CONTRIBUTION OF DEVOLVED AGRICULTURAL EXTENSION SERVICES TO HOUSEHOLD FOOD SECURITY IN MAKUENI COUNTY, KENYA

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CHUKA UNIVERSITY

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DECLARATION AND RECOMMENDATIONS

Declaration

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

Signature……. Date…12/10/2023……

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Recommendations

This thesis has been examined, passed and submitted with our approval as the University supervisors.

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12 OCT 2023

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ABSTRACT

Devolution of agriculture and extension services in Kenya aimed at promoting food security at household levels. Despite the devolution of these services for more than five years, food insecurity has persisted in some counties. Makueni County had been described as food insecure with food insecurity prevalence above 75% among farmer's households. Information on the contribution of devolved agricultural extension services on household food security was scanty; hence prompted the need to assess the contribution of devolved agricultural extension services on household's food security in the study area. The study objectives were to; evaluate the impact of devolved farmers training, investigate the effect of devolved subsidized farm inputs, and to investigate the impact of devolved agricultural advisory extension services on households' food security in Makueni County, Kenya. The study adopted a descriptive survey research design. The study population was 150,697 households. The target population was household heads and ward agricultural extension administrators. A sample size of 388 respondents was selected based on Krejcie and Morgan sampling table. The study adopted simple random and purposive sampling methods. The research instruments were Key Informant Interviews (KII) and questionnaires that were tested for reliability from pilot study at resultant correlation coefficient of alpha = 0.7. Quantitative data was analyzed using descriptive statistics (percentages and mean) and inferential statistics (correlation, regression models and chi-square), while qualitative data were analyzed using content analysis. The study hypotheses were tested at a significant level of (P 0.05). The results of the study showed a positive association between farmers training and household food security (R=.252; P.05). 58% of respondents had ability to access agricultural training. Though, only 54% had been trained. Results of the study also showed a positive association between subsidized farm input and household food security (R=.258; P .05). 79% of respondents agreed that subsidized farm inputs increased food security. However, out of the 72 % that were knowledgeable about different subsidized farm inputs, only 62% had accessed them. There was a positive association between extension advisory services and household food security (R=371; P.05).79% of respondents agreed extension advisory services were offered to farmers although only 58% had accessed the advisory service even though 72% felt advisory services increased food security. Generally, results showed agricultural advisory services had highest (M=4.41, SD=.33) contribution to household food security, followed by subsidized farm inputs (M=4.21, SD=.38) and agricultural training (M=3.78, SD=.41). It was therefore, concluded that devolved agricultural extension services had a positive contribution to household food security. The study outcome informs policy makers in devolved agriculture sector, as well as guiding County governments on their efforts towards household's food security. Therefore, the study recommended involvement of all stakeholders in the development and implementation of training program, combine research and development in implementation of subsidy program and development of local agriculture trainers who can reach out effectively to the entire community. Further studies were suggested on the role of households in adoption of devolved agricultural extension services

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ABBREVIATIONS AND ACRONYMS

ASDS	Agricultural Sector Development Strategy
CGA	County Government Act
CGIAR	Consultative Group for International Agricultural Research
CoG	Council of Governors
FFS	Farmers' Field Schools
IFAD	International Fund for Agricultural Development
KADU	Kenya Africa Democratic Union
KANU	Kenya Africa National Union
KCEP-CRAL	Kenya Cereal Enhancement Program - Climate Resilient Agricultural Livelihood
NACOSTI	National Commission for Science Technology and Innovation
NSAC	National Security Advisory Council
PC	Provincial Commissioners
PFMA	Public Finance Management Act
SPSS	Statistical Package for Social Sciences
TDGA	Transition to Devolved Governance Act
UACA	Urban Areas and Cities Act
UNICEF	United Nations International Children's Emergency Fund
USAID	United States Agency for International Development

CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

Devolution transfers power and responsibilities for service delivery from national government to local governments that elect their leaders, collect their revenue and have autonomous authority to make decisions (Hope, 2014; Ngigi & Busolo, 2019). The local governing units gain political, administrative, and fiscal powers. Alwanga & Wanjiku (2020) describes devolution as one expected to provide opportunities for local governments to develop policies that promote development, enable counties to mobilize resources to enhance investment, promote equitable sharing of both national and local resources. Devolution in Kenya established division of functions between the national government and county governments. Agriculture is one of the devolved functions performed by county governments in Kenya (Bouis, Eozenous & Rahman, 2011).

According to Kuhn , Offutt & Morehart (2004), devolving federal agricultural policies in United States of America, aimed at increasing national food production and diversify regional level farm outputs. According to Lyon, (2019a), agriculture was devolved in Scotland, Wales, and Northern Ireland regions of the United Kingdom in order to enhance farmer's support through policy reforms and farm input. It is also reported by Nyanjom (2015), that for twenty years in the United Kingdom, devolution had a tremendous contribution to national unity, economic growth, and increased food production. However, the studies above have insufficient information on contribution of devolving agriculture on domestic food security in the different continents.

Devolving agricultural extension system in Pakistan improved by 82 % the performance of extension agents. However, it had minimal influence in increasing household food security (Shahbaz & Ata, 2014). In the Philippines agriculture responsibility and function were devolved to local governments in 1991 to enhance household food security (Cidro & Radhakrishna, 2020). However, Global Household food security (2019) on household food security ranked Philippine 73rd among 113 countries globally, having 44.3% of the population experiencing food insecurity. In Indonesia, devolution entailed incorporating researchers and extension officers to evaluate farmer’s problems and offer solutions. Despite these efforts to increase household food

security, the performance of the agriculture sector has remained stagnant (Vaughan, Ayegbokiki, & Arigbede, 2017). This creates a gap in understanding the real impact of devolving agricultural extension services on household food security.

In Ghana, devolving agricultural extension services became more effective in 2012. This provided an opportunity for local governments to come up with self-initiated food production programs that increased access to agricultural goods and household food security at household level (Omar, Hassan, Bakar, & Faisal, 2019). The process of devolution in Burkina Faso took place from 1991 through the formation of governing units at the regional and commune levels. Although the main goal of these communes was to ensure enough food at the household level, (Peng, &Berry, 2018) shows more than 954,300 people were severely affected by hunger in 2018 hence needed food support and an estimated 187,200 children under five years were experiencing acute malnutrition the same year. Therefore, devolution of agrarian extension services did not enhance domestic food security in Burkina Faso.

According to Maiangwa, Omolehin, Adeniji & Mohammed, 2011; Olarinre & O, (2019), in Nigeria, agricultural development was devolved to regional governments to improve food security at household and national level. Regardless of the transfer of the above roles to local government, devolution of agriculture did not improve the state of food security in Nigeria (Mango, Makate, Mapemba, & Sopo, 2018). The decentralization of agrarian extension services in Tanzania to native villages and wards contributed to improved accessibility and distribution of extension staff and increased domestic food security. As a result of increased frequency of farmer meeting with extension officers for advisory services, (Kabwe, 2022).

In Kenya, devolution came with both benefits and difficulties which are distinctive to the devolved functions in the County governments. The ministry of agriculture was devolved to improve agricultural production at county level (Gewa, Stabile, Thomas, Onyango, & Angano, 2021; Wabwoba, Wakhungu, Obiri, & Lwevo , 2015). During the launch of devolution, it was assumed that the county governments were closer to the people and could identify the felt needs of the citizens including; water shortages, food insecurity, health, and education among others (Nyanjom, 2015).

Since the launch of devolution in Kenya, County Governments have initiated different programs and strategies to improve agricultural food production depending on their specific needs and strengths (Ali &Farah, 2019). Counties like Murang'a have improved dairy farming through the establishment of milk processing plants, providing cooling facilities, improving fodder quality for animals and value addition for milk and meat thus increasing household food security and production (Kiambi et al., 2018; Odero-Waitituh, 2017). To enhance household food security, Wajir County initiated irrigation for crop farming, boreholes, and adoption of solar and wind- powered water pumps for irrigation, recruitment of agricultural extensions officers, establishment of agricultural mechanization services center, the supply of seeds to farmers, revolving fund for farming groups, the value chain for fruits, construction of grain stores, construction of livestock market yards and establishment of revolving fund for livestock pasture and marketing groups (Kiprono & Ibanez Llario, 2020).

Agricultural transformation for household food security, rural development, and wealth creation was one of the major areas discussed by the council of governor's conference in 2017 (Radeny, Mungai, Dorothy, Osumba & Solomon, 2020). The deliberations were made to examine what each county had done to improve household food security. Various counties like Muranga, and Wajir reported a substantive increase in food production from 2.5% in 2013 to 5.5% and above, The increase is attributed to major agricultural and extension household food security initiatives adopted by county governments (Odero-Waitituh, 2017; Olonde, Agawo & Oyoo, 2021). Despite the increase in food production, Njora & Yilmaz, (2021) indicates that around 3.4 million Kenyans are food insecure. Also, the Global Household food security Index established on affordability, accessibility, and value of food products ranked Kenya 87th out of 113 countries as food insecure (Claire , Kayitakire, Saisana, 2017; Izraelov & Silber, 2019).

In Makueni County, various agricultural and extension efforts have been made to enhance household food security. These include the establishment of six value chains; grain ,fruit, crop, horticulture, dairy, meat, and poultry value chains as well as dispensation plants in order to increase household income (Makhanu, 2019). Despite these efforts Ambale, Kiptui & Saina,(2018), indicate that in 2018 only 21.8 percent of households were food secure in Makueni County. Also, Kathuri & Obando, (2020)

concluded that 75% of households practicing agriculture in Makueni County are food insecure. This justified the need to conduct this study in bid to generate results that could guide policy makers as well as future studies on the contribution of devolved agricultural extension services on household food security.

1.2 Statement of the Problem

Devolution of agricultural extension services in Kenya was an important strategy for enhancing household food security. Despite efforts made through this initiative, households in various counties in Kenya have been described as food insecure. Makueni County has been ranked among the food insecure counties with 75% of households practicing agriculture reported as food insecure. Previous studies conducted on household food security in Kenya present insufficient information on the role of devolved agricultural extension service on households' food security. Therefore, this study intended to generate relevant information on the contribution of devolved agricultural extension services to household's food security in Makueni County, Kenya.

1.3 Purpose of the Study

The Purpose of this research was to assess the contribution of devolved agricultural extension services to household's food security in Makueni County, Kenya.

1.4 Objectives of the Study

The study was guided by the following objectives

i. To evaluate the impact of devolved farmers training on household's food security in Makueni County, Kenya.
ii. To investigate the effect of devolved subsidized farm inputs on household's food security in Makueni County, Kenya.
iii. To investigate the impact of devolved agricultural advisory extension services on household 's food security in Makueni County, Kenya

1.5 Research Hypothesis

The following were the study's null hypothesis:

H_{01}: Devolved farmers training has no significant statistical impact on household's food security in Makueni County, Kenya

H_{02}: Devolved subsidized farm inputs has no significant statistical contribution on household's food security in Makueni County, Kenya

H_{03}: Devolved advisory extension service has no significant statistical impact on household's food security in Makueni County, Kenya.

1.6 Significance of the Study

Achieving household food security is one of the main objectives of the agriculture sector in Kenya that backs the social pillar of vision 2030. Attaining household food security is also an effort in realizing the second sustainable development goal that focuses to end hunger, achieve food security and improved nutrition and promote sustainable agriculture. The study outcome informs The Kenya Climate Smart Agriculture Implementation Framework 2018-2027 (KCSAIF) established to offer a guide to several inventive initiatives aimed at addressing climate change.

The results of the study enlighten policy makers in drafting various legislations governing devolution. It also informs County governments on the impact of different agricultural initiatives as well as enlightens farmers and households on different components of farming. The study outcome supported research through provision of adequate information on the contribution of devolved agricultural extension services on household's food security. The results of the study guide future studies on challenges related to the contribution of devolving agricultural extension services and household food security

1.7 Scope of the Study

The study was conducted in Makueni County, Kenya. The target population constituted household heads of Makueni County and Sub-County agriculture officials. The study purposively targeted residents of five sub-counties namely Kibwezi, Kathonzweni, Makindu, Makueni, and Mukaa due to their severity of food insecurity (Makhanu, 2019). A probability random sampling technique was used to sample targeted households.

1.8 Delimitation

The study did not include members of household who were not family heads.

1.9 Limitations

Some household heads did not practice agricultural farming and therefore declined to take part in the study. However, data collected was satisfactory for the study.

1.10 Assumptions of the Study

i. Devolved agricultural extension services were implemented in Makueni County.
ii. Every household in Makueni County was involved in agriculture farming for household food security.

1.11 Operational Definitions

The study was guided by the following operational definition of terms:

Affordable Food:	Food that people can access for consumption
Agricultural Extension Services:	Agricultural and extension activities undertaken to enhance household food security
Devolution:	The legal transfer of authorities, resources and responsibilities to county governments by national government
Food Availability:	Physical presence of food through agricultural production or purchase
Household Food Security:	Availability, accessibility and sufficiency of safe nutritious food in households
Household Head:	The person in charge of house unit and is the decision maker
Household:	A set of individuals living together in one house and eating the same food
Nutritious Food:	Food recommended for good health of human being
Contribution:	The part played by a thing in bringing about a positive or negative result or helping something to advance in either progressive or undesirable way.
Impact:	The force of impression of one thing on another.
Effect:	Change which is a result or consequence of an action or thing on another.

CHAPTER TWO
LITERATURE REVIEW

2.1 Concept of Household Food Security

According to Agunga (2014) household food security is a state when people have contact to adequate, harmless, nutritious, and socially acceptable food for healthy and active life. In contrary, according to, Astley (2013) food insecurity is limited access to nutritionally sufficient and safe food due to poor food production mechanisms, climate, poverty, unemployment and others. Domestic Food security is founded on key stakes: food availability, accessibility, utilization and stability and if any of them is uncertain the food system is helpless (FAO, 2017). Lack of sustainable food supply mechanisms in household affects the wellbeing of individuals by increasing health challenges due to hunger and malnutrition (Fawole et al., 2015). At the family food security is achieved when all members access adequate, quality, safe and culturally acceptable food (Peng & Berry, 2018).

Food security dimensions vary from global, regional, national, household and down to an individual level (Astley, 2013). The influencers of food security at each level may differ as a result of climate change, cultural acceptance, economic stability, and civil war (Izraelov & Silber, 2019). According to Chege & Semenye (2018) Food availability comprises the physical presence of food due to domestic production, purchase and food aid. The production, distribution and exchange of food can be affected by ownership and utilization of land; which influence soil health, crop selection, livestock breeding and harvesting (Kaynakçı & Boz, 2019). The availability of food at the household is influenced by unsustainable farming practices, poor harvesting and storage technology as well as processing, transportation, and packaging of produce(Shahbaz & Ata, 2014). The current study focused on assessing the state of food accessibility through farm production in Makueni County.

Food accessibility is the affordability and provision of food that meets family members' preferences (Raidini & Kabiti, 2019). The failure to get accessible food due to lack may result in hunger and malnutrition. Therefore, food availability is firmly determined by the ability of a family to buy food or capability to produce enough food (Mohajan, 2014). According to FAO (2017), the capability of a family to maintain access to food

due to sufficient resources may guarantee food security irrespective of poor harvests and local food shortages. Household food can be accessed either direct where household produce its own food or indirect where a household buy food (Fawole et al., 2015). The ability to access food is influenced by income, land, education, gender, and age of household's members and especially the head who determines food purchase. A household accessibility to food is assured if it's done in a sustainable and socially acceptable manner (Agunga, 2013). This study targeted examining the percentage of direct food accessibility by households in Makueni County.

