THE IMPACTS OF AGRICULTURAL SECTOR DEVOLUTION ON DELIVERY OF AGRICULTURAL EXTENSION SERVICES AND AGRICULTURAL PRODUCTIVITY IN KITUI COUNTY, KENYA

By

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DECLARATION AND RECOMMENDATION

DECLARATION

This thesis is my original work and has not been submitted for any academic award in any other university.

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RECOMMENDATION

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

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DEDICATION

This work is dedicated to my wife, Eunice Mueni Muasya and my son, Derrick Muasya, for their patience, support, and encouragement during the period of my Ph. D studies. My late father, Kanyele Kyambo, and my mother, Ndilu Kanyele, for prayers and encouragement. In a special way, I want to thank Mr. Benedict Mathitu, Lavender Mwikali, and Purity Mukola for their assistance during data collection.

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LIST OF ABBREVIATIONS AND ACRONYM

ADRA	**:**	Adventist Development and Relief Agency Kenya
ADS	**:**	Anglican Development Services
AFDB	**:**	African Development Bank
ASAL	**:**	Arid and Semi-Arid Lands
ASALI	**:**	A Sustainable Approach to Livelihood Improvement
AEP	**:**	Agricultural Extension Providers
IEA	**:**	Institute of Economic Affairs
ASDSP	**:**	Agricultural Sector Development Support Programme
ASTGS	**:**	Agricultural Sector Transformation and Growth Strategy
AFFA	**:**	Agriculture, Fisheries and Food Authority
ASDS	**:**	Agricultural Sector Development Strategy
CEFA	**:**	European Committee for Agricultural Training
CBO	**:**	Community Based Organization
CDF	**:**	Constituency Development Funds
CAADP	**:**	Comprehensive Africa Agriculture Development Programme
CIDP	**:**	County Integrated Development Plans
EU	**:**	European Union
FAO	**:**	Food and Agriculture Organization
GAP	**:**	Good Agricultural Practices
FFS	**:**	Farmer Field Schools
GDP	**:**	Gross Domestic Product
GIZ	**:**	German International Cooperation
GOK	**:**	Government of Kenya
IFPRI	**:**	International Food Policy Research Institute
IFAD	**:**	International Fund for Agricultural Development
JICA	**:**	Japan International Cooperation Agency
KCEP-CRAL:		Kenya Cereal Enhancement Programme- Climate Resilient Agricultural Livelihoods
KNBS	**:**	Kenya National Bureau of Statistics

KDC	**:**	Kitui Development Centre
LASDAP	**:**	Local Authority Service Delivery Action Plan
MOALF	**:**	Ministry of Agriculture, Livestock and Fisheries
NAR IGP	**:**	National Agricultural and Rural Inclusive Growth Project
NASEP	**:**	National Agricultural Sector Extension Policy
NAEP	**:**	National Agricultural Extension Policy
NGO	**:**	Non-Governmental Organization
SASSOL	**:**	Sahelian Solutions Foundation
SAPs	**:**	Structural Adjustment Programmes
SPSS	**:**	Statistical Package for Social Sciences
SRC	**:**	Salary and Remuneration Committee
SRA	**:**	Strategy for Revitalizing Agriculture
SFA	**:**	Stochastic Frontier Analysis
TA	**:**	Transition Authority
T&V	**:**	Train and Visit
UNDP	**:**	United Nations Development Programme
UBoS	**:**	Uganda Bureau of Statistics
USA	**:**	United States of America
USAID	**:**	United States Agency for International Development
WB	**:**	World Bank
WFP	**:**	World Food Programme

DEFINITIONS OF TERMS

Administrative decentralization: According to Mollah (2007), devolution is the delegation of planning, financing, and management responsibilities within a public entity and its agencies (e.g., the central government) to other units (e.g., county government).

Adoption: This is a process through which a practice or innovation is passed from its invention or generation to its end-use; from the first learning of a new idea to its final use (Rogers & Bsan, 1963).

Agricultural extension: This is an applied behavioral science that aims at introducing changes in the behavior of the farming communities through the implementation of strategies and programs that are geared towards the adoption of improved scientific technologies and innovations (Wilson & Gallup, 1985). In this study, extension will imply that farmers can get extension information three times in a month.

Agricultural sector: According to the Government of Kenya (GoK) (2019), the agricultural sector in Kenya comprises the sub-sectors of crops, livestock, fisheries, land, water, cooperatives, environment, regional development, and forestry. In this study, the agricultural sector refers to crop farming and livestock keeping in Kitui County, Kenya.

