received training above one month with 36% having 1-3 months training and 7% having over 3 months training. 6% of the farmers had not received any training on organic farming (Figure 4. 11).

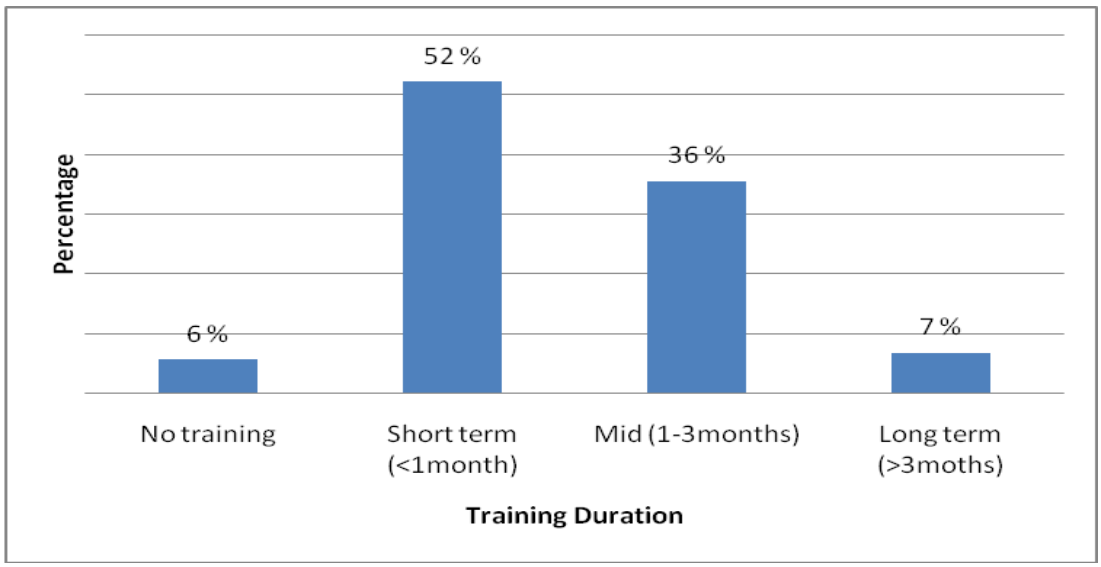

Figure 4.11: Training duration on organic farming

Findings of this study may be interpreted to mean that, lack of adequate training on organic farming may lead to insufficient practical knowledge among the farmers hence

hindering higher rate of adoption. The presence of organic farmers who have not received any training shows that there is interest among farmers to undertake organic farming but are limited by lack of training.

Logit regression analysis was also used to determine the impact of training duration on farmers' decisions to transition to organic methods (Table 4. 19). The coefficient of training length is 3.553, and its P-value is 0.000, which is less than 0.05, suggesting its importance at the 5% level of significance. The coefficient is significantly positive, suggesting that the longer a farmer has been schooled, the greater the likelihood that they would choose organic farming. According to the Cox and Sell R-square statistic, differences in training time account for up to 51.7% of the variance in the probability that farmers would choose organic farming over conventional farming.

Table 4.19: Effect of training duration on the choice of Adoption of organic farming

Model Summary						
	-2 Log likelihood		**Cox & Snell R Square**		**Nagelkerke R Square**	
	94.774a		.517		.698	
	B	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Training duration	3.553	.511	48.428	1	.000	34.924
Constant	-2.041	.402	25.817	1	.000	.130

Duration of training on organic farmers was also found to affect the level to which the farmers will adopt organic farming as shown by the logit regression model was fitted for the sample sub-set of organic farmers. The results presented in Table 4. 20 shows a Cox and Snell R-square of 0.048 which shows that the variation in the duration the farmer is trained explain 3.3% of the variation in the odds of the farmer only partially adopting organic farming or in the whole farm. The coefficient of duration of training in this model has a p-value less than 0.05 implying a significant coefficient at 5% level of significance.

Table 4. 20: Effect of training duration on the level of Adoption of organic farming

Model Summary						
	-2 Log likelihood		**Cox & Snell R Square**		**Nagelkerke R Square**	
	120.670a		.033		.044	
	B	**S.E.**	**Wald**	**Df**	**Sig.**	**Exp(B)**
Training duration	.534	.316	3.906	1	.048	1.705
Constant	-.994	.507	3.847	1	.050	.370

These findings further give an implication that increases in the duration of training organic farmers could have a significant effect on the level at which the farmer will chose to adopt organic farming. These results provide credence to the idea that boosting training might boost adoption rates. This indicates that when there is more access to training, there is also more uptake. These findings corroborate those of an empirical study by Xia and Lee (2000), who found that training significantly influences how users perceive an invention's usability, compatibility, visibility, and trialability.

4.3.4 Information dissemination on organic farming

Most of the organic farmers (82%) had received organic information through training, 52% through learning from neighbours and 41% through media. The least effective means appeared to be the agricultural field days (13%) as shown in Figure 4. 12. Majority of conventional farmers had received organic information from neighbours (50%), with 41% and 13% from media and training respectively. Only 3% of the conventional farmers had received organic farming information through agricultural shows.