In regard to Grote, Fasse, Nguyen, & Erenstein (2021) utilizing available and accessible food in the family is determined by members' capability to absorb and digest food effectively. Also, Vaughan et al., (2017) ascertains that the nutritional value, quality and quantity of food in a household should be harmless and enough to support each person's nutritional requirements. Various factors including food storage mechanisms, hygiene, feeding practices for people with special needs and the health status of household members defines their state of food stability (Olarinre, 2019). When food is available, accessible and frequency of consumption is not reliable it leads to food uncertainty (Oino, 2016).

2.2 Farmers Training and Household Food Security

An agricultural education program is a collection of formal and informal, short- or long-term educative activities prepared for a person or institution of farmers to achieve specified agricultural goals (Cai et al., 2019). More precisely, agricultural education interventions aim to promote knowledge or skill transfers on specific agricultural issues that are thought to benefit farmers (Oduro-ofori et al., 2015). Also agricultural education is a strategy to disseminate appropriate new skills, innovations and technology to boost productivity and reduce rural poverty (Agunga, 2013).

Although historically agricultural training adopted a non-participatory approach in teaching, agricultural extension courses are now more involving (Shahbaz & Ata, 2014). However, there is insufficient information on farmer's involvement in developing training content. Particularly when it comes to instruction and knowledge transfer, farmers are called to participate in an already developed program, which

hinders meeting the real needs of farmers. According to Hainzer, Bugajim, &Brown (2021), farmers participation in training whose goal is defined by outsiders may not fully meet the training needs of farmers. Nevertheless, there is inadequate information on of farmer's participation developing training curriculum in Makueni County.

According to Caffaro, Micheletti, Roccato, & Cavallo (2020), Agricultural training initiatives cover a wide range of areas from; education of drought tolerant crop varieties, crop insurance, climate-smart agriculture, farming inputs support with a major focus on household food security. The initiatives also assume diverse types of activities, most usually information-related activities such as providing combined stages that collect and share information on projects or other initiatives, guiding research and development on agriculture in relation to climate change, or creating knowledge sources that collect and distributes research on agriculture and climate change (FAO, 2017). Some also provide tangible references and advice to farmers, e.g. on practices and tools; begin pilot projects on the ground or issues materials, seeds, or other inputs to farmers (Kaynakçi & Boz, 2019).

Any program that aims at facilitating change in farmer's life through sharing of new information in their agricultural endeavors is considered an agricultural education intervention (Salami, Kamara, & Brixiova, 2010). Farmer training programs come in a wide variety. Some programs emphasis on coaching farmers advanced farming techniques (Agunga, 2013). Globally implementations of various agricultural initiatives have led to tremendous increase in agricultural production (Sibande, Bailey, & Davidova, 2015). ICT training Initiatives in Indian Agriculture have promoted increased agricultural production in different commodities(Grote et al., 2021). The application of Agricultural knowledge and innovation systems in Italy empowered farmers with adequate skills and techniques. This specific technical and financial extension support to farms and farmers, through the dissemination of all forms of information and innovation improved farms productivity in Italy (Caffaro et al., 2020; De Rosa et al., 2013).

Agricultural schooling and education, according to Dinar et al., (2007) offers a number agricultural support program to farmers, including training farmers on improved

agricultural production techniques in order to increase produce. For human development, growth and modernization of countryside economies, education, including agricultural education and extension programs, is a crucial need. To develop and improve abilities, as well as to raise productivity and income-producing capabilities, education and extension networks must be established and expanded for both men and women (Joseph et al., 2019).

The establishment of farmers training centers in Ethiopia played a key role in providing farmers with diverse agricultural support through training services, practical farm management demonstrations, as well as training farmers on produce records keeping (Oduro-ofori et al., 2015). However, there is inadequate information on the contribution of agricultural training centers on household food security. Although, agriculture training is aimed at improving farmer's farm produce, Grote et al., (2021) argue that the effect of agricultural training on African small scale farmers is not sufficient to guarantee food security. According to Mobeen & Varghese, (2016), Farmer's training should be comprehensive and involving as possible to improve food security. Also, farmers training on seed selection, farm management, harvesting techniques as well as effective storage should be promoted (Anderson & Feder, 2014). There is scanty information on the agriculture training areas done by the county government of Makueni. Therefore, this study sought to generate adequate information on the components of agricultural training in Makueni County.

The Kenyan government recognizes the importance of agricultural training to farmers in achieving the goals of the Vision 2030 (Diakite, Agembo & Sola, 2018). The Vision 2030 is based on the innovative capabilities that could improve local and national productivity and raise the country's level of food security. However, information on its adoption by devolved units to improve food security is scanty. According to Fuglie et al., (2017) training farmers improves their ability adopt new techniques increasing produce hence food security. Farmers need to be trained on improving farm produce through effective farming techniques in order to increase agricultural produce. Also, farming training is more effective when a variety of channels are used to promote understanding, and this may be done by utilizing appropriate avenues including workshops, seminars, on-farm instruction, and demonstrations (Isaboke, 2021).

In Malawi, farmers were trained on better choices of farm inputs such as manure and fertilizer increasing their ability to make good farm decisions (Cai et al., 2019; Holden & Lunduka, 2013). Tanzania's creation of farmer's field schools helped increase farmers' ability to improve farm productivity through training farmers on effective farming methods, seed choice, pesticide controls techniques, and post-harvest management (Davis et al., 2010). However, the outcome of this training on empowering farmers to increase food production at household is not well defined.

According to Rwomushana et al. (2015), the merging of training on better use of high–yield seeds and donation of planting seeds in Uganda empowered farmers to increase food productivity. In the same way, training farmers in Uganda on local soil quality, crop rotation, timely application of fertilizers and pesticides play a huge role in increasing farm productivity. Training of farmers empowers farmers with adequate knowledge on good seed choices, good storage practices as well as the ability to access technical support to address agricultural production enhanced household food security at households (Oino, 2016).

Hainzer et al., (2021), ascertains that the introduction of peer to peer learning in Kenya played a major role in enabling farmers across the country. It trained farmers on appropriate management techniques for their farms. This participatory approach aimed at strengthening the effort of Farmers Fields Schools (FFS). Training services that used a collaborative approach with the community addressed food insecurity more precisely as well as educating communities on how to access credit and the importance of participating in decision making (Morris, Henley, & Dowell, 2017). The County Government of Makueni trained farmers on post-harvest management to equip farmers with adequate skills to appropriately handle produce. It also trained them on the construction of food storage structures (Muema, Coulibaly, & Mutune, 2018). However, the impact of these efforts on household's food security is not defined.

2.3 Subsidized Farm Inputs and Household's Food Security

A subsidy program in agriculture involves farmers support to acquire farm inputs in a more precisely economical way lower than the market price (Gewa et al., 2021). According to Morris Henley, & Dowell, (2017), majority of industrialized nations

developed agricultural aid regulations during the 1930s to reduce the unreliable nature of farm input costs and to increase or maintain farm profits. In nations that export food, like France, agrarian subsidies are routinely used to increase farm profits, either by directly paying farmers or lowering market price for farm inputs. Increased planting seeds and fertilizer costs in Africa have had a significant detrimental impact on both urban and rural households, raising awareness among policymakers of the need to increase the productivity of main food crops (Klimczuk & Klimczuk-Kochańska, 2019).

The Agricultural Adjustment Act of 1933, granted the administration power to determine lowest costs of agricultural materials and protect government inventory achievement in land use through livestock slaughter, was the precursor of modern agricultural subsidy programs inside the US (Sibande et al., 2015). In China, the first agriculture farm inputs subsidy through grain incentives was established in the year 2004 (Raidimi & Kabiti, 2019). From the 1960s to the 1980s, numerous African countries, including Kenya, Tanzania, Malawi, Zimbabwe, and Zambia, conducted extensive subsidy programs (Davis et al., 2018). These programs were distinguished by a government-managed farm input marketing system, whereby farmers received farm inputs at precise low prices on closely backed credit.

Fertilizer subsidy programs have a tendency to be inefficient due to high administrative expenses, government monopolies, and political manipulation (Kacianka et al., 2017). As part of the operational modification in Zambia, subsidy programs were eliminated in 1980s and entry markets were liberalized, which resulted in declined agricultural productivity (Kabir, 2016).The Zambian Fertilizer Support Programme (ZFSP), was reintroduced in 2002 with more emphasis on reducing the cost of farm inputs in the market through government organized inputs supply chain. Chege, & Semenye, (2018) claims that the initiative has been generally beneficial from a national perspective and may provide an affordable return on investment as a strategy to increase food security. Nevertheless, there is scanty information on how the subsidy program influenced domestic food security.

Agriculture is a major drive of economic growth in Tanzania, employing 80% of the population attributing to 45% of countries income. According to Sibande et al., (2015) the Tanzanian government introduced a farm input subsidy program in 2008 to support poor household to engage in farming. The Accelerated Food Security Project for Tanzania goal was to increase farm produce through improved farmers' access to essential agricultural inputs. Despite these efforts in improving agricultural production, there is no documented impact of this efforts in improving the state of household food security (Kinuthia, 2020). Prompting the need to examine the role played by agricultural subsidy programs in Makueni County

According to Makhanu, (2019), the Kenyan government established three policy reforms to respond to food insecurity. These reforms aimed at empowering farmers through supply policy that advocated for subsidy on farm input especially fertilizer and maize planting seeds. The national and county governments in Kenya distributed fertilizers, hybrid maize, and sorghum seeds and land ploughing services at lower rates to farmers (Dorcas, Koech, Kinama, & Ojulon, 2019). Despite this, the report doesn't substantiate any influence of subsidy initiatives on family food security.

The County government of Wajir rolled out a farmer's empowerment program that provided farmers with subsidized farm inputs such as fertilizers and credits opportunities (Kiprono & Ibanez Llario, 2020). Also, Isiolo County has been at the forefront to empower farmers through the provision of farm equipment and seedlings (Ali & Farah, 2019). Farmers in Kitui County have benefited from subsidized hybrid cotton seeds and pesticides from the county government of Kitui (Mugi-Ngenga et al., 2015).Conversely, these reports fail to explain the influence of this program to household food security.

Dorcas et al., (2019) narrates that Makueni County installed a fruit and milk processing plant to ease post-harvest damages. This existed due to huge losses incurred with seasonal fruits. To minimize losses after harvest, Makueni County also established good market links and established cold storage facilities for mangoes and milk. The county government has also established cooperative societies to help farmer's markets produce on large scale (Memon, Khushk; & Mallah, 2015). However, this study doesn't

document the number of farmers empowered to reduce post-harvest losses at the household level.

Musyoki & Wangari, (2016) narrates the Kenyan national government and county governments intended to offer incentives to encourage value-addition and establish agro-processing industries. The ministry advocated empowering farmers through establishing a reserve to support small scale farmers in agro-processing. It also planned to promote research and adoption of appropriate technology (Nyanjom, 2015). According to Muema et al., (2018), the County Government of Makueni had already established four value chain systems including, fruit, dairy, indigenous chicken, and green grams. Although the County government reports on the already established strategies, this study will examine how farmers have been empowered through devolution of agriculture and extension services to increase household food security.

2.4 Advisory Extension Services and Household Food Security

Muyanga & Jayne, (2006) affirms agricultural advisory extension services entail the transfer of agricultural information, knowledge, innovations, and timely consultation service to farmers for practical use. The International Food Policy Research Institute (IFPRI)-(2018) endorses advisory extension services are vital in supporting farm production in rural areas hence increasing domestic food security. Also, Klimczuk & Klimczuk-Kochańska, (2019) agrees that advisory extension services transfers relevant applicable and suitable agricultural information, knowledge and innovations or skills to farmers for best agricultural yields. However, these studies don't comment on the role of advisory extension services on food security.

Diakite et al., (2018) narrates that devolution of advisory extension services in Kenya from Kenyan national government to county governments assisted farmers to prompt their desire to adopt agricultural innovation. Although advisory extension services in Kenya are request-based farmer's demands are not fully addressed (Hainzer et al., 2021). According to Kaynakçı & Boz, (2019) farmers may not be informed on how to access agricultural advisory services even when they are available. Therefore, this study sought to generate information on the level of accessibility to advisory extension services by farmers.

Even though according to Mobeen and Varghese, (2016), devolution of agriculture in Kenya, assumed county governments will provide advisory extension services to farmers. The level of availability and accessibility to different advisory services by farmers in different counties in Kenya is yet to be established (Makhanu, 2019). This creates the zeal to investigate the level of availability and accessibility of extension advisory services in Makueni County. Also, assenting to Ali &Farah (2019) advisory extension services should guide farmers in establishing effective private and public partnerships in order to enhance food security. However, the number of partnerships established by different counties is not certain hence the need for this study to generate relevant information on different available agricultural partnerships in Makueni County.

Although, in Kenya counties like Kiambu, Makueni, Murang'a has established different partnerships with entities like Alliance for a Green Revolution in Africa, to provide extension advisory services to farmers in Kiambu, the contribution of these services in empowering farmers to enhance food security is minimal (Isaboke, 2021). Other counties like Embu experience insufficiency in crop and dairy yields due to limited access to advisory services to farmers (Isaboke, 2021). This was attributed to top-down approach in offering advisory services to farmers. Also, Murang'a County established dairy farming advisory services which led to establishment of milk processing plant, providing cooling facilities, improving fodder quality for animals and value addition for milk and meat thus increasing food security and production (Ali & Farah, 2019). However, the contribution of these efforts in improving domestic food availability is uncertain.

According to Makhanu (2019), the county government of Makueni aimed at empowering farmers through the expansion of agricultural advisory extension services. The county intended to start 30 plant and livestock farmer clinics in each ward to provide on-farm advice to farmers. It also planned to automate extension services to increase farmer's accessibility to these services. Yet, there is inadequate data on the implementation of these plans and their impact on households' food security. In partnership with Safaricom, Makueni county government also established a mobile-based app, Digital farm to enable farmer's access to extension services and agronomical

advice on their mobile phones (Makhanu, 2019). Nevertheless, the data on adoption and utilization is scanty creating the need for this study.

2.5 Theoretical Framework

The theoretic outline explains the different theories adopted in the study. This study was guided by the Theory of Access, Bundles of Rights and Powers by Ribot Jesse and Peluso, and Accountability Theory by Sam Silverstein. The study adopted the theory of Access, bundles of Rights and power to elaborate how access to different devolved agricultural extension services is a right of farmers, and whether the divergence on who controls power and makes decisions affects how farmer's benefits from access and utilization of devolved agricultural extension services. The accountability theory was adopted to measure whether county governments are accountable in offering devolved agricultural services to farmers and whether they are accountable and responsible over their actions. The adoption of the two theories was key in this study, in explain how farmers' rights are influenced by county governments and whether devolved units are accountable and takes responsibilities of their actions in supporting farmers.

2.5.1 Theory of Access, Bundles of Rights and Powers

The Theory of Access, bundles of rights and power by Ribot and Peluso published in 2003 enlightens the difference between an individual right to access resource and their capability to profit (Ribot & Peluso, 2003). According to the theory, poor operational and interpersonal procedures hinders people from utilizing available resources in a beneficial manner even though it's their right. Myers & Hansen, (2019) argues that capability to profit from available resources requires access mechanisms not limited to policy and social economic status. In relation to the current study, based on this argument a farmer may not benefit from farming if they don't have enough resources to till their land even though, they rightly have access to arable land.