Constitution: According to the Free Dictionary (2021), defines a constitution as a document that details the fundamental law that establishes the functions of the government as well as defines the relationship between the government and its citizens. A constitution outlines the basic principles under which a country must conform. In this study, the term "constitution" refers to the law that outlines the governance structures of a country.

County government: Kenya Constitution (2010), defines a county government as a devolved unit of governance in which the constitution is exercised. In this study, "county government" refers to a second-level governance structure through which service delivery is relayed.

Delivery: Delivery refers to the actualization of services to the final recipients, such as customers or clients (Lovelock & Wright, 1999). In this study, service delivery refers to the execution of government functions on behalf of the citizens. Such services may include agricultural extension.

Devolution: According to Kangu (2015), devolution is the delegation of powers from a higher level of governance (e.g. the central government) to a lower level (e.g. the county government). According to this study, devolution is the transfer of government functions from the central government to the county governments.

Facilitation: Any activities that makes tasks for others easy, or tasks that are assisted. In this study, facilitation will be taken to mean an extension officer can execute extension activities with ease (Luke, 1998).

Impact: According to Collins Dictionary (2022), the term "impact" means the effect or influence that something has on a situation, process, or person. In this study, the term "impact" means the contribution of agricultural sector devolution on extension service delivery.

Small scale farmers: According to Food and Agriculture Organization (FAO) (2010), smallholders are identified by the size of their farms based on a threshold size of 2 hectares. In this study, a small-scale farmer was one who owned less than 2.0234 hectares.

ABSTRACT

Agriculture supports the livelihoods of rural people in developing countries, including Kenya. Agriculture is the mainstay and driver of the Kenyan rural economy. Despite the critical role of agriculture in Kenya, poor access to extension support services persists. The study was carried out to evaluate the impact of devolution of the agricultural sector on the provision of agricultural extension services and agricultural productivity in Kitui County. To achieve this objective, the following specific objectives were addressed, namely to: assess the influence of selected socio-economic factors on farmers' awareness of the devolution of agricultural extension services; determine the factors influencing the delivery of extension services by the county governments; establish the interactions between agricultural extension functions run by county and national governments; and assess the impact of agricultural extension services on the farmers' household income with respect to agricultural productivity and income as proxies for the years 2012 (before devolution) and 2016/2017 (after devolution). A total of 70 extension officers and 99 farmers were sampled from Kitui County using a stratified random sampling approach. Secondary information sources such as national and county ministries' reports and existing literature were reviewed to supplement the primary data. A questionnaire was the main tool used for data collection in this study. Data obtained were analyzed through: descriptive and inferential statistics; binary logistic regression; linear regression; and stochastic frontier analysis. The logit binary model showed that age of household, gender, education, income, and size of the land were important factors that influenced farmers' awareness of the devolution of agricultural extension services. Further, this study established that most of the sampled respondents reported insufficient performance in extension service provision by the county government due to challenges such as inadequate transport, salaries not paid on time, lack of proper staff promotion, lack of clear terms of service without duplication, unconducive work environment, and low facilitation for extension activities. There is minimal interaction between agricultural extension functions run by county and national governments due to the minimal involvement of county extension staff in the development and implementation of the work plans as well as monitoring and supervision at the national level. For example, the sampled smallholder maize farmers who had access to agricultural extension services had their yield productivity increase by 16.4%. The devolution of agricultural extension services resulted in a significant improvement in agricultural productivity and farmer's income by 27.2% and 13.8%, respectively. This study recommends that more campaigns with focus on women's groups and elderly farmers should be held in the vast Kitui County to create awareness about the devolution of agricultural extension services. Greater involvement of extension staff in development and implementation of work plan at the national level as well as monitoring/supervision should be enhanced in order to contribute to better interactions between national government and county governments. Also, there is a need to provide incentives to extension officers through adequate facilitation, remuneration, and promotion. Therefore, adequate funds should be allocated to the devolved agricultural extension services, for example, a specified percentage of the agriculture sector budget as a way of enhancing overall agricultural productivity and households' incomes.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Agriculture supports the livelihoods of rural people in developing countries (World Bank, 2021). The contribution of agriculture to the Gross Domestic Product (GDP) in sub-Saharan Africa is approximately 30% (Jayne & Sanchez, 2021). In developing countries, more than 90% of the rural population depends on rain-fed agriculture for food security and income (Hlophe-Ginindza & Mpandeli, 2021). The contribution of the agriculture sector to the GDP in East Africa is about 40%, being a source of livelihood for approximately 80% of the region's residents (Amwata *et al.,* 2018; Amwata, 2020). In Kenya, agriculture (practiced by approximately 75% of the rural population) is mainly rain-fed and geared towards subsistence purposes (Kogo *et al*., 2021). The sector accounts for 33% of GDP and 80% of national rural employment (GOK, 2019). According to Kenya's Agriculture Sector Transformation and Growth Strategy, agriculture may be a very effective means of enabling people to earn a living and a useful tool for the country's economic development (GOK, 2019). The Kenya Vision 2030, together with the Big Four Agenda, recognizes the agriculture sector as an economic pillar focused on the promotion of food security and employment creation (Wanderi & Makandi, 2019). Consequently, it influences the country's poverty incidence levels, nutrition and health, as well as the overall quality of life (Ayieko *et al*., 2021). In order to achieve its goals, the agriculture sector should be supported with respect to productivity (MOALF & C, 2017).