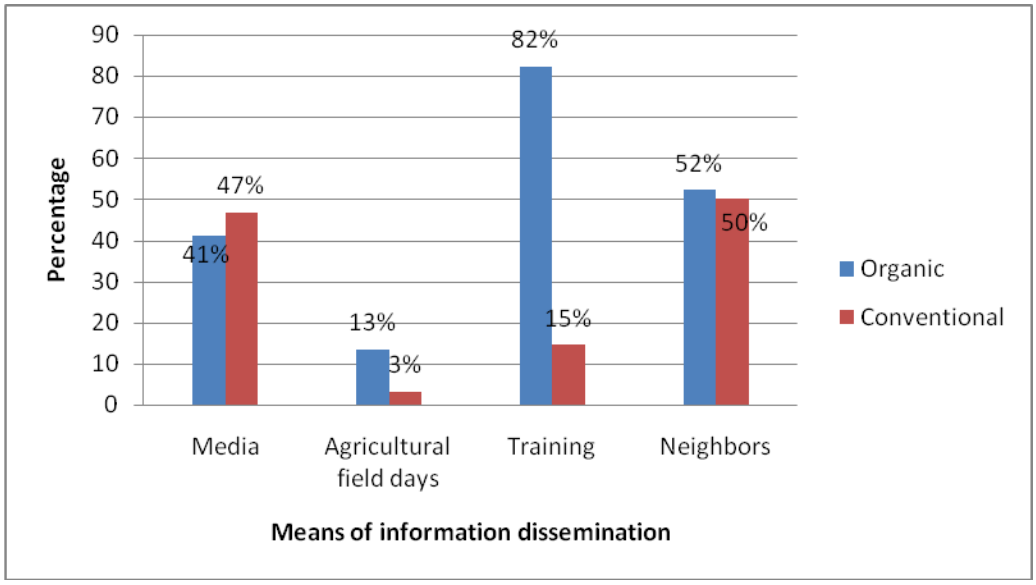

Figure 4. 12: Methods used to disseminate organic information

According to Molieleng et al (2021), farmers will be encouraged to adopt appropriate farming technologies if information dissemination is efficient. There may be some variation in how influential factors influence adoption decisions depending on the medium. Media (including newspapers, television, radio, and socio-media); trips to agricultural field days; training via occasional attendance at seminars, meetings, or demonstrations; and agricultural input providers all qualify as active or intentional means of information distribution. A passive or unintentional approach might include occasional interactions with public/private extension agents and observation of and imitation of neighbours.

Findings of this study point out the accuracy and details provided to farmers through training hence leading to higher adoption. Significant details could also be acquired through farmer-to-farmer learning. This is in agreement with Kaufmann et al. (2011) who stated that organic farmers are an central source of pertinent information when it comes to sharing their experience and encouragement other farmers to adopt organic farming. Okwu (2011) states that, effectiveness of extension channels used to disseminate information on new ideas are critical in determining whether farmers adopt new technologies and continue utilizing them. This suggests that the means of information delivery used may impact whether or not a new idea is adopted, based on the clarity of the information, accuracy of details offered, the degree of engagement

that is had with the farmer. While agricultural shows are meant to help in disseminating information and technologies to farmers through displays and demonstrations, they appear to be the least in disseminating organic agriculture information.

4.3.5 Accessibility of Organic Farm inputs

Results in Table 4. 21 indicates that only 27% (n=90) of the respondents recognised availability of stockists and organic inputs shops. However, 1% of them reported that they were not able to access the stockists/organic farm inputs shops.

Table 4.21: Accessibility of organic farm inputs by organic farmers in the study area

		Accessibility of Organic Farm inputs		Total
		Easily accessible	Not accessible	
Are there stockists or shops	Yes	26%	1%	27%
of Organic Farm inputs	No	0%	73%	73%
Total		26%	74%	100%

A further analysis shows that three major organic inputs accessible by the minority of organic farmers were available at almost equal proportions i.e., Bio-pesticides 35%, organic fertilizers 35% and foliar feeds 30 % (Figure 4. 13)