Ribot and Peluso, (2003), examines access based on two parameters of "bundle of rights" and "bundle of powers". The bundle of rights holds on rule of law to determine who benefits while bundle of powers clinches on organization positions and social status to control benefits from resources (Norman, 2002). In respect to this argument, devolution in Kenya advocates for all citizens to benefit based on the bundle of rights,

however due to corruption and other social injustices due to social class all citizens don't benefit equally from devolved function in regard to bundles of power.

Therefore, based on this theory, the bundles of powers operate along the bundle of right to determine how different users of resources profit and maintain continuous control over them. The understanding of access assisted in recognizing the role of county governments in empowering farmers to access devolved agriculture and extension services. It also facilitated the acknowledgment how organization and interpersonal capabilities among household members informs their ability to access and establish continuous control over different reproductive assets. When farmers have access to production assets such as land and county government provide affordable farm inputs food production is increased. When farmers don't have control over assets of production their efforts and option are limited leading to food insecurity.

The Theory of Access elaborates how patterns of bundles of private property ownership rights and bundles of power determines access and control to resources. Therefore, this theory was selected as it offers basis for understanding the role of county governments in devolving agriculture and extension services to people and their ability to utilize them to enhance household food security in households. The ability to access and utilize farm inputs leads to reliable farm outputs. Based on the Theory of Access, the study intended to relate diversities in the bundles of rights and powers and how they influence farmer's ability to access and benefit from devolved agricultural extension services

2.5.2 Accountability Theory

According to Frink and Klimoski, (1998), the accountability theory suggests that decentralization of functions such as agricultural extension services are there to promote accountability in the provision of service delivery to the people. Due to the proximity of devolved units to people, it's assumed their functions are known to citizens as compared to their knowledge of the role the national government. Transfer of functions to County governments which are closer to the people, in theory, intensifies availability, accessibility, and utilization of agriculture and extension services by the people and in turn increase household food security.

As described by Kacianka et al., (2017); McGrath and Whitty, (2018), a suitable way to realize accountability is to differentiate its use as a virtue or as a mechanism. As a virtue, accountability is the ability of a person or entity to take responsibility which is a desirable characteristic of civil servants. Hence, in this use, accountability is an expected characteristic of county governments. It was thus expected that county government exhibited willingness to taking responsibilities for the devolved agriculture and extension services, which would improve agricultural production hence attainment of household food security.

As a mechanism, accountability is perceived as the state at which a person or an entity takes the responsibility to clarify their actions to another entity or person they are accountable to. County governments are held to account for their actions in agricultural extension service delivery by entities such as the Senate, county assembly, and the auditor general. Therefore, these obligated entities should be actively involved in the oversight of devolved agricultural extension service delivered by County governments to the public to ensure effective and proper utilization of the devolved resources.

Accountability theory emphases on the process of responsibility by obligated entities in service delivery. Therefore, this theory helped in understanding how county governments are taking responsibility and accountability in their actions in agriculture extension service delivery to the people.

2.6 Conceptual Framework

The conceptual framework explains how independent and dependent variables relate to each other (Kabir, 2016). The independent variables in the study included components of devolved agricultural advisory services including Farmers Training, Subsidized farm Inputs, and agricultural advisory Services. The dependent variable was household food security while the intervening variables comprised government policy and natural calamities. Government policies can interfere with budget allocations and regulate supply of certain extension services. Various natural calamities like floods, drought, and locusts' invasion can destroy all efforts of devolution geared towards household food security.

The dependent variable had three sub-components; food availability, accessibility, and utilization. Food availability deals with supply of food based on production and distribution that increases food quantities at the household level. The economic power and market point accessibility of a household determines its level of food accessibility. The concept of food utilization focused on a household's ability to adequately eat enough food of the right value and measure. According to the conceptual framework, if there is relevant adequate farmers training on different components of agricultural production, farmers have access to substantive subsidized farm inputs and relevant advisory services are offered while intervening factors remain constant then, households would be food secure.

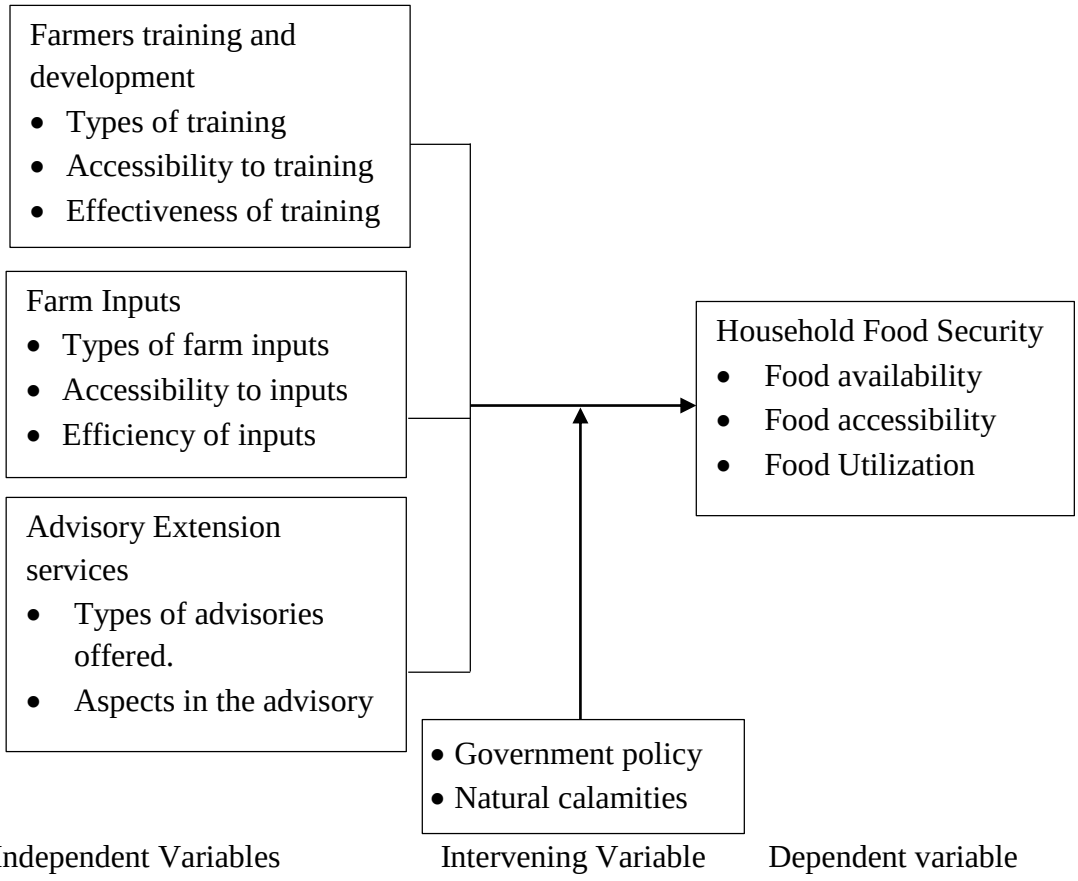

Figure 1: Conceptual Framework

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Location of the Study

The study was carried out in Makueni County. Makueni County is located in the former Eastern province. In relation to the 2019 National Housing and Population Census, the county has a population of 977,015 people and 244,669 households covering an area of 8,034.7 square kilometers (KNBS, 2019). The County was previously known as Makueni district before devolution. The County is made of nine sub-counties namely Kathonzweni, Kibwezi, Kilungu, Makindu, Makueni, Mbooni East, Mbooni West, Mukaa, and Nzaui. The county experiences semi-arid climatic conditions with an mean temperature range between $15^{0c} – 26^{0c}$ and annual rainfall ranges between 250mm to 400mm per annum on the lower regions of the county and the higher region receives rainfall ranging from 800mm to 900mm (Penga and Berry, 2018).

The largest population in Makueni County practices agriculture at the subsistence level. Despite the erratic rainfall in the region majority of the residents depends on rainfall for farming. Major crops in the region include maize, cowpeas, green grams, beans, and pigeon peas. About 1,762.71 square kilometer of the County is non-arable and 5042.69 square kilometer is arable. Farming is a crucial basis of revenue, domestic food, and industry and manufacture raw materials (Makhanu, 2019). Dorcas et al., (2019) ascertains that in the past year's farmers in Makueni County were able to plant twice a year; from March – April season and November to December season. This was possible due to reliable rainfall in the area. Unfortunately, due to climatic change, the rains are never reliable and consistent (Muema et al., 2018). Due to this, the county has adopted planting drought persistence crops such as peas, maize, pigeon peas, millet, sorghum, and beans.

The county also produces oranges, maize, and pawpaw as well as practicing dairy farming. The County has three agro ecological farming zones; mixed Farming coffee and dairy zone within a population of 463,404 in about 48.8%, mixed Farming food crops/cotton/livestock zone in a population of 298,707 in about 31.5% and marginal mixed farming cotton/beef zone in a population of 187,467 an estimate of 19% (Muema et al., 2018). In 2014 the county recorded a 72% decline in maize production, 40% in

cowpeas, and 16% in green grams due to depressed rains. Makueni county food assessment report in 2016 reported households' food consumption declined from 3 food per day to 2 food per day among household members (Musyoki & Wangari, 2016). (Mohajan, 2014) stated that only 21.8 percent of households were food secure in Makueni County. The area is suitable for the study due to the efforts made by the County government in respect to devolution of agricultural extension services to enhance household food security.

3.2 Research Design

The study assumed a descriptive survey research design. Thakur (2012), ascertains descriptive survey research design incorporates both qualitative and quantitative methodologies to gather precise data regarding the present position of a phenomenon and establish a conclusion from discovered facts. The study collected data and presented the analysis outcome on the way things were statistically experienced without influencing the variables in line with the provisions of the descriptive survey. To realize this, primary data was collected using questionnaires. Therefore, a descriptive research design was suitable for use in the study, as it allowed the collection of data, analyzing, interpreting and explaining contribution of devolved agricultural extension services on household food security, in Makueni County.

3.3 Study Population

The study targeted two hundred and forty-four thousand six hundred and sixty-nine households and nine sub-county agricultural officers in Makueni County.

Table 1: Distribution of Population and Number of Households by Sub-County in Makueni County.

Sub County	Population	Number of Households
Kathonzweni	79,281	18,365
Kibwezi	194,004	47,912
Kilungu	60,869	14,586
Makindu	83,391	21,756
Makueni	128,880	34,479
Mbooni East	97,523	23,734
Mbooni West	102,292	24,833
Mukaa	106,239	28,185
Nzaui	124,536	30,819
Total	977,015	244,669

Source: 2019 Kenya Population and Housing Census: Volume 1

3.4 Study Target Population

The study targeted one hundred and fifty thousand six hundred and ninety-seven (150,697) households and five (5) agricultural officers from five selected sub-counties due to their high severity of food insecurity. According to James & Ellen, (2020) Kathonzweni, Kibwezi, Makindu, Makueni and Mukaa sub-countries had a high preverence of food insecurity among farming households.

Table 2: Target Population

Sub County	Number of Households (N)
Kathonzweni	18,365
Kibwezi	47,912
Makindu	21,756
Makueni	34479
Mukaa	28,185
Sub total	150,697
Agriculture officers	5
Total	150,702

Source: 2019 Kenya Population and Housing Census

3.5 Sampling Technique and Sample Size

This segment defines how a sample of 388 respondents was selected using simple random and purposive sampling techniques

3.5.1 Sampling Technique

The study adopted Purposive sampling to select the five targeted sub-counties within Makueni County due to their high rate of food insecurity. Makueni County has nine sub-counties. Each of the sampled sub-counties formed strata from which targeted number of households were selected. Proportionate sampling was used to select households from each sub-county based on their population's proportions. Systematic simple random sampling was embraced to identify households to administer questionnaires. The K^{th} factor was taken to be 3, thus a questionnaire was administered in every third household from the previous one. A research assistant guided respondents on how to take part in the study. Purposive sampling was used to select sub-county agriculture officer from the target Sub-Counties. The agriculture officers participated in the study because they were directly involved in the oversight of devolved agricultural extension services.

3.5.2 Sample Size

According to Krejcie and Morgan, (1970), in a population of between 75,000 and 1,000,000 a representative sample size of 384 can be definite to characterize the population but to take care of attrition the study used 388 household heads. The sample included three hundred and eighty-eight (388) household heads and five (5) agriculture officers as shown in Table 3.

Table 3: Sampling Grid

Sub-County	Population	Sample (n)	
		Household	Agriculture Officer
Kathonzweni	18365	47	1
Kibwezi	47912	123	1
Makindu	21756	56	1
Makueni	34479	89	1
Mukaa	28185	73	1
Total	150697	388	5

Source: 2019 Kenya Population and Housing Census: Volume 1

3.6 Research Instruments

The study used different research instruments to gather both quantitative and qualitative data on research questions. The study used questionnaires and interview schedules for primary data collection. To ensure efficiency, the research instruments were subjected to validity and reliability coefficient tests.

3.6.1 Questionnaire

A questionnaire was used to gather data from household members. It contained closed and open-ended questions. To cover all the facets, the questionnaire was separated into three sections. Section (A) questions collected personal data like gender, age, level of education, and general information of the respondents. The section also helped to collect data on respondent's characteristics such as size of household, gender of household head, source of income, ward, and household food security status as well as seek household's opinions and feelings about the variables of devolved agriculture and extension service and their contribution on household food security. Sections B, C, and D were intended to collect data on each of the three objectives of the study.

3.6.2 Key Informant Interview Guide

Interview schedules were administered to sub-county agricultural officer. The advantage of an interview schedule enabled the interviewer to get more information like feelings and opinions through non-verbal communication otherwise not obtainable using a questionnaire. The interview guide was based on research questions to ensure consistency.

3.7 Data Collection Procedure

The researcher acquired an introduction letter and Ethical review letter from Chuka University and a research permit from the National Commission for Science, technology and innovation (NACOSTI). After obtaining the research permit, the researcher presented these documents to the minister of Agriculture Makueni County. Thereafter, the researcher presented introduction letters to the various agriculture officers at Sub-County Level.

The questionnaires were administered to respondents by availing forms to them to fill with the aid of research assistants who helped the illiterate to fill the questionnaires. One research assistant per sub-County was trained to ensure confidentiality of respondents, how to present themselves to the respondents and how to distribute the questionnaires to the targeted population. An introduction letter was attached in each questionnaire explaining to respondents the purpose for the study as well as reassurance of confidentiality. The respondents also signed a consent form to permit the collection of data.

3.8 Piloting

A pilot study was conducted two weeks before the real study in the Kilungu sub-county. According to Junyong (2017), a pilot study of 10-20 percent of sample size is adequate for quantitative study. Therefore, the piloting involved administering the same questionnaire to ten percent (388 questionnaires) of sampled households to confirm the clarity and simplicity of questions. The pilot study helped assess the feasibility of the research process, adequacy of resources required including time allocation and data management problem that may arise. The area and participant in the pilot study were excluded in the study population.

3.8.1 Validity

To guarantee the validity of research instruments, the researcher engaged in experts' consultation and discussion with supervisors on questionnaires. This involved the evaluation of questions to be certain they have captured the content of study objectives. Content validity of the research instruments was enhanced by ensuring only inferences linked to the components under investigation were captured in the questions. A pretesting of questions was done to determine clarity, whether questions were understood, answerable, and acceptable.

3.8.2 Reliability

Reliability of research instruments was ensured through piloting. A pilot study was conducted two weeks before the real study in Kilungu Sub- County. The piloting exercise involved administering the same questionnaire to ten percent of sampled households to confirm the clarity and simplicity of questions. This was done to improve dependability, ascertain time allocation, and to regulate uncertainty in household's questionnaire. Study results were analyzed and the resultant correlation coefficient of alpha = 0.7 was considered adequate for the instruments' reliability in accordance with (Moore, Notz & Flinger 2013).