It is generally agreed that the provision of agricultural extension services can enhance agricultural productivity in Kenya (Kogo *et al*., 2021). Agricultural extension can support and facilitate people who are engaged in agriculture through the provision of agro-advisories, bridging the skills and technology gaps for improved livelihoods and well-being (GOK, 2019). Extension services may involve both government agencies as well as private sector actors. In some cases, extension is also provided by NGO's and

producers/farmers organizations. Extension can extend research and technology knowledge to rural farmers, which by extension can improve their welfare. Modern extension services include technology transfer, facilitation, training/learning, linkages to markets and enhancement of partnerships for the benefit of farmers (Davis, 2008). According to the Strategy for Revitalizing Agriculture (SRA), agricultural extension is considered a useful tool in poverty alleviation (MOALF&C, 2017). Consequently, the declining effectiveness of the public extension service can be considered as a major factor that impedes agricultural growth and development. The Strategy for Revitalizing Agriculture (SRA) (GOK 2004), proposed key reforms in the extension systems geared towards linkages between research and technology generation points, the extension system and farmers - the final beneficiaries. The Strategy for Revitalizing Agriculture proposed six policy areas that were to be given first-hand priority - public extension system being among them (Alex *et al.,* 2002; Katz, 2002). There is an ongoing debate that private extension service is more efficient than public extension in service delivery.

Agricultural extension systems in many countries were established with the aim of strengthening their food system (Swanson 2006; Hu *et al.*, 2009). With the support of international organizations, most Asian developing countries (as well as many others around the world) were able to improve their food security by the 1980s (Swanson, 2006). Due to reduction in budgetary allocation in agriculture, many countries were later forced to reform their public extension systems by reducing the numbers of extension workers (Umali & Schwartz, 1994; Feder *et al.*, 1999). In Europe, most reforms were implemented through privatization; while in other countries (e.g. Uganda) they took the form of both decentralization and commercialization (Anderson & Feder, 2004; Rivera, 2004; Hu *et al.*, 2009). With the introduction of privatization, access to public agricultural extension services was reported to be lost in some cases (Anderson & Feder, 2004). It is argued that due to market and system failures, both buyers and sellers experience constraints in effecting transactions and establishing the necessary relationships to engage in demand-driven innovation processes (Klerkx & Leeuwis, 2008). According to Hu *et al.* (2009), reforms such as commercialization were

responsible for greater adoption of new farming technologies such as the use of pesticides and fertilizers in China.

In most African countries, extension services were focused on increasing agricultural productivity, farmers' training, and technology transfers (Dhehibi *et al*., 2020). Some of the approaches that extension services adopted included the Integrated Rural Development Program, training and visit and farmer field schools. In Africa, agricultural extension was reported to have had a significant and positive effect on farmers' knowledge and skills, the adoption of superior technologies, and an increase in productivity (Danso-Abbeam *et al.,* 2018). In Ghana and Mali, use of extension approaches such as FFS was, however, argued to have been an elite driven activity that excluded the poor and less educated (Davis, 2008).

Agricultural extension history in Kenya dates back to the early 1900s (Cheruiyot, 2020). The first remarkable success of agricultural extension in Kenya was introduction of hybrid maize technology in the 1960s and 1970s through integrated approaches and projects (Nagarajan *et al.,* 2019). The integrated approach that Kenya adopted had shortcomings of ineffective management, inappropriate coordination, poor communication among project implementers and low engagement of the community (Ngigi & Busolo, 2019). According to Olayemi *et al*. (2021), use of the T&V approach in agricultural extension helped in improving the quality of staff (officers) through training and establishment of enhanced linkages in Kenya. However, T&V approach was implemented among the more educated and productive farmers in better-off areas. Due to poor development of T&V approach, the system did not incorporate the voices of farmers, thereby resulting in a lack of accountability and unresponsiveness to the needs of farmers. Consequently, sustainable agricultural productivity impact was not recorded, let alone the existence of a positive return on the investment (Gautam & Anderson, 1999).