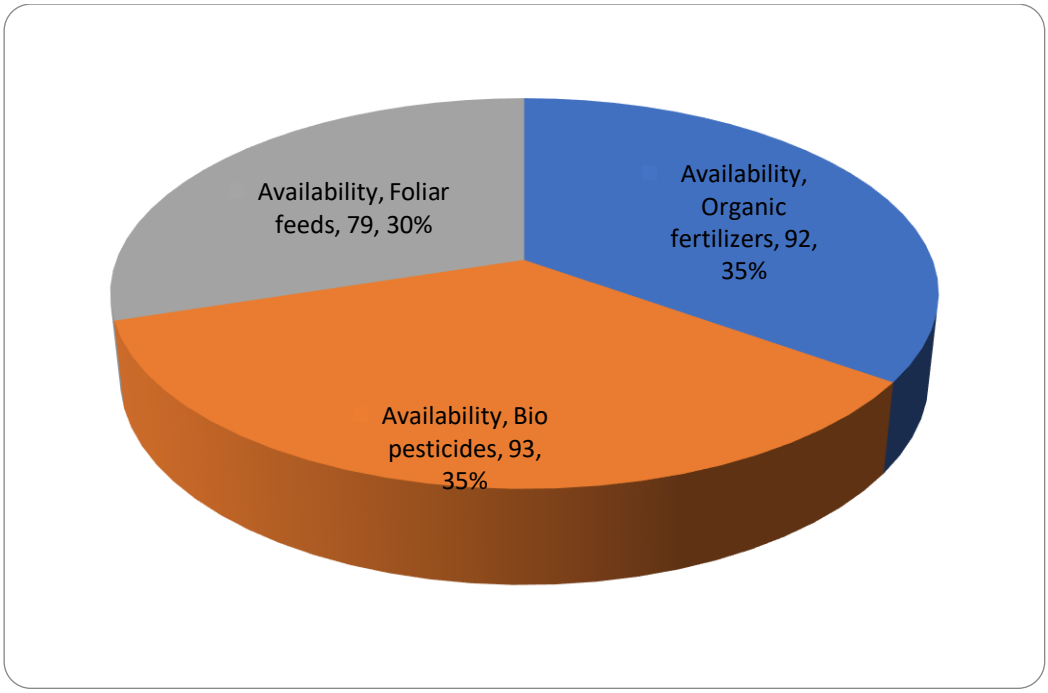

Figure 4. 13: Organic inputs available in the shops within the study area

Most of organic farm inputs are usually low-cost compared to synthetic ones and farmers can use alternatives such as use of nitrogen-fixing crops or green manure. The time of planting and the most effective rotational and companion cropping methods are two examples of such actionable information. While most of organic farm inputs are on-farm inputs or available from nearby farms, its preparation is labour intensive and requires skills and proper timing such as manure, bio-pesticides and foliar feeds compared to buying synthetic farm inputs. This makes the farmers to supplement their action-based inputs with buying readymade organic inputs. Accessibility of these organic farm inputs determines whether the farmers use organic or other available alternatives including the synthetic ones. According to Tsion and Steven (2019), intensified knowledge and access to alternative organic farm inputs are imperative to ensured adoption of organic farming practices

These findings may explain the high number of partial organic farmers who go for inorganic farm inputs due to inaccessibility of organic products. This may also happen when there is poor timing in composting or bio-pesticides preparation. This may find farmers not having ready manure or pesticides during the onset of planting seasons and pest infestation respectively.

4.4 Farmers perception towards organic farming

To what extent a new agricultural system, technology, or innovation is adopted depends heavily on farmers' first impressions of its features. How farmers feel about organic farming is a major factor in whether or not they embrace the practice. Knowledge about organic farming, the cost of organic farming, the advantages of organic farming, socioeconomic circumstances, and an enabling environment may all influence how people feel and, in turn, how likely they are to embrace organic farming practices (e.g. provision of credit facilities, training on technicalities).

4.4.1 Comparison between the total benefits of organic farming and conventional farming

Figure 4. 14 shows that 57% of the farmers polled believed organic farming to have more advantages than conventional farming, 26% believed the advantages of both farming methods were comparable, and 17% said conventional farming had more advantages.

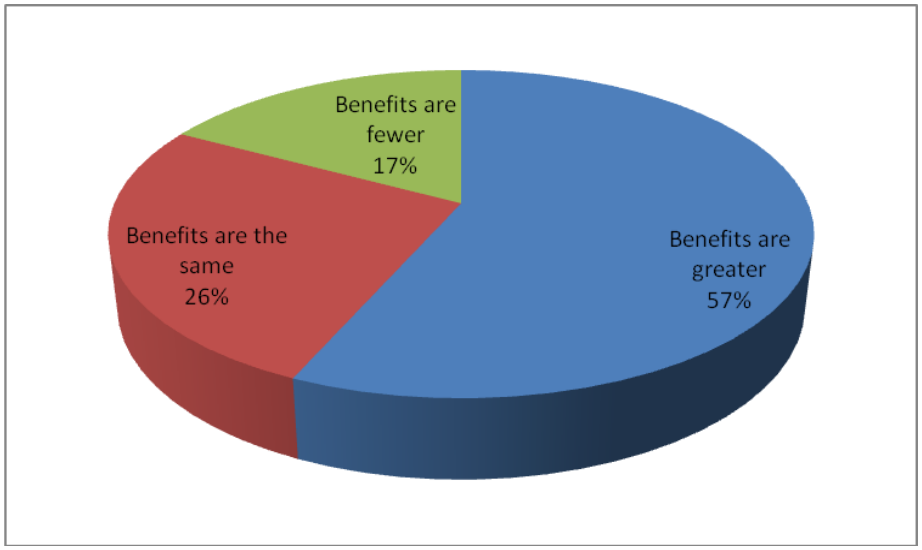

Figure 4.14: Benefits of organic farming compared to conventional farming

Following is a description of an additional investigation of the perceived advantages of organic farming (Fig. 4.15). More than 80% of those surveyed said they had switched to an organic lifestyle because they saw a decrease in production costs, an enhancement of the environment, a boost in soil fertility and structure, or an improvement in family health. A significant number of respondents believed that

organic farming does not improve the overall crop yields (20%) and does not improve the market value of the farm produce, does not improve the overall crop yields, has certification and market barriers, was difficult to manage pest in organic farming system.