3.9 Ethical Considerations

The researcher was issued with a clearance letter from the Chuka University Ethics Review Committee, and further did an application for a research permit from the National Commission for Science Technology and Innovation (NACOSTI). The researcher then requested for data collection authorization permission from the Makueni County Director of Education as well as receives permission from the County Commissioner. The researcher maintained the integrity and dignity of respondents throughout the data collecting process as well as promising confidentiality and privacy. The respondents were not requested to indicate their names on the questionnaires.

3.10 Data Analysis

The collected data was taken through data analysis phases which involved data clean up, and classification. Data clean-up involved editing, coding and tabulation in order to detect any anomalies in the responses. Data was then transferred to SPSS software

package (version 25.0 software) for analysis. Descriptive statistics for mean and standard deviations were computed. Valid percentage frequencies were also reported and compared between dependent and independent variables using cross tabulations.

Test of normality was computed for Likert type questions. Non normal data was normalized by transformation of the data using logarithm to base 10 values before they can be used. Equally, the ordinal data was converted to categorical data before Pearson correlation and linear regression analysis was computed. This helped determine the type of correlation (Pearson's or Spearman/s correlation analysis) and whether a regression analysis was to be used in comparing the role of dependent variable as household food security versus independent variables: Farmers training and development services, subsidized farm inputs and advisory extension services.

Regression analysis was used to determine the contribution of utilization of devolved agricultural extension services on household food security. Computations of chi-square was used to check responses on the research hypotheses that if there was any relationship between devolution of agricultural extension services and household's household food security Furthermore, thematic analysis was used to analyze qualitative data collected from key informative interviews to determine the contribution of devolved agricultural extension services on household's foods security.

Table 4: Data Analysis Matrix

Research hypothesis		Independent Variable	Dependent Variable	Method of Analysis
$H_{01:}$	Farmers training has no impact on household food security in Makueni County, Kenya	Farmers Training	Household food security	Percentage Regression Chi-square
$H_{02:}$	Subsidized farm inputs have no influence on household food security in Makueni County, Kenya	Farm Inputs	Household food security	Percentage Regression Chi-square
$H_{03:}$	Advisory extension service has no impact on household food security in Makueni County, Kenya	Advisory Extension Services	Household food security	Percentage Regression Chi-square

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Response Rate

Data showing the number of respondents who took part in the study was analyzed and results summarized in Table 5.

Table 5: Response Rate

	Issued Questionnaires	Returned Questionnaires	Percentage
	388	364	93.8
Total	388	364	93.8

Source: Field Data (2022)

Table 5 shows that out 388 questionnaires distributed 364 respondents accepted to participate in the study and properly filled and returned their questionnaires projecting (93.8%) while 24 of the targeted respondents declined to take part in the study. The response rate was considered sufficient to produce precise results. A reply rate of 50% is appropriate for investigation and reporting; a response of 60% is worthy and a response rate of 70% is outstanding (Mugenda & Mugenda, 2012).

4.2 Demographic Characteristics of the Respondents

Respondent's bio-data was collected based on age, marital status, gender, religion, educational levels and family size of the respondents' households. This ensured that all features of the population were considered in the study. Results were discussed in section 4.3.1 – 4.3.6.

4.2.1 Distribution of Respondents by Gender

Gender data of household heads was analyzed descriptively and results were summarized in Figure 2.

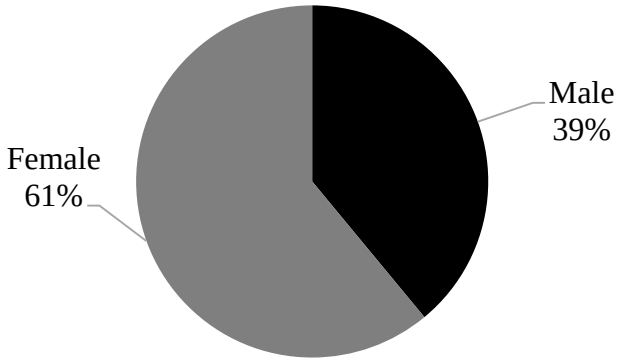

Figure 2: Gender of the Respondents

As per the study results, 61% of the respondents (household heads) were female and 39% were male in gender. The results probably implied that majority of households were headed by females who were also likely to be in charge of household food security. The study results seem to be in line with results of a study by Botreau, & Cohen (2020), where disproportionality was noted between the male and female gender in relation to household food security. Results generated by the same study also hinted that most women had various socio-economic roles in their households which limited their accessibility to resources and strategies related to food production and household food security. Wabwoba & Wakhungu (2019), identified households headed by women to be more food insecure than household headed by men. The results point out need for further discovery of effective strategies that could enhance commitment in the participation of women in agricultural production to enhance food security in the study region.

4.2.2 Distribution of Respondents by Age

The study investigated the age of respondents and the results summarized in Table 6.

Table 6: Age Groups Distribution

Age	Frequency	Percent	Valid percent	Cumulative percent
Below 20	11	3.0	3.0	3.0
20-30	96	26.3	26.3	29.3
31-40	153	42.0	42.0	71.3
41-50	69	18.9	18.9	90.2
50 and above	35	9.8	9.8	100.0
Total	364	100.0	100.0	

The study results proven that majority of the respondents (42.0%) were in the age group of 31-40 years, 26.3% were between 20-30 years, 18.9% aged between 41-50 years, 9.8% were aged above 50 years while 3.0% aged below 20 years. The study outcome showed clearly that a higher number of the respondents (87.5%) were youthful (40 years and below) and therefore in the productive age. The study results agree with Hainzer et al., (2021) where it was noted that as young people are more actively engaged in farm production. It was also concluded that households headed by young people had tendency to engage in more productive activities resulting to improved household food security as compared to household headed by the elderly people. Although the results portray majority of the house hold heads in the productive age,

there is a gap in connecting the age of the participants and food insecurity in the study area

4.2.3 Distribution of Respondents by Religion

The study investigated the religion of the respondents. Results on the descriptive analysis were summarized in Table 7.

Table 7: Religion of Respondents

Religion	Frequency	Percent	Valid percent	Cumulative percent
Christian	269	73.9	73.9	73.9
Muslim	27	7.4	7.4	81.3
Other	68	18.7	18.7	100.
Total	36.4	100.0	100.0	

Results on religious associations of respondents in Table 7 portrayed Christianity as the predominant (74%) religion. It was further witnessed that the smallest number of respondents (7.4%) were Muslims by faith while 18.7% of the respondents subscribed to other religions.

The results seemed to be in agreement with Nkamleu, (2007) who conducted a study relating Religion and Food security and posted results indicating that other predominantly indigenous beliefs projected higher agricultural activities and productivity compared to Christian religion beliefs. On the contrary, results of a study by Nkamleu, (2007) however portrayed positive relationship between religion and agriculture. It was observed that food was a primary point of people's contact with the natural world, in the sense that food production and religion have been linked since their originations. Accordingly, the same study posted conclusions that sustainability of agriculture relates to convergence of science, agriculture and religion. It was therefore deemed significant to recognize the divergent views on the relationships between household food security and religion.

4.2.4 Distribution of Respondents by Marital Status

The marital status of respondents was analyzed and descriptive statistics of results summarized in Table 8.

Table 8: Respondents' Marital Status

Marital status	Frequency	Percent	Valid percent	Cumulative percent
Married	238	65.4	65.4	65.4
Separated	92	25.3	25.3	90.7
Widow	34	9.3	9.3	100.0
Total	364	100.0	100.0	

Results in Table 8 shows that (65.4%) of household heads were married, 25.3% separated and 9.3 % widows. It is also important to recall that most (68%) household heads were of female gender. This could imply possible change in household headship roles that could have implications on agricultural production and hence household food insecurity in Makueni County. The outcome of this study supports a report by Isaboke, (2021) which concluded that households where the heads were married were more food secure as compared to those with separated and windowed heads. The reality in the study area which is labeled as food insecure showed that mostly respondents were married. Understanding the link between the marital state of respondents and domestic food security could guide in formulation of sustainable strategies. The study pointed out need to conduct more studies on the association between marital status and food security.

4.2.5 Distribution of Respondents by Level of Education

The research investigated the level of education of study participants and a summary of the descriptive statistics represented in the Table 9.

Table 9: Respondents Level of Education

Religion	Frequency	Percent	Valid percent	Cumulative percent
Primary	92	25.3	25.3	25.3
High School	149	40.9	40.9	66.2
Tertiary	76	20.9	20.9	87.1
University	26	7.1	7.1	64.2
Other	21	5.8	5.8	100.0
Total	364	100.0	100.0	

The outcome of the study revealed (40.9%) of study participants had high school education, (25.3%) had acquired tertiary schooling, (20.9%) had university education, (7.1%) had primary school education, and only (5.8%) had other education qualifications. The outcome indicated that greatest of study participants had schooled

up to high school. In a study by Fret & Ken, (2016), it was shown that education helped household heads to adopt new knowledge and technology in farming increasing farm output hence improved food security at the household.

The results agree with Hainzer et al., (2021) study that indicated education as an important determinant on how different household heads undertake agricultural production activities. Majority of the respondents in the study area seemed to have acquired basic secondary education which may probably not have instilled adequate food production skills. Therefore, the study suggested review of syllabus in learning institutions to include different strategies of attaining household food.

4.2.6 Respondents Household Size

The study investigated Respondents' household sizes and a summary of the descriptive statistics represented in the Table 10.

Table 10: Respondents Household Size

Members	Frequency	Percent	Valid percent	Cumulative percent
1-3	178	48.9	48.9	48.9
4-6	118	32.4	32.4	81.3
7-9	37	10.2	10.2	91.5
10 and above	31	8.5	8.5	100.0
Total	364	100.0	100.0	

Source: (Field 2022)

Results showed highest number of households (48.9%) had 1-3 members, (32.4%) had 4-6 members, (10.2%) had 7-9 members and (8.5%) had 10 and above members. The number of household members determines the quantity of food required to sufficiently feed the family and reflects the efforts employed to assure enough food at the household. Households with more members requires more food compared to ones with few dependents, (Oino, 2016). Hainzer et al., (2017) affirms that the number of household members is a key determinant of food security, as large families have huge burden in providing adequate food to their household members as compared to smaller families. Majority of the respondents had families of 1-3 members which can also be related to the young age (40 years and below) of most of the respondents. This calls for

further studies to investigate other factors that can limit the involvement of young people in agricultural activities.

4.3 The Impact of devolved Farmers Training on Household's Food Security

Farmers training promotes transfer of new knowledge and skills to farmers Cai et al., (2019). Makhanu (2019), Farmers may not be aware of new developments in agricultural sector in terms of improved farming methods, availability of more productive and improved seeds as well as new pesticides and fertilizers. Therefore, examining the role of farmers training is critical in understanding the dynamics of agricultural training and its contribution to household food security.

4.3.1 Ability to Access to Training Services on Agricultural Farming

The study explored on the percentage of respondents who had access to training services and the outcome of their descriptive statistics represented in Figure 3.

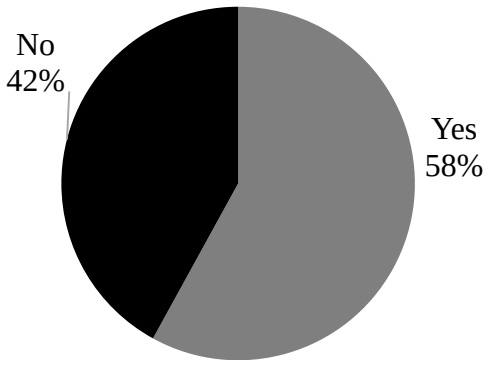

Figure 3: Ability to Access to Training Services on Agricultural Farming

The study outcome revealed that (58%) of study participants had access to advisory services offered by the county government on agriculture while (42%) had no access to agriculture services. This outcome was in agreement with a report by Muema et al., (2018) which noted that the biggest challenge in agricultural services is accessibility which limits farmer's ability to adopt new skills. Previously this study found out that 89% of respondents had the desire to be trained on agricultural practices; however only 58% had accessed to training opportunities. This prompts the urge to further investigate the causes of the miss-match between desire and accessibility of training services.

4.3.2 Respondents Participation in Agricultural Training

The study investigated the percentage of respondents trained on agriculture and a summary of descriptive statistics presented in Figure 4.

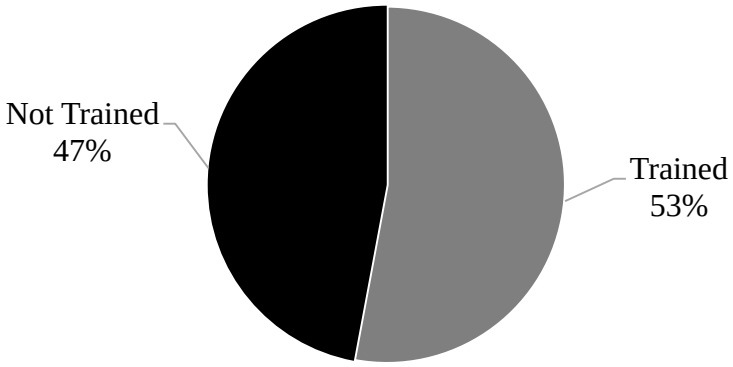

Figure 4: Agricultural Training of Respondents

The findings indicated that 54% participants had attended agricultural training from the county government while 46% of respondents had not received any agricultural training. Makhanu (2019) upholds agricultural training provides farmers with skills and knowledge to help increase food security. A study by Joseph et al., (2018) ascertains that the manner in which training of farmer's influences food stability is still a challenge as farmers still experience food insecurity due to other socio-economic challenges. This study proposes further studies to examine the components of training that can help farmers improve food security.

4.3.3 The Need for Agricultural Training

The study examined respondents need for training and a descriptive summary of their views represented in Figure 5.

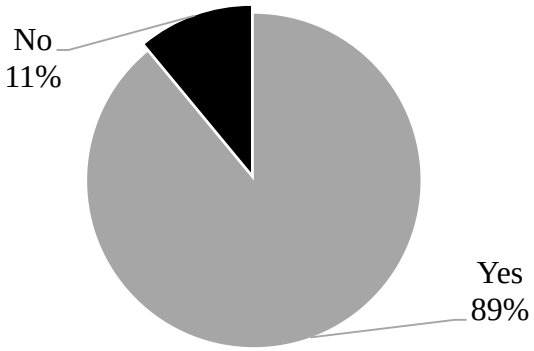

Figure 5: The need for Agricultural Training

The study outcome shows that 89% of respondents need agricultural training while 11% of respondents indicated they don't need agricultural training. These results agree with Agunga, (2013), that farmers have a higher desire to be equipped with new skills and technologies. Therefore, a further study is required to examine the challenges farmers face in acquiring the trainings they desire.