In 1992, Kenya implemented liberalization and structural reforms, and the funding and delivery of extension services became a combination of public and private arrangements

(Nissanke, 2019). This included contracting of public extension workers, NGO's, farmers' organizations, and private sector. The privatization and commercialization of extension offer great potential, but in order to benefit resource-poor farmers, it requires testing strategies that are participatory, location-specific, and most importantly, flexible and dynamic to local stakeholder needs and resource limits (Davidson, 2007). Governments are working hard to make sure agricultural extension is demand-driven in an effort to deliver effective and efficient services to rural communities. This means tailoring the information, advice, and services to the expressed demands of the recipients (Rivera, 2004). Studies have shown that reforms in agricultural extension are required to ensure that farmer's priorities and conditions are given preference (Davidson, 2007).

According to Kingiri (2021), smallholder farmers have traditionally benefited from government extension systems (through the ministry of Agriculture) as well as commodity-based systems (through the government parastatals, out-grower companies, and cooperatives). The main targets of agricultural extension are both food crops and livestock. Some of the extension models and styles that the Kenyan government has tried include the progressive farmer model approach, integrated agricultural rural development approach, farm management, T&V, attachment of officers to organizations, farming systems approaches, and FFS (Rivera *et al.,* 2001; Amwata *et al.,* 2018). The commodity-based extension model focuses mainly on commercial cash crops. The commodity-based extension model is profit-driven and only works well when all the stakeholders adequately benefit from the expenditures of the extension service. In the commodity-based extension model, all aspects of production and marketing are coordinated vertically (Siankwilimba *et al*., 2022).

The performance of the public agricultural extension service in Kenya has been a subject of discussion for years (Gautam & Anderson, 1999). The agricultural extension service has been perceived as a top-down approach, with extension officers designing extension programmes without farmers' involvement. Quite often, these officers tend to apply these designs to different regions without considering the different agro-ecological zones. It is

considered a major contributor to the poor performance of the agricultural sector (Republic of Kenya, 2005). Consequently, there has been an effort to reform the public agricultural extension service in order to make it cost effective, broad-based, participatory, sustainable, accountable, and responsive to farmers' needs. Smallholder farmers do not only require advice necessary for increased productivity, but also linkages to markets, support in value addition, and diversification of incomes.

Due to the ineffectiveness of the public extension system, private agricultural extension systems have gained increasing popularity (Anderson, 2020). These extension systems comprise private companies, non-governmental (NGOs) and farmers' organizations (Nambiro *et al.,* 2005; Rees *et al.,* 2000). The privatization concept is aimed at increasing the participation of the private sector. With the emergence of private agricultural extension systems in agriculture, a number of concerns have emerged regarding their strengths and weaknesses. An additional concern relates to the role of the government in the private agricultural extension system. To respond to these concerns, the government has been forced to revise the national extension policy through the National Agricultural Sector Extension Policy (NASEP) and its implementation framework (GOK, 2011).

Prior to ushering in the devolved government on March 4th, 2013, following the enactment of the Kenyan Constitution in the year 2010, the agriculture sector comprised of ten (10) separate sub-sectors, namely: crops, livestock, fisheries, land, water, cooperatives and marketing, environment and natural resources, regional development, and development of ASAL's. The devolution of extension services is aimed at taking the services closer to the people and ensures effective service delivery (GOK, 2011). The main setbacks of agricultural extension service in Kenya include inadequate funding, poor staffing and lack of involvement of farmer in planning (Rivera, 2004). In the devolved system, county governments have the mandate to provide extension services and authority to levy taxes on the services they provide (GOK, 2011). The effectiveness of the devolved extension system is dependent on farmer awareness, access to information, and the affordability of extension services (Ragasa *et al.,* 2015). This

responsibility is not only for the county governments but also the national government. This can be achieved through coordination between the two levels of government. More clarity on the roles of each party is crucial. So far, both the county governments and the national government have put in place adequate measures to be able to grow and develop the agriculture sector in the country (Wafula & Odula, 2018).