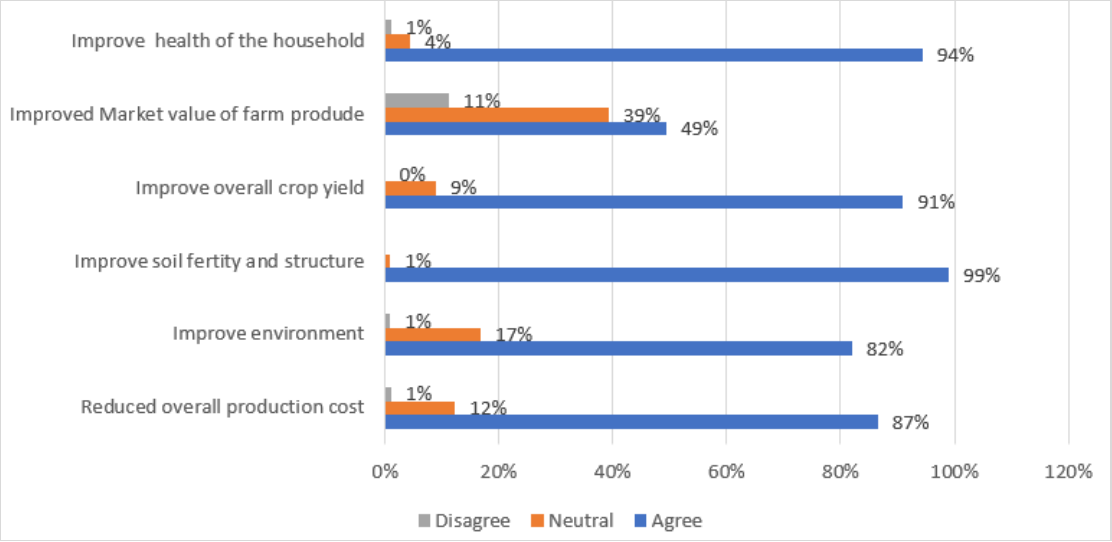

Figure 4.15: Ratings on perceived benefits of organic farming

According to Bekuma (2018), the rate of adoption is determined by farmers' perceptions of the attributes of the innovation. The positive perception of an innovation among farmers influences their decision to embrace it. According to Mulatu et al. (2021), farmers perceptions of an innovation are influenced by (I) awareness of relative advantages and (II) concerns about an innovation. The differences between the two are taken as the total perceived characteristic of the innovation and determines its adoption.

The study findings shows that majority (80%) views organic farming to have health and environmental benefits, reduced production cost and improves soil fertility and structure. This agrees with the findings of Zeynab et al. (2017), who stated that the primary benefits of organic farming include protection of the environment and increased resistance to environmental changes, increased income for farmers and decreased expenditures on external inputs, improved social capacity, and more job openings.

Although the findings suggest that organic farming is generally well-liked, this has not translated into widespread practice. Interviews with farmers revealed that farmers were first drawn to organic farming because of the potential for higher pricing. The strict

certification criteria prevent them from realizing the promised premium pricing, so they give up or decrease the area of farm under OF along the route. This explains why most organic farmers in poor nations grow crops for export to affluent countries, where there is customers willingness to pay a large price premium for organic products, as stated by Willer & Lernoud (2017). Minten *et al.* (2018) found that the retail premium for organic fruit is not always reflected in the price realised by farmers for their goods. This is because different players in the value chain keep a share of the profits. The prices organic farmers earn are often not much greater than the prices they would obtain in conventional markets. A lot of the time, organic small farmers don't sell all of their produce at approved marketplaces (Jena *et al.,* 2017).

These findings show that although social and environmental issues are highly significant and a motivator to adoption of organic farming, financial rewards is a major driver to adoption of organic farming. It's possible that the large proportion of those who identified as neutral lacked sufficient knowledge about organic farming to make a judgment regarding the claims made about the industry.

4.4.2 Conventional farmers' past experience in organic farming

Results showed that 29% of conventional farmers polled had tried organic farming in the past but abandoned the practice. Figure 4.16 summarizes the reasons why organic farming is being abandoned into three groups: production difficulties, pricing and marketing issues, and management problems. The principal reason for abandoning organic farming was cited to be difficulty in pest and disease management (33%) under management challenges. Limited access to organic produce market (22%) and unrealised premium prices (17%) shows significant contribution to abandoning of organic farming by the respondents. Under production challenges, low yields in organic farming (11%) seemed to be the greatest deterrent to respondents in continuing with organic farming.