4.3.4 Benefits of Training on Agricultural Farming

The study investigated respondents rating on the benefit of Agricultural Training and a descriptive summary of their responses represented in Figure 6

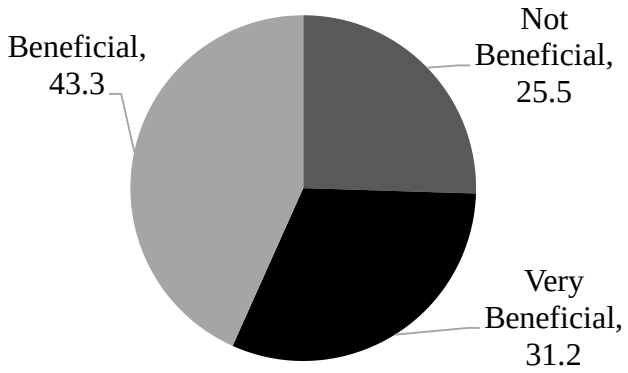

Figure 6: Benefits of Training on Agricultural Farming

From the study outcome (43.3%) of the respondents involved in the study felt that training on agricultural farming by the county government was beneficial .This was in agreement with a study by FAO, (2017) which revealed agricultural training is beneficial in helping farmers adopt new methods of farming to increase food security.(31.2%) respondents felt that training was very beneficial, whereas (25.5%) respondents expressed the view that training on agricultural farming by the county government was not beneficial in boosting household food security which agreed with the outcomes of a study by Fawole et al., (2015) which narrated that due to different socio-economic challenges farmers training may not solve household food insecurity. The outcome of these different studies seems to agree with this study that different farmers have different opinions on the benefit of agricultural training. This study proposes further studies on examining the cause of divergent opinion among farmers on the benefit of agricultural training

4.3.5 Agricultural Training on Different Components

The study tested farmer's opinion on different agricultural training components and results showed in Table 11 below.

Table 11: Agricultural Training on Different Components

Statement	1%	2%	3%	4%	5%	Likert Mean
The county has trained farmers on appropriate management techniques for their farms	8	67	4	17	20	3.79
There have been training services that used a collaborative approach with the community addressed food insecurity	6	2	60	34	19	3.98
Most farmers in my region have been trained on the construction of food storage structures	3	8	72	12	7	4.09
Agricultural training and development services have led to improved food productions	7	12	51	21	15	3.73
Training by the county government has done adequately on drought tolerant crop varieties, crop insurance, climate-smart agriculture, farming inputs support with a major focus on household food security	4	18	66	23	3	3.93

Results in Table 11 shows that(72%)of study participants ascertains that they have been trained on the construction of food storage structures, (66%) of respondents agreed that training by the county government has been done adequately on drought tolerant crop varieties, crop insurance, climate-smart agriculture, farming inputs support with a major focus on household food security and 60% of respondents agreed that there have been training services that used a collaborative approach with the community addressed food insecurity.

Further, 67% of the respondents agreed that the county has trained farmers on appropriate management techniques for their farms, and 51% agreed that agricultural training and development services have led to improved food production in Makueni County. The mean response tally (3.90), suggested that majority of study participants believed that training was done substantively on specified components of agriculture. The study outcome indicates that productive efforts have been made to enhance agricultural productivity in the study area. This outcome is in agreement with Joseph et al., (2019), that proposes that training on farm management, seed selection and storage facilities increases farmers know how enhancing agricultural productivity which in

return promotes household food security. However, irrespective of training on different components of agriculture, the study area is referred to as food insecure. Thus, establish the need to investigate the level at which training can enhance food security at household level.

4.3.6 Inferential Statistical Analysis

This segment represents the correlation and regression analysis in relation to the first objective. Analysis, presentation, and interpretation are provided for different components of devolved agricultural training. Table 4.10 displays descriptive statistical findings for means, standard deviations, and valid data items related farmers training.

4.3.7 The Impact of Farmers Training on Household Food Security

The means and standard deviations of farmers training was examined and summary of inferential statistics represented in Table 12.

Table 12: Farmers Training and Household Food Security

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic Std.	Error	Statistic Std.	Error
Training	364	3.78	0.41	-0.63	0.11	1.87	0.26
Food security	364	3.91	0.37	-0.56	0.11	1.91	0.26

Key: 5 Strongly Disagree, 4 Disagree 3 Moderately Agree, 2 Agree; 1 Strongly Agree

The study identifies the mean and standard deviation for farmers training as (M=3.78; SD=.41). The fact that farmers' training in Makueni County was generally acknowledged. The following methods were used to achieve training: participation in seminars, participation in conferences, and education programs. The household food security mean and standard deviation are also included in Table 12 (M=3.91; SD=.37). Most people from the study area stated that Makueni County had better household food security, which enhanced food supply, accessibility, use, and stability.

Table 12 also provides skewness and kurtosis tests to determine if the farmers training and household food security study variables' error distributions are normally distributed. Thakur, (2021) state that a variable's distribution is regarded as normal if

its kurtosis and skewness values fall within the range of -2.0 and +2.0. Table 12 demonstrates that the values of skewness and kurtosis for the variables training and household food security were within the advised range. Therefore, the normality test was successful.

It demonstrates that in Makueni County farmers were trained and that household food security was improved, but the level of association between farmers and household could not be established. Hence, there is considerable disagreement as to whether there was a correlation between them because the mean for household food security was greater than that of farmers training. Therefore, a straightforward linear regression analysis was needed. As employed model 4.1. Below

$$y = \beta_0 + \beta_1 x_1 + \varepsilon \qquad (4.1)$$

The explanatory variable was farmers training, while the response variable y was household food security. The term ε "residual" or "error" denoted the variance between actual household food security numbers and those predicted by the model. Initial evaluations of model 4.1 were successful. Therefore, the impact of farmers training in ensuring household food security was investigated. The contribution was examined at a 5% level of significance. Table 13 presents the results.

Table 13: Regression Analysis for Farmers Training and Household Food Security

Model	Unstandardized coefficient		Standardized coefficient		
	B	Std. Error	Beta	t	Sig
(Constant)	3.436	0.172		20.004	0.000
Training	0.210	0.041	0.262	5.074	0.000
Best line of fit					
R=0.252[a]					
R^2=0.068					
Adjusted R^2 =0.066					
F_{ratio} = 32.744					
P<.05[b]					

a. Dependent Variable: Food Security
b. Predictors: (Constant), Training

Table 13 demonstrates a marginally positive association between farmers training and household food security (R=.252; p.05). A portion of household food security was

measured with an R-square of.068, which was explained by farmers training. It revealed that variations in farmers training were responsible for around 6.8% of the disparity in household food security. The replica's generalizability was indicated by the adjusted R-square. If not identical, it should to be near to R-square as practicable.

The study's deviation from the last model was minimal. i.e.003, or.3%. This suggested that the model might have accounted for about .3% less variance in findings if it had been resulting from the larger population (F ratio = 32.744; p .05). The linear regression model was statistically significant. According to standardized beta coefficients, household food security increased by about .262 units for every standard deviation increase in farmers training. The ideal simple linear regression calculation between farmers training and household food security is also provided by Table 13 and Model 4.1.

$$y = 3.436 + .210x \qquad (4.2)$$

There is a statistically significant link between household food security and farmers training, according to linear regression model 4.2 (R =.252; p .05. The variance in training explained 6.8% of the model. According to the linear regression model 4.2, the level of household food security was around 3.436 units lower without training and increased by .210 units for every unit of training. Hainzer et al., (2021) supports the outcome of this study by ascertain training farmers equips them with new knowledge that support them in increasing farm produce hence improved food security.

Mobeen and Varghese (2016) , also agrees with the study results that training small scale farmers on different farming techniques food security is ensured at household level. However, despite the fact that the current study found a link between farmers training and household food security, earlier investigations by (Ali & Farah, 2019) did not. Furthermore, Lameck & Hulst,(2021) were not concerned about the models of analysis, despite the fact that the current study demonstrated the usage of regression models. Also, even though the FAO, (2014) report did not ascertain connection between training and food security, the current study enhanced knowledge by making this connection between training and household food security. Therefore, the study rejects

the null hypothesis that Farmers training has no impact on household food security in Makueni County, Kenya.

4.3.8 Thematic Analysis of Qualitative Findings on Farmers Training in Makueni County, Kenya

The researcher interviewed agriculture officers on the impact of agricultural training on household food security. Majority of the interviewees agreed that farmers training influenced household food security. Agriculture officer, P1, observed;

> *Teaching farmer's new skills using extension services models with the goal of supporting and facilitating people to engage in agricultural production for household food security management, farmers training In Makueni County through participation in seminars, participation in conferencing, continued professional development, coaching programs, mentoring programs, and programs has improved farmer's knowledge on farming hence improved household food security? (P1, Male, 2022).*

The outcome of the analysis was in agreement with Oino, (2016) that when farmers are trained on different components of farming, they change and adopt more productive and resourceful ways in their farming activities. Therefore, it was concluded that Makueni County farmers are in a better position in terms of knowledge acquisition than before devolution in terms of agricultural production.

The same thoughts were supported by another agriculture officer by acknowledging farmers training have improved household food security. On further probing, agriculture officer, P2, noted;

> *Household food security in Makueni since devolution has improved although not in a very substantive percentage due to other uncontrollable factors such a limited rain amounts and extensive drought. However, the County has established food security systems that aim in long run to enable people at all time to have physical and economic access to sufficient, safe, nutritious food that fits their dietary needs and food preferences for an active life. (P2, Male, 2022).*

The results support a study by Hainzer, (2015) that concluded that food security at the household level is determined by different social economic factors. This outcome therefore, explained why different households practicing agriculture were still food insecure irrespective of being actively engaged in farming activities.

Therefore, farmers training positively impacted the state of food in families in Makueni County, Kenya. Agriculture officer 3 explained the county government efforts on implementing agriculture training program as follows;

> *That farmers training on household food security has promoted partnership among farmers, accessing resources from other farm institutes, maintaining contact with other agricultural institutes, and interaction among farmers themselves. She noted that availability of county government supports even though not consistent has helped in training farmers on different components especially during uncertain circumstances such as locust outbreak and this has reduced extreme negative impact on crops hence increasing food production, although majority of residents are still experiencing food insecurity (P3, Female, 2022).*

This outcome explained how different stakeholders' plays key role in helping farmers to access and adopt different farm support services. Joseph et al, (2019) also supports this outcome in explaining the importance of involving different players in agricultural activities.

4.4 Influence of Subsidized Farm Inputs on Household Food Security

The influence of subsidized farm inputs on household food security was investigated and a summary of respondent's views represented in Table 14.

Table 14: Subsidized Farm Inputs and Household Food Security

Statement	1%	2%	3%	4%	5%	Likert Mean
Subsidized farm input especially fertilizer and maize planting seeds have led to increased household food security	3	79	11	6	7	3.99
The county government of Makueni has distributed fertilizers, hybrid maize seed, and sorghum seed and land ploughing services at lower rates to farmers.	4	72	9	16	2	3.78
There is a farmer's empowerment program that provide farmers with subsidized farm inputs such as fertilizers and credit opportunities	7	68	32	22	17	4.16
Farmers in Makueni County have benefited from subsidized hybrid seeds and pesticides	2	6	25	11	5	3.79
Mean Likert Mean						3.93

The study outcome indicates 79% of study participants agreed that subsidized farm input especially fertilizer and maize planting seeds have led to increased household food security, also 72% of respondents approved that the county government of Makueni has distributed fertilizers, hybrid maize seed, and sorghum seeds and land ploughing services at lower rates to farmers, crop insurance, climate-smart agriculture, farming inputs support with a major focus on household food stability. While 68% of participants established that there is a farmer's empowerment program that provide farmers with subsidized farm inputs such as fertilizers and credits opportunities. Further, 62% of the respondents agreed that, farmers in Makueni County have benefited from subsidized hybrid seeds and pesticides agricultural training leading to improved food production in Makueni County. The mean score of the replies was 3.93 signifying that majority of study participants supported that subsidized farm inputs increases food security.

The outcome of this study is in agreement with Lamech & Hulst, (2021) that agriculture input subsidies boost household food security. This is because household food security and production are often said to be correlated with farmer poverty levels throughout most of African countries. The findings are also in line with those of Kinuthia, (2020) who examined the influence of subsidized farm inputs on household food security in Kenya and Tanzania and established a positive correlation between household food security and subsidized farm inputs.

4.4.1 Inferential analysis of Subsidized Farm Inputs and Household Food Security

The means, and standard deviations for subsidized farm inputs and household food security was analyzed and represented in the summary of the outcome in Table 15

Table 15: Subsidized Farm Inputs and Household Food Security

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Food security	364	4.32	0.33	-0.57	0.13	1.90	0.26
Subsidies	364	4.21	0.38	-0.18	0.13	0.42	0.26

1 Strongly Disagree; 2 Disagree; 3 Moderately Agree; 4 Agree; 5 Strongly Agree

The mean and standard deviations for subsidized farm inputs was (M=4.21; SD=.38) as per the study outcome. A consensus was established that in Makueni County farmers benefited from subsidized farm inputs programs. In the study area subsidized farm inputs information was shared among farmers through agricultural meetings, farmers peer exchange and agricultural institutions exchange program.

In the study subsidized farm inputs and household food security research variables' error distributions are further tested for normalcy using skewness and kurtosis in Table 15. (Thakur, 2021) state that a variable's distribution is regarded as normal if its kurtosis and skewness values fall within the range of -2.0 and +2.0. Table 15 demonstrates that the levels of skewness and kurtosis for the variables subsidized farm inputs and household food security were within the obtained range. Therefore, the normality test was successful.

Table 15 also demonstrates availability of subsidized farm inputs in Makueni County and an improvement in household food security, but it is unable to reveal how subsidized farm inputs affects household food security. Furthermore, there is some disagreement as to whether there was a correlation between them because the mean for household food security was greater than that for subsidized farm inputs. Therefore, a straightforward linear regression analysis was done as represented in the mode below

$$y = \beta_0 + \beta_1 x_1 + \varepsilon \quad (4.3)$$

Household food security was the response variable y, while subsidized farm in puts was the explanatory variable. The term ε "residual" or "error" denoted the difference between the observed values of household food security and the values that the model attempted to approximation. Model 4.3 preliminary testing were justified. Thus, the influence of subsidized farm inputs in ensuring household food security was investigated. The influence was examined at a 5% level of significance. As shown in Table 16.

Table 16: Regression Statistics for Subsidized Farm Inputs and Household Food Security

Model	Unstandardized coefficient		Standardized coefficient		
	B	Std. Error	Beta	t	Sig
(Constant)	3.268	0.208		15.700	0.000
Subsidies	0.248	0.050	0.258	4.994	0.000
Best line fit					
R=0.258[a]					
R^2=0.067					
Adjusted R^2 =0.064					
F_{ratio} = 24.942					
P<.05[b]					

a. Dependent variable: Food Security
b. Predictors: (Constant), Subsidized Farm Inputs

The outcome in Table 16 demonstrates a marginally positive association between subsidized farm inputs and household food security (R=.258; p.05). A portion of household food security was measured with an R-square of .067, which was explained by subsidized farm inputs. It revealed that differences in subsidized farm inputs initiatives were responsible for around 6.7% influence on household food security. The model's generalizability was indicated by the adjusted R-square. If not identical, it should been close to R-square as possible. The study's deviation from the final model was minimal. i.e. .003, or.3%.

This suggested that the model might have accounted for about .3% less variance in outcomes if it had been resulting from the entire population (F ratio = 24.942; p .05). The linear regression model was statistically significant. According to standardized beta coefficients, household food security increased by about .258 units for every standard deviation rise in subsidized farm inputs habits. Table 16 and model 4.3 offers the ideal simple linear regression equation as;

$$y = 3.268 + .248x \quad \text{.....4.4)}$$

The linear regression model 4.4 found a statistically positive correlation between the variance in household food security and subsidized farm inputs (R =.258; p.05). 6.7% of the model was explained by subsidized farm inputs variation. The degree of household food security was around 3.268 units lower without subsidized farm inputs

and increased by .248 units for every unit of subsidized farm inputs, according to the linear regression model 4.4. Morris et al., (2017) acknowledged that provision of subsidized farm inputs reduces farmers stress on accessing resources required in farm production hence increasing produce.