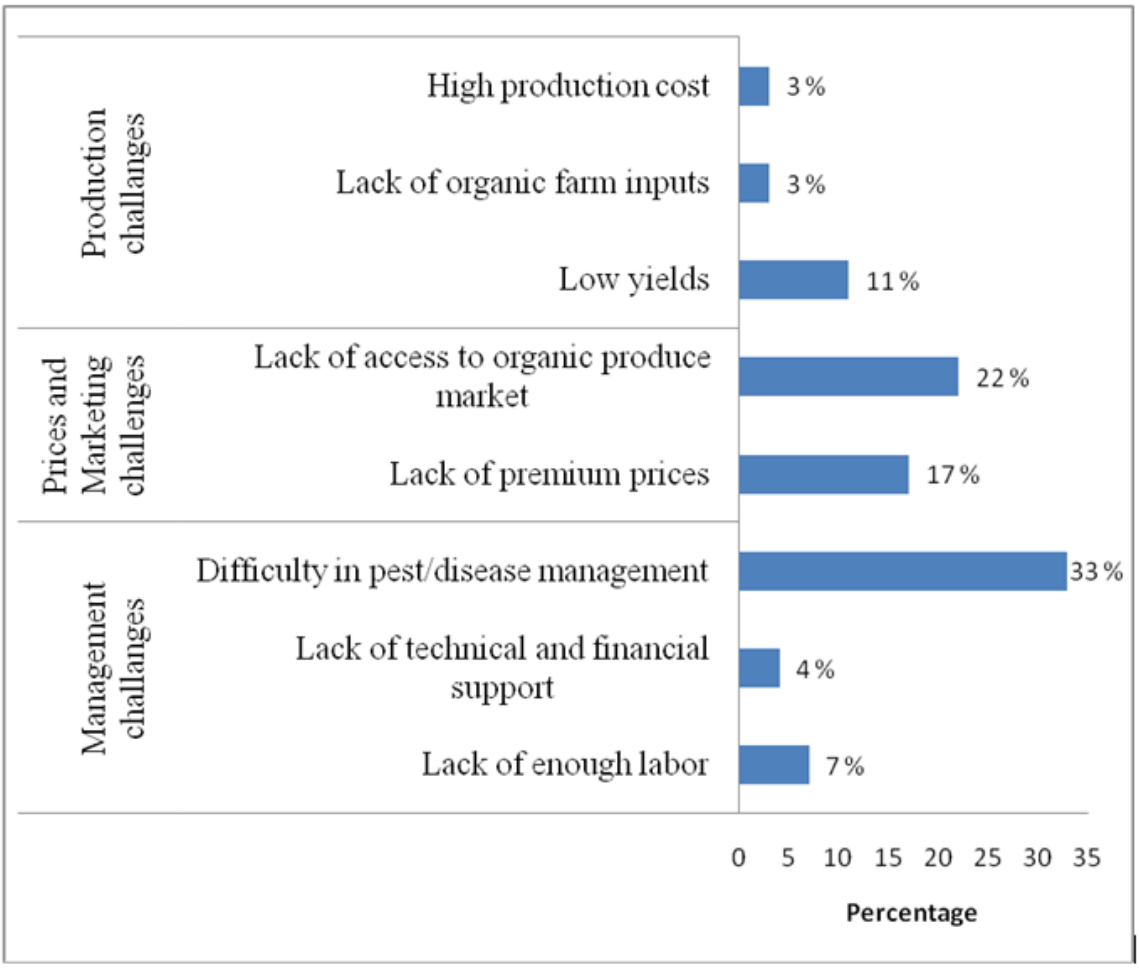

Figure 4. 16: Reason for abandoning organic farming

In forsaking organic methods, all of the farmers gave many explanations. Generally, most of the problems associated with organic farming stem from organic agricultural management and the pricing/marketing of organic goods. This shows that farmers who have undertaken organic farming in the past but given up have a hard time transitioning to organic farming, finding organic markets, and earning organic premiums. This is corroborated by the fact that there was only one organic market that was about 45 kilometers from the research region. Moreover, that market was open only twice a week throughout the time period of this study (in Thika). Since farmers were still in a time of transition, the present organic market for organic avocado and macadamia that were being pushed by firms like Jungle nut, Olivade, Fairtrade, and Kakuzi had not begun achieving the premium pricing in the first 3 years.

Organic certification requires a three-year transition time, which is consistent with the results of Caldwell *et al*. (2014) and Ruben & Fort (2012). To some extent, the money

spent on organic farming up to this point might be considered lost. Farmers during this time period not only miss out on the organic pricing premium, but their yields are often at an all-time low while they learn and experiment with the new techniques of production. Farmers in the study region were compelled to sell their goods in local markets, where they received prices that were comparable to those of conventionally produced goods. This demonstrates the need of tight collaboration between pro-organic agricultural groups and early adopters to ensure that no one falls off the wagon during the transition.

4.4.3 Major constraints to adoption of Organic Farming

Due to Kenya's poor organic farming adoption rate, this study aimed to, via in-depth interviews, determine the main obstacle to organic farming. The reasons why conventional farmers are hesitant to move to organic techniques were also considered. Some organic farmers only use organic methods on a section of their land while others utilize them for all of it. There are obstacles in organic farming that need to be addressed across all of these groups.

Results in Figure 4. 17 show that constraints varied across the farmer categories and farmers cited more than one constraint. Among the conventional farmers, low yields in organic farming (79%) and inadequate knowledge on organic farming (62%) were identified as significant barriers to adoption. The farmers decried lack of adequate information and inconsistent extension services, leading to misconceptions concerning practices, yield expectations. Pest, disease and weeds control also emerged to be a major constraint among the conventional farmers as compared to the other farmer categories due to its risks of yield losses or crop failure. A few conventional farmers also cited uncertainty in access to premium prices. This could be due to the current absence or limited organic produce markets.

On the other hand, organic farmers both partial and whole farm seemed to rank lack of adequate water for farming (60% and 68%, respectively) and lack of premium prices for the organic produce (53% and 72%, respectively) as their major constraints. However, organic-partial and conventional farmers found inadequate knowledge on organic farming (both at 62%) to be of major constraint. Only a few of the organic whole -farm farmers cited low yields as a constraint probably because most of them

were in the post-transition period where the yields are expected to have started increasing.

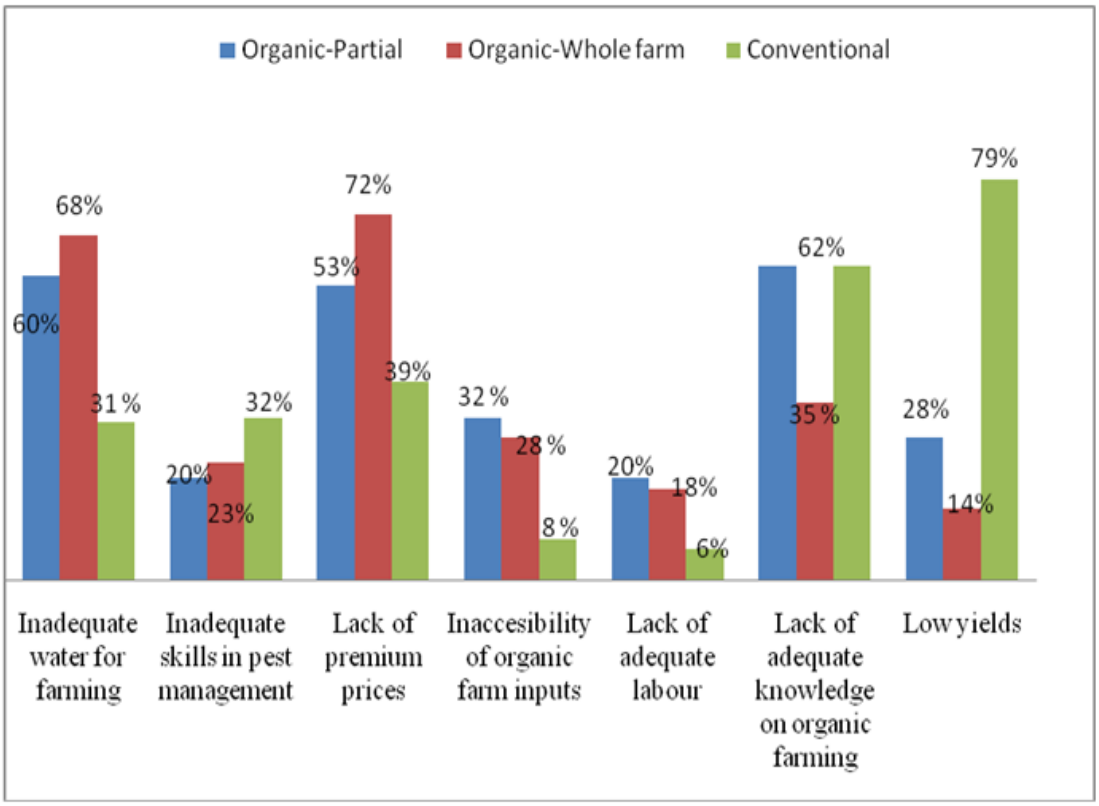

Figure 4.17: Constraints in adoption of organic farming across farmer categories

According to the findings, low yields and a lack of premium pricing seem to be the major constraints to the uptake of organic farming by both organic (partial and whole farm) and conventional farmers. Organic farming has to be lucrative in order to be sustainable, claim Berber *et al*. (2011). This concurs with the study's findings, which indicate that the viability of expanding organic farming will mostly depend on how well it does financially in comparison to conventional farming. Delbridge *et al.* (2011) highlighted several factors that determine the profitability of organic agriculture. Among them were crop yields, premium prices for organic products, labour costs, the possibility of reduced income during the organic transition period, and potential cost savings from the decreased use of non-renewable resources and purchased inputs.

Inadequate water for farming and a lack of proper education on organic farming both emerged as significant barriers to adoption of organic farming. Water management and conservation are integral parts of most organic agricultural systems. This suggests that

problems like these might be overcome with the help of appropriate training. Organic yields may be much greater than those produced from low-input conventional farming with intense training and a major increase in the usage of organic fertilizers, as noted by Ibanez & Blackman (2016) and Wollni & Andersson (2014). Niggli (2015) adds that using organic soil management strategies may lessen the impact of weather extremes on crop yields. Only by disseminating sufficient information on organic agricultural management can this goal be reached.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

This study found no correlation between the gender and the use of organic or conventional farming methods. The findings also showed that there is no discernible age-related difference in the prevalence of organic agricultural practices. Education was also not found to have any significant effect on whether a farmer adopts organic farming or not. This was attributed to the fact that, majority of organic farming techniques being promoted had been traditionally used and were not technical hence farmers did not require formal education to implement. Majority of the farmers under study were found to adopt organic farming partially while the minority practice organic farming at whole farm level. There was a clear trend on decrease of organic farming practices as the land size increased. Organic farming was more widely adopted by smaller farms than by larger ones. However, the farmer's propensity to adopt organic farming practices partially or whole farm had nothing to do with the size of their farm. Types of Crops grown and livestock kept were found to have no significant association with the farming type adopted. However, variety of crops grown by a farmer was found to have a significant effect on the choice or the odds of a farmer choosing to adopt organic farming. This positive association implies that farmers who increase or intend to increase more variety of crops grown in their farms, are more likely to adopt organic farming practices. It was observed that organic farming is in its early stages in the study area and there has not been specific training or studies to show which animals could provide better manure for organic farming. As a result, farmers have continued with the animals and crops they have traditionally kept and grown respectively. Farmers with more than over three decades of experience in farming were found to be more likely to adopt organic farming than farmers with less farming experience. Partial organic farmers pointed out unmet immediate expectations in terms of yields, challenges in labour requirements, marketing challenges as well as challenges in pest and disease management as the biggest challenges that hindered whole farm conversion.

NGOs were reported to be the most significant players in promoting organic farming mainly through training, followed by learning from neighbours who had already adopted organic farming and farmer groups. The government seemed to lag behind in support for organic farming, mainly providing technical advice through its extension

officers. Training was mostly offered on composting and farm yard manure handling, Mulching /cover crops and crop rotation making them the most adopted organic farming techniques among the respondents. On this component, variety of trainings, variety of training organisations and training duration were found to influence the extent (partial or whole farm) to which an organic farmer adopts organic farming. Training was also found to be the most effective way of disseminating organic farming information. Accessibility of organic farm inputs carriable showed that only 27% (n=90) of the respondents recognised availability of stockists and organic inputs shops. However, 1% of them reported that they were not able to access the stockists/organic farm inputs shops. Major organic inputs accessible by the minority of organic farmers were available at almost equal proportions i.e., Bio-pesticides 35%, organic fertilizers 35% and foliar feeds 30 %

The study found that there is a generally liking across all farmer categories (conventional, partial and whole farm organic farmers) of organic farming due to its said health and environmental benefits, reduced production cost and improves soil fertility and structure. However, this has not translated into widespread practice. Low yields and a lack of premium pricing emerged to be the key reasons behind to slow uptake of organic farming. Main reasons why farmers abandoned organic farming and reverted to using conventional production methods was found to be problems implementing organic production techniques; and accessing organic markets and premium prices for their produce.