Additionally, this study used linear regression models to show how subsidized farm inputs contributes to household food security in numerical terms. However, the model of analysis and the measurable contribution of subsidized farm inputs and resources were not mentioned in Public Policy Statements (2007).In their article on household food security, Mugi-Ngenga et al.,(2015) noted that different support from state department to farmers through offering affordable farm inputs through subsidy program support farmers to reduce input expenses hence improved return.. Although Mugi-Ngenga et al., (2015) results were quiet on the ideal employed and did not reveal the measure of contribution of subsidized farm inputs to household food security, this study was clear on the analysis model and demonstrated the influence of subsidized farm inputs to household food security.

The current study's findings concur with a report on household food security by Kinuthia, (2020) which noted that availability of subsidized farm inputs among small scale farmers led to improvements in household food security in Australia. These experts have a special network of food producers and work together to promote and manage the use of modern technology in accessing farm inputs to increase food production. Although, Holden and Lunduka (2013) failed to demonstrate the model used to associate subsidized farm inputs and household food security, this study used regression models.

Izraelov and Silber, (2019) noted subsidized farm inputs in relation to weak marketing infrastructure, limiting access to markets, and increased transaction costs, price swings, and volatility, as well as higher prices with significant food poverty. Njora, and Yilmaz, (2021) complement the findings of the present study, which found that subsidized farm inputs greatly increased household food security. However, the subsidized farm inputs dimensions in the two research varied. Additionally, Njora & Yilmaz, (2021) did not

demonstrate the significance of subsidized farm inputs metrics to household food security.

In Makueni County, this study indicated subsidized farm inputs had a significant influence on household food security. In line with Raidimi & Kabiti, (2019) study that linked increased produce among small scale farmers to available farm inputs subsidy program. Furthermore, Raidimi and Kabiti, (2019) used correlation models in the same way as the present study. Therefore, the study rejects the null hypothesis that subsidized farm inputs have no influence on household food security in Makueni County, Kenya

4.4.2 Thematic Analysis of Qualitative Findings on Subsidized Farm Inputs on Household Food Security in Makueni County, Kenya

The study interviewed agriculture officers on the influence of subsidized farm inputs on household food security in Makueni County, Kenya. Where majority of interviewees agreed that subsidized farm inputs influenced household food security. The agriculture officer, P4, observed;

> *Subsidized farm inputs have helped farmers to acquire and access seeds, fertilizers, pesticides more easy. Even the poor farmers can have something to plant. Although other natural conditions like drought and short rains hinders our efforts, there is a tangible evidence on the increased produce by different farmers (P4, Female, 2022).*

The earlier studies did not adequately investigate these substantively. Shahbaz & Ata, (2014), examined the impacts of fertilizer subsidies on household food stability and established a positive association as this study. Even though this study investigated the influence of subsidized farm input and established a positive contribution, food insecurity and poverty remain pervasive among smallholder farmers. This prompts the desire to further to examine more dynamics related to subsidy programs.

4.5 Role of Advisory Extension Services on Household Food Security

The study examined the role of advisory extension services on household food security and a summary of the outcome represented in Table 17.

Table 17: Advisory Extension Services and Household Food Security

Statement	1%	2%	3%	4%	5%	Likert Mean
Agriculture extension advisory services are being offered by the county government of Makueni	3	79	11	6	7	4.09
Extension advisory services offered by the county government have led to increased household food security	4	72	9	16	2	3.89
Farmers in Makueni have received Extension advisory services on different farming methods that have led to increased household food security	7	58	32	22	17	3.76
Agricultural extension services supports farmers to access support funds to enhance farming in Makueni county	2	62	25	11	5	4.11
Agricultural extension services supports agricultural production and increasing household food security.	3	79	11	6	7	3.69
Mean Likert mean						3.91

The study outcome shows 79% of the study participants supports that agricultural extension advisory services are being obtainable from the county government of Makueni, 72% of respondents approved that extension advisory services offered by the county government have led to increased household food security and 58% of respondents agreed that farmers in Makueni County have received Extension advisory services on different farming methods that have led to increased household food security. Further, 62% of the study participants established that agricultural advisory services have helped farmers to access support funds to enhance farming in Makueni County, and 79% of respondents agreed that Agricultural advisory services are important in supporting agricultural production and increasing household food security through offering timely advice to farmers.

The mean score of the replies was 3.91 signifying that majority of respondents approved that agriculture advisory services improves household food security. The outcome agree with Lyon, (2019b) , study that concluded availability of different extension advisory services to small scale farmers including farming advice, training, consultation services improves farmers production levels hence improved food security. The results also support Raidimi & Kabiti, (2019) study that advisory extension services cannot be overlooked because of the influence they exert over household food security.

4.5.1 Inferential Analysis of Advisory Extension Services on Household Food Security

The means and standard deviations for the role of advisory extension services and household food security was analyzed and results represented in Table 18.

Table 18: Advisory Extension Services and Household Food Security

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Error Std.	Statistic	Error Std.
Food security	364	4.32	0.39	-0.57	0.13	1.91	0.26
Advisory Extension	364	4.41	0.33	-0.11	0.13	0.36	0.26

1 Strongly disagree; 2 Disagree; 3 moderately agree; 4 Agree; 5 strongly agree

Study outcome shows advisory extension services means and standard deviations as (M=4.32; SD=.39). Broadly respondent's established that advisory extension services influenced household food security in Makueni County. The mean and standard deviation for household food security are also included in Table 18 (M=4.41; SD=.33). It was also agreed that Makueni County's household food security situation has improved, meaning that food was probably more readily available, accessible, used, and stable. The advisory extension services and household food security study variables are further tested for normality of error distributions using skewness and kurtosis in Table 18.

Thakur, (2021) state that a variable's distribution is regarded as normal if its kurtosis and skewness values fall within the range of -2.0 and +2.0. The values of skewness and kurtosis for the variables advisory extension services and household food security were within the advised range, as shown in Table 18. Therefore, the normality test was successful. Table 18, which demonstrates that advisory extension services were available to farmers in Makueni County and that household food security had improved, but unable to demonstrate how advisory extension services affected household food security. Furthermore, the advisory extension services mean was several points lower than the household food security mean, raising questions about whether there was a relationship between the two. Therefore, a straightforward linear regression analysis was done as shown below

$$y = \beta_0 + \beta_1 x_1 + \varepsilon \quad (4.5)$$

Household food security was the response variable$y$, and advisory extension services was the explanatory factor. The term ε denoted the difference between actual household food security status and the model's best approximation. Model 4.5 preliminary tests were justified. Therefore, the role of advisory extension services on household food security was investigated. The contribution was examined at a 5% level of significance.

Table 19: Regression Analysis for Advisory Extension Services and Household Food Security

	Model	Unstandardized coefficient		Standardized coefficient		
		B	Std. Error	Beta	t	Sig
1	(Constant)	3.718	0.213		12.766	.000
	Advisory Extension services	0.361	0.048	0.371	7.471	.000
	Best line of fit R=0.371[a] R^2=0.138 Adjusted R^2 =0.135 F_{ratio} = 55.810 P<.05[b]					

a. Dependent variable: Food Security
b. Predictors: (Constant), Advisory Extension Services

Regression analysis results demonstrates a marginally significant positive connection between advisory extension services and household food security (R=.371; p.05). R-square of .138 measured a portion of household food security, explained by advisory extension services. It revealed that advisory extension services were responsible for about 13.8% of the difference in household food security. The model's generalizability was indicated by the adjusted R-square.

If not identical, it should have been close to R-square as practicable. The study's deviation from the final model was minimal-.003, or.3%. This suggested that the model might have accounted for about .3% less variance in conclusions if it had been resulting from the population rather than a sample. (F ratio = 55.810; p .05) The linear regression model was statistically significant. According to standardized beta coefficients, household food security increased by about .371 units for every standard deviation

increase in advisory extension services policies. Table 19 and model 4.5 also provides the optimum simple linear regression equation between advisory extension services and household food security as:

$$y = 2.718 + .361x \quad (4.6)$$

Variance in household food security and advisory extension services were statistically correlated (R =.371; p .05) according to the linear regression model 4.6. The difference in advisory extension services accounted for 13.8% of the model's explanation. According to the linear regression model 4.6, the level of household food security was around 2.718 units lower without advisory extension services and increased by 0.361 units for every additional unit of advisory extension services.

Shahbaz and Ata (2014), concluded that advisory extension services are important variables that encourage farmer to contribute more to household food security through increased farm produce. Results were consistent with this study's findings, that advisory extension services have a major impact on household food security. However, although their study investigation focused more on women, but this study took both genders into account.

FAO, (2014) transfer of farming knowledge and skills, research, and extension as a key contributor in the roadmap to the achievement of food and nutritional security, which agrees with this study that advisory extension services impacts household food security positively. Additionally, FAO, (2014) noted that relationships between and among men and women play a significant role in defining susceptibility to food insecurity and malnutrition, however, this study showed that advisory extension services significantly contribute to food availability, stability, and accessibility.

4.5.2 Thematic Analysis on the Role of Advisory Extension Services on Household Food Security in Makueni County, Kenya

Study interviewed Agriculture officers on the influence of advisory extension services on household food security in Makueni County. Majority of the interviewees did agree

that advisory extension services influenced household food security. Agriculture officer, P5, observed;

> *Advisory extension services may directly affect family food security since they increase farmer's production power which may increase agricultural production. Nevertheless, despite the program's execution, food insecurity and poverty remain pervasive among smallholder farmers. This casts doubt on the program's viability and efficacy, he claimed. (P5, Male, 2022).*

This study justifies that advisory extension services may directly influence household food security based on prior research (Fuglie et al., 2017; Gewa et al., 2021; Lyon, 2019a). Since one of the goals of establishing Advisory extension services is to alleviate poverty, comparing the effects of Advisory extension services against household food security provides an estimate on the efforts made towards achieving food security.

4.6 Joint Analysis of Devolved Agricultural Extension Services and Household Food Security

The study examined jointly how training, subsidized farm inputs, and advisory extension services contributed to household food security in Makueni County. A summary of descriptive statistical findings for means, standard deviations, and valid data items is represented in Table 20.

Table 20: Statistical Analysis for Devolved Agricultural Extension Services and Household food security

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic Std.	Error	Statistic Std.	Error
Food security	364	4.32	0.39	-0.57	0.13	1.91	0.26
Farmers Training	364	3.78	0.41	-0.63	0.11	1.87	0.26
Subsidies	364	4.21	0.38	-0.18	0.13	0.42	0.26
Advisory Extension	364	4.41	0.33	-0.11	0.13	-0.36	0.26

1 Strongly disagree; 2 Disagree; 3 moderately agree; 4 Agree; 5 strongly agree

The mean and standard deviation for household food security are shown in Table 20 (M=4.32; SD=.39). The means and standard deviations for the three independent variables of subsidized farm inputs (M=4.21, SD=.38), advisory extension services

(M=4.41, SD=.33), and training (M=3.78, SD=.41), are also displayed. The training, subsidized farm inputs, advisory extension services, and household food security study variables are further tested for normality of error distributions using skewness and kurtosis in Table 20. (Thakur, 2021) state that a variable's distribution is regarded as normal if its kurtosis and skewness values fall within the range of -2.0 and +2.0. All of the variables' skewness and kurtosis values fell within the suggested range, as shown in Table 20. Therefore, the normality test was successful.

Table 20 did not demonstrate how Makueni County's farmers contribute to household food security, despite the fact that it was generally acknowledged that they participate in subsidized farm inputs, farmers training, and accessed advisory services. In addition, with the exception of select units, the mean for household food security was greater than mean for subsidized farm inputs and training. The initiatives' potential to collectively contribute to household food security in a statistically significant way was questioned. The multiple linear regression model sought was;

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \varepsilon \quad (4.7)$$

The reply variable y signified household food security while illustrative variables; x_1, x_2 and x_3 characterized training, subsidized farm inputs, and advisory extension services. The variable ε signified deviance of perceived value of household food security based on model (4.7). The outcome of its multi-collinearity is represented in Table 21.

Table 21: Pearson Correlation Matrix

		Training	Subsidized Farm inputs	Advisory Extension	Food security
Farmers Training	Pearson Correlation	1			
	Sig. (2-tailed)				
	N	388			
Subsidized farm inputs	Pearson Correlation	0.363**	1		
	Sig. (2-tailed)	0.000			
	N	388	388		
Advisory Extension Services	Pearson Correlation	0.147**	0.269	1	
	Sig. (2-tailed)	0.006	0.000		
	N	388	388	388	
Food Security	Pearson Correlation	0.262**	0.258	0.371**	1
	Sig. (2-tailed)	0.000	0.000	0.000	
	N	388	388	388	388

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

The outcome of the study shows subsidized farm inputs and training had the strongest correlation coefficient (R=.363; p>05). Subsidized farm inputs and advisory extension services came next (R=.269; p>05). Advisory extension services and training had the lowest correlation coefficient (R=.147; p>.05). At the 1% level, each was statistically significant. All of the independent variable correlation coefficients fell within the suggested range of -0.70 to 0.70 (Duveskog et al., 2011). The independent variables did not therefore exhibit multi-collinearity. Therefore, multiple linear regression analysis was done and outcome presented in Table 22.

Table 22: Linear Regression Analysis of the Agricultural Extension Services and Household Food Security

Model		Unstandardized coefficient		Standardized coefficient		
		B	Std. Error	Beta	t	Sig
1	(Constant)	1.716	0.227		6.187	0.000
	Training	0.131	0.051	0.165	3.352	0.001
	Subsidized Inputs	0.110	0.041	0.115	2.167	0.031
	Advisory Extension Services	0.321	0.052	0.316	5.976	0.000
	$R=0.516^a$					
	$R^2=0.266$					
	Adj $R^2=0.193$					
	$F_{ratio} = 29.661$					
	$P<.05^b$					

a. Dependent variable: Food Security
b. Predictors: (Constant), Farmers Training, Advisory Extension Services

The study outcome demonstrates a weakly positive connection between joint devolved agricultural extension services and household food security (R=0.516; p>.05). R-square of .193, which was explained by devolved agricultural extension services, measures a portion of household food security. It reveals that devolved agricultural extension services were responsible for about 19.3% disparity in family food stability state. (F ratio = 29.661; p>.05) The joint linear regression model was statistically significant. Therefore, devolved agricultural extension services boosted household food security. Standardized Beta coefficients.

For advisory extension services, the highest Beta coefficient of (R0.316 ;p>.05) was statistically significant. When the variance in the model caused by subsidized farm

inputs and training was under control, it produced the strongest individual contribution to enhancing household food security. The adjustment of variance between subsidized farm inputs and advisory extension services , led the Beta value for training of (R 0.165; >p.05) statistically significant contribution to food security. Subsidized farm inputs also has a statistically significant beta value of (R 0 .115; p>.05).

The control of variance described by advisory extension services and training in the model provided the smallest improvement to household food security. The training, subsidized farm inputs, and advisory extension services interventions are the best linear regression model for the association with household food security expressed below:

$$y = 1.716 + .131x_1 + .110x_2 + .321x_3 + \varepsilon \quad (4.8)$$

A somewhat positive multi-correlation between variations in household food security and variations in devolved agricultural extension services-training, subsidized farm inputs, and advisory extension services-was found in the linear regression equation 4.8 (R =0.439; p >0.05). It was statistically significant that the linear model (4.8) could account for variation in devolved agricultural extension services to the extent of about 19.3%. Additionally, the model's unstandardized coefficients were used to interpret (4.8). The value of household food security that would be expected in the absence of subsidized farm inputs, training, and advisory extension services practices was 1.716. The coefficients revealed that household food security increased by .131 units for every unit increase in training while subsidized farm inputs and advisory extension services were kept constant; by.110 units for every unit increase in subsidized farm inputs while advisory extension services was kept constant, household food security increased by .321 units as training and subsidized farm inputs were kept in check.