5.2 Conclusion

There exists a relationship between the adoption of organic farming in the Murang'a County, Kenya, and household characteristics, institutional support factors and farmers' perception towards organic farming. Some of the factor influenced both the choice to adopt as well as the level at which organic farming was adopted on the farm.

Household characteristics such as farm size, variety of crop farmed, farmers experience in farming activities and overall expertise level of farmers had a substantial impact on whether or not organic farming was adopted in the Murang'a south region. Effect of farmers experience on adoption of organic farming could be based on assumption that over years they have tried and tested both farming systems and have weighed the pros

and cons hence settled on organic farming. On the other hand, as people grow older, they become more health conscious and hence opt to adopt organic farming.

Training as an institutional support component appeared to influence both the decision to embrace organic farming and the extent to which it has been adopted in the Murang'a south region. The number and variety of trainings attended by a farmer from a variety of training organisations significantly influence the choice to adopt organic farming. However they do not necessarily influence the level to which farmers adopt organic farming. On the other, duration to which the farmers take on the trainings influence both the choice to adopt organic farming as well as the level to which the farmer adopts organic farming. Farmers who take longer trainings have higher odds of fully adopting organic farming in the whole farms compared to farmers who attend shorter trainings.

Financial motives which include cost savings on production and premium price marketing appeared to be a key motive towards the need to transition to organic farming. For organic farmers this was in combination with other motives such as food safety, and environmental protection. Farmers therefore engage in a farming system where their motives are realized. The research showed that organic and conventional farmers alike faced similar barriers to transitioning to organic farming. Low yields and a lack of premium pricing, difficulties in pest and disease management, and uneven extension services resulting to misunderstandings about organic farming management were noted as major problems by conventional farmers. Water shortages, a lack of premium rates for organic food, and a lack of education were cited most often by both part-time and full-time organic farmers as their greatest challenges.

This study therefore concludes that the main difference in choices between organic farmers and conventional farmers is one of attitudes and perceptions towards organic farming. These attitudes and perceptions are shaped by the total benefits of organic farming and conventional farming in terms of profitability, productivity and human and environmental health benefits. The attitudes and perception towards organic farming can therefore be positively influenced by making improvements in the availability of information, intensifying training and advisory services relating to pest and diseases management, inputs and markets in order to improve the organic farming adoption.

From a statistical standpoint, it seems that farmer to farmer interactions is a viable choice for disseminating information about agricultural innovations and increasing their uptake, which in turn should increase production at the farm level. The other option is promotion of farmer-participatory approaches in technology evaluation and selection to allow farmers to choose technologies that best suit their needs. However, a combination of strategies one or more of the aforementioned strategies would be the most appropriate.

5.3 Recommendations

1. This study recommends that the organizations promoting organic farming should target households with higher livestock holding to ensure that they produce enough biomass to produce farm yard manure for their farms.
2. The pro-organic farming organizations should intensify their training in the most practical way and include educational material which the farmers can use as reference materials.
3. The pro-organic organizations should also help farmers to identify high value crops that can be grown organically and link then to organic markets to ensure selling produces at premium prices.
4. There is an urgent need to expedite the development of an all-encompassing policy and set of strategies that can assist in standardizing and promoting organic farming in the country.

5.4 Suggestions for further research

1. There is therefore need to keep an up-to-date database for the available market showing the demand and standards required so that these standards are maintained while promoting organic farming hence help in accessing these markets.
2. Environmental protection benefits of organic farming should be quantified in a manner to show long-term economic gains in terms of cost saved on improvement of soil fertility hence guarantee sustainability of this food production system.
3. Now that agriculture is a devolved function in Kenya, it is imperative to conduct additional research to identify the context-specific motivations of farmers for adopting organic farming systems to enhance its adoption.

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APPENDICES

Appendix I: Questionnaire

Dear farmer, the researcher would wish to investigate the factors affecting adoption of organic farming in Murang'a south region, Kenya. As such, the researcher wishes to correct some responses from you. Kindly fill this questionnaire as faithfully as possible. There is no right or wrong answer. Kindly be assured that the researcher will maintain highest level of confidentiality as per the requirements of this research. Additionally, be assured that the information you provide shall be used for no other purpose other than the completion of this research study.

Section 1: Demographics

1. Farmer's name (optional)
   _____
2. Sex: Male ( ) Female ( )
3. Age:
   a. 20-29
   b. 30-39
   c. 40-49
   d. 50-59
   e. 60 and above
4. Level of education
   a. Non-formal
   b. Primary
   c. Secondary
   d. Tertiary

Section 2: Farmer and Farm Characteristics

5. How large is your farm? (acres) _____
6. For how long have you been a farmer?
   _____
7. What crop(s) do you farm?
   _____
8. How many people live in your household? _____
9. How many of these help you with farm work? _____

10. Do you pay other people to help you on your farm? Yes ( ), how many? _____ No ( )
11. Do you know what organic farming is?
    a. Yes ( ), what is it? _____
    b. No ( )
12. If yes, do you practice organic farming?
    a. Yes ( ), what percentage of your land is under organic farming? _____
    b. No ( )
13. For how long have you practiced organic farming? _____
14. Has your farm ever been used for organic farming? Yes ( ) No ( )
15. How many years did you practice organic farming? _____
16. If you no longer practice organic farming, why did you abandon it?
    a. High labour demand ( )
    b. Lack of available labour to support it ( )
    c. Lower productivity compared to conventional farming ( )
    d. Lack of market for organic products ( )
    e. I found it costlier than conventional farming ( )
    f. Lack of necessary materials such as animal manure ( )

Section 3: Institutional Support

17. For how long have you lived in this village? _____
18. Does this area have farmer groups or organizations? Yes ( ) No ( )
19. Do you or your partner belong to a farmers' group or association? Yes ( ) No ( )
20. If Yes,

Name of the association	How does the association benefit your household?

21. If No, why?

_____

22. How did you find out about organic farming?
    a. By way of various forms of media
    b. By participating in an agricultural field day event
    c. By means of demonstrations carried out on farms
    d. From my neighboring farmers who had already adopted it
    e. Others (specify)
23. What are some of the key reasons that prompted you to start engaging in organic farming? (tick all the appropriate)
    a. I was convinced that there is ready market for its products which fetch premium prices
    b. I wanted to make use of my household labour
    c. I was convinced that it is less expensive than conventional farming
    d. I was convinced that organic farming protects the environment
    e. I wanted to make use of organic farming materials I had such as manure
    f. Scarcity of conventional farming materials such as herbicides
    g. I was convinced that organic farming has higher productivity than conventional farming
24. Who influenced you to adopt organic farming?
    a. Fellow farmers
    b. Myself after reading about it or listening to media programs (e.g. radio)
    c. Farmers' group/association
    d. NGO's
    e. Government agencies/agricultural extension officers
25. Have you ever taken or attended any training related to organic farming? Yes ( ) No ( )
    a. If yes,
        i. For how many days? _____
        ii. Who were your sponsors? _____
        iii. What did you learn? _____
26. In the last year, have you taken part in an agricultural field day or demonstration on a working farm? Yes ( ) No ( )

27. If yes, (a) who sponsored the event?

    (b)What did you learn?

28. 28. How many times in the past year has an extension officer helped you or come to see you? _____

29. If at least once,

What was the officer's agency/organization?	What did you learn

30. Are there any campaigns or seminars for promotion of organic farming?

    (a) Yes

    If yes, by who?_____

    (b) No

Section 4: Farmers' Perception

31. Does organic farming have more benefits for your farm as a whole than the way you used to farm?

    a. The advantages are definitely far bigger;
    b. Yes, the advantages are marginally bigger.
    c. The advantages are similar;
    d. No, advantages are somewhat less;
    e. No, advantages are far less

32. Please assess the following claims regarding organic agriculture (Using the scale: one (1) for strongly disagreeing to five (5) for strongly agreeing with, a score of two (2) would indicate disagreement, a score of three (3) would indicate neutrality and a score of four (4) would indicate agreement)

    a. Organic farming has decreased total production expenses
    b. Organic agriculture has enhanced the environment
    c. Organic farming has increased agricultural productivity generally
    d. Organic farming has increased the worth of agricultural products

33. Has the transition to organic farming been accompanied by a shift in either the number of workers employed or the amount of time spent on the farm?

    a. Yes, It resulted in a rise in the number of employees
    b. No change

c. Yes, it led to a decrease of workers

Section 5: Overall

Using the scale: one (1) for strongly disagreeing to five (5) for strongly agreeing with, a score of two (2) would indicate disagreement, a score of three (3) would indicate neutrality and a score of four (4) would indicate agreement. Utilize the key given to mark

	1	2	3	4	5
34. Organic farming is labour intensive					
35. Organic farming has higher production cost that conventional farming yet there is no market for organic products					
36. I have not adopted organic farming because there is no sufficient labour in this area					
37. If I had enough household labour, I would have adopted organic farming					
38. I am a full-time farmer, therefore, I like organic farming because it helps me reduce production cost by providing my (and my spouse's) labour instead of relying on external inputs, which are expensive					
39. I do not think organic farming safeguards the environment					
40. I practice organic farming because I want to protect the environment by avoiding the use of chemicals					
41. I have not adopted organic farming because I have never heard about it					
42. I have ever heard about organic farming but I do not understand its advantages and disadvantages; therefore, I have not adopted it					
43. I have ever heard about organic farming but I do not know how to do it and this is why I have not yet adopted it					
44. If there was somebody or an organization to take me through organic farming, I can adopt it because I know it protects the environment					

45. If I am able to do the cost-benefit analysis of organic farming against conventional farming, maybe I might find it more profitable than conventional farming, which means I might adopt it					
46. I am after productivity not environmental protection. Whichever gives me better yields, I will be in for it					
47. I have adopted organic farming and I have realized it is better than conventional farming in terms of yield					
48. I once adopted organic farming but left it because I could not get the necessary requirements such as manure. I can easily get materials for conventional farming					
49. I will only adopt organic farming after I am convinced that it is good. Therefore, I will wait for others to adopt it before I can move in					
50. I am satisfied with conventional farming practice and there is no need trying organic farming					
51. Organic farming is very expensive for me to adopt					
52. The government is doing a lot in promoting organic farming					

53. What do you believe are the most main challenges to organic farming?
……
……
……

54. What is your overall view towards organic farming?
……
……
……

55. Do you have any suggestions regarding what should be done to encourage farmers to grow/embrace organic agriculture?
……
……

Appendix II: Research Permit

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Appendix III: Photos of the study

Plate 1: Organic farm inputs at Kangari town

Plate 2: Some organic products available at the market in Murang'a south region

Plate 3: Organic fertilizers available in the market in Murang'a south region