4.6.1 Chi-Square Analysis for Devolved Agricultural Services and Household Food Security

In this study Ordinal regression is employed to forecast household food security founded on a assortment factors that are interdependent. In this particular investigation, the food security factor is represented by an systematic reply group variable, while the independent variables ; farmers training, subsidized farm inputs and advisory services are either categorical or continuous. Result tables apply threshold variable for the

intercept term. The location variable designates the coefficient for the independent variable linked with the chosen association function.

4.6.1.1 Chi-Square Regression Analysis for demographic factors and Household Food Security

The results of the Pearson Chi-square analysis investigating the connection between food security and rate of food satisfaction, as well as demographic variables such as gender, marital status of household heads, level of education, religious affiliation, and household size. The output indicates the Pearson Chi-square statistic is not statistically significant with a p-value of 0.319, greater than the significance level of 0.05. Therefore, there is no significant association (p-values>0.05) among demographic characteristics and food security.

Specifically, the chances of food security for male-headed households decrease by 2.1% equated to female-headed households (β=-0.021). The probabilities for married hoisehold heads heads to experience food scarcities are 0.39 matched to individuals household heads (β=0.390). Individuals with a lower level of education have odds of being exposed to food security of 0.201, equated to those who have attained higher education (β=-0.201). Additionally, the likelihoods of experiencing food shortages for households with less than an acres of land are 0.313 compared to those with more than one acres (β=0.313).

$$y = 0.291x_1 + 0.313x_2 + 0.201x_3 + 0.39x_4 - 0.021x_5 + 0.180$$

To summarize, the household's food security is affected by demographic factors however, the impact is not statistically significant according to the findings presented in Table 23.

Table 23: Chi-square analysis between Demographic factors and Household Food Security

Parameter		Estimate (β)	Sig
Threshold	[Frequency of food security=0]	0.180	0.939
Location	Gender respondent (x_5)	0.021	0.384
	Marital status(x_4)	0.390	0.560
	Education level (x_3)	0.201	0.711
	Household level (x_2)	0.313	0.537
	Religion (x_1)	0.291	0.621
	Model Chi-Square = 111.551	Chi-Square =0.384	
	Negelkerke's R^2=0.017	Significance =0.319	
	Cox and Snell's R^2 = 0.008	McFadden's R^2 = 0.011	

4.6.1.2 Chi-square Analysis between Farmers Training, Subsidized Farm Inputs and Advisory Services, and Household Food Security

The Pearson Chi-square test results for household security and three devolved agricultural extension services, including farmers training and subsidized farm inputs, indicate that there is no significant relationship (p-value = 0.371 > 0.05). The table presenting parameter estimates provides a summary of the impact of each predictor. The relationship between devolved agricultural extension services and household food security is not statistically significant (p-values > 0.05) and positive. On the other hand, farm advisory extension services exhibit an inverse relationship. The odds of farmers training contributing to food security are 0.515 equated to those who lease (β = -0.515). Furthermore, the chances of subsidized farm inputs influencing food security are 0.627 (β = 0.627).

$$y = 0.515x_1 + 0.627x_2 - 0.724$$

Therefore, the state of household food security is affected by devolved agricultural extension services such as farmers training, subsidized farm inputs and advisory extension services, although their impact may not be significant, as depicted in Table 24.

Table 24: Pearson Chi-Square Analysis between farmers training, subsidized inputs, advisory services, and Household Food Security

Parameter		Estimate (β)	Sig
Threshold	[Frequency of food security=0]	-0.724	0.892
Location	Famers training (x_3)	0.627	0.491
	Subsidized inputs (x_2)	0.453	0.578
	Advisory services (x_1)	0.321	0.611
	Model Chi-Square = 17.342	Chi-Square =0.371	
	Negelkerke's R^2=0.014	Significance =0.331	
	Cox and Snell's R^2 = 0.008	McFadden's R^2 = 0.018	

4.6.1.3 Chi-square Analysis between availability and utilization of devolved agricultural extension services and household food security

The statistical analysis conducted on household food security and agricultural extension services indicated that the Pearson chi-square statistic on agricultural training was not significant, with a p-value of 0.342, which is higher than the commonly used significance level of 0.05. The critical chi-square value for 1 degree of freedom at a 5% significance level is 3.63.The factor assessments in Table 25provide a summary of the effect of each predictor variable. It shows that there is an insignificant (p-values>0.05) positive relationship between the availability and access to training services and households food shortage. Additionally, the analysis reveals an inverse relationship between attendance of farmers training and level of farming knowledge attained.

The likelihood of having access to subsidized farm inputs is 0.543, which is higher than the commonly used significance level of 0.05. The critical chi-square value for 1 degree of freedom at a 5% significance level is 3.63. The likelihood of not having access to these services (β=-0.171). Attending extension training programs reduces the chances of experiencing food shortages by 17% .The likelihood of experiencing food shortages for those who were trained once a month is 0.431, while it is related to those who were trained two or three times a month (β=0.342).

$$y = 0.171x_1 + 0.543x_2 + 0.342x_3 - 0.431x_4 + 1.862$$

In summary, the availability of devolved agricultural extension services to households significantly affects their food security status, although its impact may not be as pronounced as shown in Table 25.

Table 25: Chi-square Analysis between availability and utilization of devolved agricultural extension services and household food security

Parameter		Estimate (β)	Sig
Threshold	[Frequency of food security=0]	1.862	0.951
Location	Frequently attended AES (x_4)	0.431	0.591
	Attended AE Training (x_3)	0.342	0.611
	Access to subsidized farm inputs (x_2)	0.543	0.616
	Availability of extention services (x_1)	0.171	0.717
	Model Chi-Square = 57.421	Chi-Square =0.877	
	Negelkerke's R^2=0.010	Significance =0.363	
	Cox and Snell's R^2 = 0.0014	McFadden's R^2 = 0.012	

4.6.1.4 Joint Chi-square Analysis of Agricultural Extension Services and Household Food Security

The results of the chi-square analysis on the impact of utilizing agricultural extension and food security indicate that it is not statistically significant (p-value = 0.388>0.05). The computed chi-square value is 0.851, which is lower than the critical chi-square value. The critical chi-square value for 1 degree of freedom at a 5% level of significance is 3.63.The following factors estimates provide a summary of the impact of each predictor. "There is a positive relationship between the utilization of agricultural extension services and its effect on food shortage, but it is not statistically significant (p-values>0.05). On the other hand, the usefulness of utilizing extension services shows an inverse relationship. The odds ratio (β= -0.221) indicates that the risk of food shortages decreases by 51.3% for individuals who perceive the utilization of agricultural extension services as very useful, compared to households with different views. For those who do not utilize extension services, the risk of exposure to food security is 0.678 times (β=678). Additionally, the odds of experiencing food shortages are 0.924 for those who believe that utilizing extension services contributes to the improvement of the household's well-being (β=-0.924)."

$$y = -0.221x_1 + 678x_2 + 0.924\,x_3 + 0.137$$

Hence, the impact of devolved agricultural extension services on household food security is observed in Table 26

Table 26: Chi-square Relationship between agricultural extension services impact and Household Food Security

Parameter		Estimate (β)	Sig
Threshold	[Frequency of food security=0]	0.137	0.879
Location	AES improves wellbeing (x_3)	0.924	0.677
	AES Utility(x_2)	0.678	0.617
	AES Attending useful (x_1)	0.221	0.692
	Model Chi-Square = 7.835	Chi-Square =0.851	
	Negelkerke's R^2=0.009	Significance =0.363	
	Cox and Snell's R^2 = 0.014	McFadden's R^2 = 0.006	

4.6.2 Hypothesis Testing

The first hypothesis examined the impact of devolved agricultural training on household food security. The statistical analysis, using regression, showed a positive association between farmers training and household food security (R=.252; P>.05). The Pearson chi-square statistic yielded a p-value of 0.627, which is higher than the significance level of 0.05. The critical chi-square value for 1 degree of freedom at a 5% significance level is 3.63. Since the computed chi-square value of 0.627 is slightly lower than the critical chi-square value, we reject the null hypothesis (H_{01}) that states farmers' training has no impact on household food security. The study further suggests that other factors, such as socio-economic conditions, limited use of technology and environmental factors, and inadequate food production due to low input utilization, might contribute to the food security challenges observed.

Hypothesis 2 (H_{02}) states that providing subsidized farm inputs has no influence on household food security. Regression analysis showed a positive association between subsidized farm input and household food security (R=.258; P .05). The person chi-square statistic yielded a p-value of 0.453 which is higher than the commonly used significance level of 0.05. The critical chi-square value for 1 degree of freedom at a 5% significance level is 3.63. Therefore, since the chi-square statistic 0.453 is slightly lower than the chi-square critical value we reject the null hyphothesis that subsidized farm inputs has no influence of household food security.

Hypothesis 3 (H_{03}) suggests that advisory extension services have no impact on households food security. Regression analysis showed a positive association between extension advisory services and household food security (R=371; P >.05). However,

the person chi-square statistic yielded a p value of 0.321 which is slightly higher than the commonly used significance level of 0.05. The critical chi-square value for 1 degree of freedom at 5% significance level is 3.63. Therefore, since the chi-square statistic yileded is lower than the chi-square critical value we reject the null hyphothesis that agricultural advisory services have no impact on household food security.

CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of key findings

Devolution of agricultural extension services including training, subsidized farm inputs and agricultural advisory services empowers farmers to increase their farm produce hence increased accessibility of food at the household. The outcome of this study revealed that Farmers in Makueni County have benefited from different devolved agricultural extension services such as training on drought tolerant crops, seed selection, and farm management, as well as advice on various components of farming and on construction of food storage structures.

The study results indicated that different demographic factors of farmers have different impacts on household food security in the study area. The outcome indicated that 61% of farmers were female of which 87.5% were 40 years and below. This portrayed a mismatch between family leadership and involvement in agricultural activities as 65.4% of respondents were married. The results showed that most of the respondents were Christian and had acquired basic education to high school level.

The utilization, accessibility and availability of different devolved agricultural services varies among different farmers as per study results. Only 54% of respondents were trained on various components of agriculture, 62% of respondents had utilized different subsidized farm inputs, and 58% of respondents had benefitted from advisory services. The overall results concluded that agricultural advisory services made the highest contribution in increasing availability of household food security, followed by subsidized farm inputs and agricultural training. Therefore, it was concluded that devolved agricultural extension services increases availability of food at household through agricultural production.

The study results, showed that farmers training had a significant contribution to household food security. It was also, evidence that, farmers in Makueni County had received training on seed selection, farm management, construction of storage facilities, drought tolerant crops as well as integration of different sources of household food security. The findings showed a marginally positive association that was statistically

significant (R=0.252; p>0.05). The outcome of the study showed farmer training made a statistically significant boost to household food security in Makueni County. According to standardized beta coefficients, training activities improved household food security by about .262 units for every standard deviation rise.

The statistical analysis, using regression, showed a positive association between farmers training and household food security (R=0.252; P>0.05). The Pearson chi-square statistic yielded a p-value of 0.627, which is higher than the significance level of 0.05. The critical chi-square value for 1 degree of freedom at a 5% significance level is 3.63. Since the computed chi-square value of 6.27 is slightly higher than the critical chi-square value, we reject the null hypothesis (H_{01}) that states farmers' training has no impact on household food security. The study further suggests that other factors, such as socio-economic conditions, limited use of technology and environmental factors, and inadequate food production due to low input utilization, might contribute to the food security challenges observed.

Subsidized farm inputs had a moderately contribution to household food security from the study results. The outcome showed that farmers in the study area had benefited from subsidized farm inputs such as fertilizers, hybrid maize seeds, sorghum seeds, land ploughing services, pesticides, crop insurance and credit opportunities. Regression analysis showed a positive association between subsidized farm input and household food security (R=0.258; P>0 .05). The person chi-square statistic yielded a p-value of 0.453 which is higher than the commonly used significance level of 0.05. The critical chi-square value for 1 degree of freedom at a 5% significance level is 3.63. Therefore, since the chi-square statistic 4.53 is slightly higher than the chi-square critical value we reject the hyphothesis that subsidized farm inputs has no influence of household food security.

The study outcome indicated that, advisory extension services offered to farmers in the study area were farming advice, consultation services on seed selection, farm management, credit availability, climate relevant farming techniques. Regression analysis showed a positive association between extension advisory services and household food security (R=0.371; P>0.05). However, the person chi-square statistic

yielded a p value of 0.321 which is slightly lower than the commonly used significance level of 0.05. The critical chi-square value for 1 degree of freedom at 5% significance level is 3.63. Therefore, since the chi-square statistic yileded is lower than the chi-square critical value we reject the hyphothesis that agricultural advisory services have no impact on household food security.

5.2 Conclusion

Based on the study results it was concluded that:

In the study area farmers had received training on different components of farming, benefited from different subsidized farm inputs, and received different advisory services. The study outcome showed a positive association between farmers training and household food security. Changes in training and household food security had statistically significant weak positive connection. The variation in household food security can be related to farmers' training. Despite being there, training had little impact on Makueni County's household food security.

The study outcome revealed a positive association between subsidized farm input and household food security. Variations in subsidized farm inputs and household food security showed a statistically significant weak positive link. The variations in household food security were linked to subsidized farm inputs farmers. Despite being present, subsidized farm inputs farmers have little impact on Makueni County's household food security.

The results of the study showed a positive association between extension advisory services and household food security. The relationship between changes in advisory extension services and household food security was statistically significant but weak. The variance in household food security was ascribed to advisory extension services among farmers. Despite being clear, the contribution of advisory extension services to household food security was little.

Together, devolved agricultural extension services and household food security showed a somewhat positive association. Thus, devolved agricultural extension services were responsible for the county of Makueni’s household food security situation. Although

on a modest scale, there was evidence that devolved agricultural extension services enhanced household food security. Comparatively, when the variation caused by subsidized farm inputs and training was controlled, advisory extension services made the biggest distinctive contribution to enhancing household food security.

5.3 Recommendations

It is evidence that improvement in Makueni County's household food security was made possible by devolved agricultural extension services like as subsidized farm inputs, training, and advisory extension services. To enhance sustainable household food security, the study recommends:

i. Engagement of all stakeholders including farmers, county and national government officials and Non- governmental organizations dealing with agriculture and food security in development and implementation of agricultural training program in order to capture farmers' interests and meet their specific farm needs and requirements
ii. Combine science and indigenous knowledge in implementation of subsidy services. To enable farmers to utilize local knowledge and improve it through modern farming technology in order to use farm friendly inputs such as manure
iii. Development of local agriculture trainers who can reach out effectively to the entire community. This will ensure agriculture advises are given in local language and manuals developed in language that farmers can clearly understand.

5.4 Suggestions for Further Studies

Having noted the various gaps in the realationship between independent and dependent variables. This study reccomends

i. Further study to examine households' efforts in implementing devolved agricultural extension services
ii. Further study to examine factors limiting farmer's utilization of devolved agricultural extension services and investigate other factors influencing household food security.
iii. A study to examine the effects of multiple technologies , which directly affects household food security.

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APPENDICES

Appendix I: Introduction Letter

Dear respondent,

My name is Kalvin Musyoki Malonza, a postgraduate student at Chuka University pursuing Master in Science Community Development. I am carrying out a field research. Kindly take part in the study with assurance that any information you share will be used only for academic purposes and confidentially will be assured. Findings of the study, shall be upon request, be availed to you.

Thank you

Kalvin Musyoki Malonza
(Researcher)

Appendix II: Questionnaire for Households Heads

Dear Respondent,

This research is meant for academic purpose and your responses will be treated with utmost confidence. You are requested to provide honest replies in this questionnaire. Kindly tick where applicable.

Section A: Background Information

1. What is your Gender?
   Male [ ] Female [ ]
2. Kindly specify your age group?
   Below 20 years [ ] 20-30 years [ ] 31-40 year [ ] 41-50 years [ ] 50 years and above
3. What is your religion?
   Christian…….Muslim ……Any other specify……
4. Marital status
   Single [ ] Married [ ] Separated [ ] Widow [ ]
5. Highest level of education
   Primary [ ] High school [ ] Tertiary [ ] University [ ] others…….
   Specify [ ]…….
6. Size of the household
   1-3 members [ ] 4-6 members [ ] 7-9 members [ ] 10 and above [ ]
7. How many hectares of land do you use for farming
   One and below [ ] one and above [ ]
8. Is your household food secure
   Yes [ ] No [ ] neither of the two [ ]

Section B: Farmers Training Services

9. Have you attended any kind of agricultural training from the county government to help you increase food production at the household?
   Yes [ ] No [ ]
10. How beneficial was the agricultural training you attended in improving your agricultural practices?
    .....

11. How often do you attend agricultural training?

    One a month [ ] Twice a month [ ] more than twice a month [ ]

12. Do you think there is need to attend training organized by the county government on agriculture practices? ……

13. Do you think the status of food security has improved in your household after benefiting from devolved agricultural training…….....

14. How many meals do you have at you household now compared to the number of meals you had before receiving training from the county government…….

15. Which area of training have you benefited most from since agricultural training was devolved…….

16. Please mention some areas you would like to be trained on as far as food production is concerned.

    _____

    _____

17. Kindly indicate your level of agreement on the following statements that regard the role of farmers training and development service on household's food security in Makueni County, Kenya. Rate where 1= Strongly Agree, 2 Agree, 3 Moderately Agree, 4 Disagree and 5 = Strongly Disagree

Statement	**1**	**2**	**3**	**4**	**5**
The county has trained farmers on appropriate management techniques for their farms					
There have been training services that used a collaborative approach with the community addressed food insecurity					
Most farmers in my region have been trained on the construction of food storage structures					
Agricultural training and development services have led to improved food production					
Training by the county government has been done adequately on drought tolerant crop varieties, crop insurance, climate-smart agriculture, farming inputs support with a major focus on food security.					

Section C: Subsidized Farm Inputs

18. Do you think the county government is supporting farmers with subsidized farm inputs?

Yes [ ] No [ ]

19. Have you benefited as person from county government subsidized farm inputs?

    Yes [ ] No [ ]

20. How do you get information on availability of subsidized farm inputs in Makueni County?.....

21. Are subsidized farm inputs provided by county government easy available and accessible…….
22. In your opinion has subsidized farm inputs led to improved food security at the household?.....
23. How is the current state of food security at your household since you started benefiting from subsidized farm inputs?.....

24. Kindly indicate your level of agreement on the following statements that regard influence of seeds and fertilizer provision services on household's food security in Makueni County, Kenya. Rate where 1= Strongly Agree, 2 Agree, 3 Moderately Agree, 4 Disagree and 5 = Strongly Disagree

Statement	**1**	**2**	**3**	**4**	**5**
Subsidized farm input especially fertilizer and maize planting seeds have led to increased food security					
The county government of Makueni has distributed fertilizers, hybrid maize seed, and sorghum seeds and land ploughing services at lower rates to farmers					
There is a farmer's empowerment program that provide farmers with subsidized farm inputs such as fertilizers and credits opportunities					
Farmers in Makueni County have benefited from subsidized hybrid seeds and pesticides					

Section D: Advisory Extension Service

25. Have you received any advisory services on farming practices from the county government on agriculture food production?

    Yes [ ] No [ ]

26. Which agricultural extension services have you received from the county government?.....

27. Are county government agricultural advisory services easily accessible to farmers?

    ……

28. Are advisory services offered helped in increasing household food security??

    ……\…….

29. How was the state of food security at the household before you started receiving agricultural extension service?.....

30. How is the current status of food security at the household since you started benefiting from agricultural extension service?.....

31. Kindly indicate your level of agreement on the following statements that regard the role of Advisory extension services on household's food security in Makueni County, Kenya. Rate where 1= Strongly Agree, 2 Agree, 3 Moderately Agree, 4 Disagree and 5 = Strongly Disagree.

Statement	**1**	**2**	**3**	**4**	**5**	
Agricultural extension advisory services are being offered by the county government of Makueni						
Extension advisory services offered by the county government have led to increased food security						
Farmers in Makueni County have received Extension advisory services on different farming methods that have led to increased food security.						
Agricultural extension services have helped farmers to access support funds to enhance farming in Makueni County.						
Agricultural extension services plays a vital role in supporting agricultural production and increasing food security						

Appendix III: Key Informant Interview Guide

Officer in the Ministry of Agriculture

Date of interview……..

1. Gender.

   Male [ ] Female [ ]

2. Department/Office……..

3. Which agriculture and extension services initiatives have the county government established to ensure food security in the county?

   .....

   .....

   .....

4. What is the contribution of the following components of devolved agricultural extension services of food security in Makueni County?

   a. Farmers training

   ……

   ……

   ……

   b. Subsidized farm inputs

   ……

   ……

   ……

   c. Advisory services to farmers

   ……

   ……

   ……

5. In your opinion, to what extent does devolution of agriculture and extension service helped in increasing food production in Makueni County in the last 6 months?

   ……

   ……

   ……

Appendix IV Respondents Consent Form

Question Serial No…….

It has been adequately explained to me and I understand and agree to take part in this study without being cohoused or threatened. Therefore it's in my sound mind I take part in this study and the researcher is not accountable for any wrong information I may give but in the truth of my mind I only give truthful information depending on my understanding.

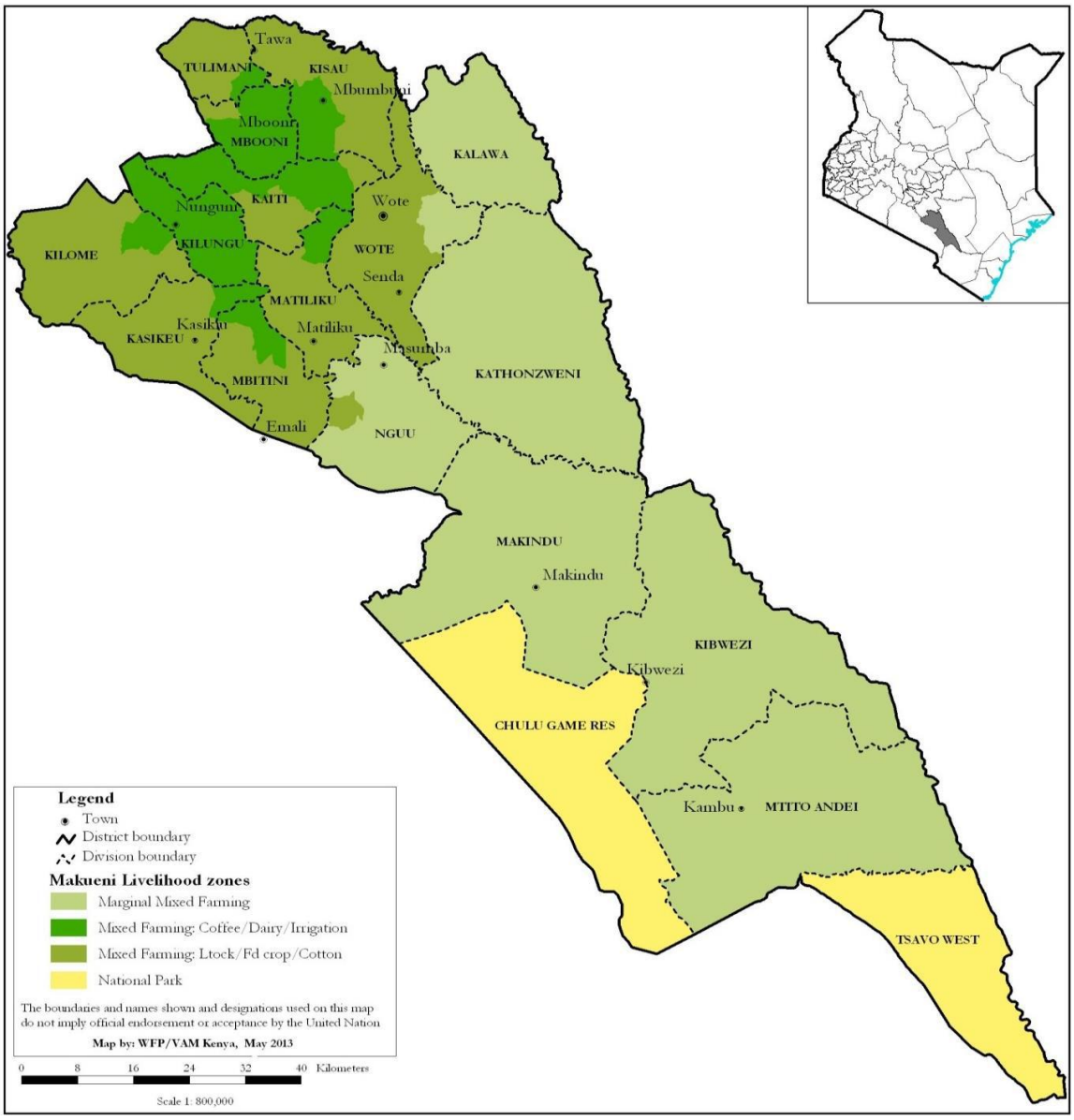
Signature……Date……
……..

Appendix V: Sample Determining Table

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	104	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	1000000	384

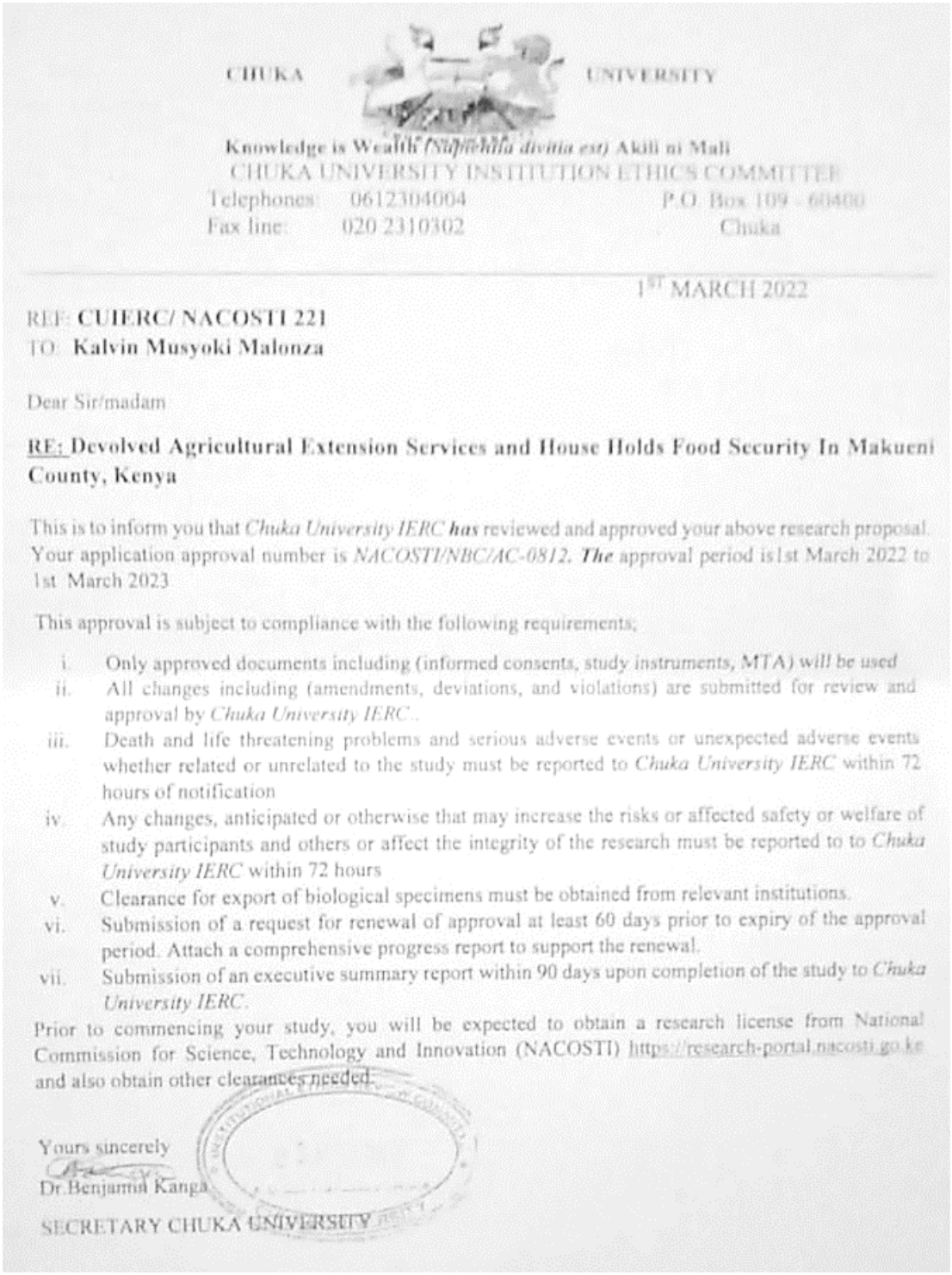
Source: Krejcie, & Morgan (1970).

Appendix VI: Map of Makueni County



Source: https://www.ndma.go.ke/index.php/resource-center/category/37-2015

Appendix VII: Institutional Ethics Review Letter



CHUKA UNIVERSITY

Knowledge is Wealth *(Sapientia divitia est)* Akili ni Mali

CHUKA UNIVERSITY INSTITUTION ETHICS COMMITTEE

Telephones: 0612304004 P.O. Box 109 - 60400

Fax line: 020 2310302 Chuka

1ST MARCH 2022

REF: **CUIERC/ NACOSTI 221**

TO: **Kalvin Musyoki Malonza**

Dear Sir/madam

RE: Devolved Agricultural Extension Services and House Holds Food Security In Makueni County, Kenya

This is to inform you that *Chuka University IERC* ***has*** reviewed and approved your above research proposal. Your application approval number is *NACOSTI/NBC/AC-0812. **The*** approval period is1st March 2022 to 1st March 2023

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by *Chuka University IERC*..
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to *Chuka University IERC* within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to to *Chuka University IERC* within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to *Chuka University IERC*.

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://research-portal.nacosti.go.ke and also obtain other clearances needed.

Yours sincerely

Dr.Benjamin Kanga

SECRETARY CHUKA UNIVERSITY

Appendix VIII: National Commission for Science, Technology and Innovation (NACOSTI) License

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 423324

Date of Issue: 06/June/2022

RESEARCH LICENSE

This is to Certify that Mr.. KALVIN MUSYOKI MALONZA of Chuka University, has been licensed to conduct research in Makueni on the topic: DEVOLVED AGRICULTURAL EXTENSION SERVICES AND HOUSEHOLDS FOOD SECURITY IN MAKUENI COUNTY, KENYA for the period ending : 06/June/2023.

License No: NACOSTI/P/22/18060

423324

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

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