1.2 Statement of the Problem

There is documented empirical evidence of a relationship between decentralization and service delivery (Ahmad *et al.,* 2008; Besley *et al.,* 2007; Freinkman & Plekhanov, 2009; Kannan, 2013). Unfortunately, most studies have focused on developed countries and a few on selected developing countries of Asia and Latin America. The relationship between decentralization and service delivery in the context of sub-Saharan Africa and particularly in Kenya is scarce (Balunywa *et al.,* 2014; Tshukudu, 2014). A good extension system is the one that istailored to the local context (GOK, 2012). The governance system in Kenya is dedicated to making devolution work thereby encouraging local participation in planning and development program of the government. The citizens are also expected to facilitate service delivery through taxes (GOK, 2011). It follows that it is more reasonable to design programs that fully satisfy the farmers if they are to pay for extension services given to them. The devolution of agricultural sector in Kenya presents an opportunity to increase farmer participation as well as ensure that extension services are delivered in a way that benefit farmers to the maximum. Unfortunately, the agricultural sector faces challenges; extension officers are few and not adequately facilitated; they are unable to reach many farmers (GOK, 2011). There is inadequate literature on this topic leading to significant knowledge gaps as far as the impact of devolution of the agriculture sector on delivery of agricultural extension services and agricultural productivity in Kitui County is concerned. Given the importance of extension services as a tool for improved household food security and income, this study is therefore justified, urgent and very critical.

1.3 Purpose of the Study

The purpose of this study was to evaluate the impact of devolution of the agriculture sector on delivery of agricultural extension services and agricultural productivity in Kitui County.

1.4 Objectives of the Study

The specific objectives of the study were:

i. To assess the influence of socio-economic factors on farmers' awareness of devolution of agricultural extension services
ii. To determine the factors influencing delivery of extension services by the County Government of Kitui
iii. To establish the interactions between agricultural extension functions run by county and national governments
iv. To assess the impact of agricultural extension services to the farmers' agricultural productivity and incomes before (2012) and after devolution (2016/2017).

1.5 Hypotheses

The following hypotheses guided this current study.

$Ho_{1:}$ There is no significant influence of socio-economic factors on farmers' awareness of devolution of agricultural extension services

$Ho_{2:}$ There are no factors influencing the delivery of extension services by the county governments after devolution

$Ho_{3:}$ There is no significant interaction between agricultural extension functions run by county and national governments

$Ho_{4:}$ There is no significant contribution of devolution of agricultural extension services to the farmer's agricultural productivity and income.

1.6 Significance of the Study

This study aimed at providing useful information to a number of actors in the agriculture industry as follows:

i. Farmers: the farmers will have enhanced awareness on how to maximize the use of devolved agricultural extension services to improve their agricultural productivity and income.
ii. County governments: will have facts to redesign their County Integrated Development Plans (CIDP) and enhance agricultural productivity of the county.
iii. Extension officers: more clear structures will be established to enhance efficiency and effectiveness of their operations and to provide farmers with tailor made services based on real needs.
iv. Academia: develop relevant academic programmes and short courses to extension officers based on the level of awareness of farmers on devolution of agriculture.
v. Policy makers: Have access to scientific facts for review of existing or development of new policies to strengthen extension service delivery in the county.

1.7 Scope of the Study

A wide variety of crops exist in Kitui County, for subsistence and commercial purposes. The major food crops include beans, maize, bananas, fruits, vegetables, millet, sorghum, green grams and cassava, among others. This study only focused on maize, the main staple food and the most commonly grown by farmers in order to understand the impact of devolution on maize productivity by farmer's in Kitui County.

1.8 Assumptions of the Study

The study assumed that although most responses are based on recall rather than written records, the information obtained was generally accurate. The study also assumed minimum variation in climatic conditions in the county. It was also assumed that the government policy, economic environment and culture offered synergy on the devolution

of agriculture in the study area. The study also assumed that the devolution of agriculture extension services took place uniformly in the county.

1.9 Limitations of the Study

The poor road infrastructure and rugged terrain were a challenge during data collection and visits to the extension officers and farmers by the researcher. These challenges were circumvented by using a motorcycle to navigate the rough terrain and access most of the remote areas.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Farmers' Awareness of Devolution of Agricultural Extension Services

The decentralization of the agricultural sector in Kenya implies that extension services are devolved from the national to a lower level - the county governments. In Kenya, the devolution of the agricultural sector took effect with the promulgation of the country's 2010 constitution. Devolution involves the distribution of powers to the devolved units (Kibua & Mwabu, 2008). One of the major fundamental goals of devolution was to enhance peoples' participation in decision making on matters affecting their livelihoods (GOK, 2011). Agricultural extension service is one function that was devolved. There is low communities' devolution awareness of agricultural extension services. Awareness is key to the realization of benefits from devolved functions such as extension services (GOK, 2011).

Farmer awareness on matters of devolution of agricultural extension is very important (Muhumed & Minja, 2019). In India, it was found that farmers who were less aware of the interactions between climate change and agriculture were less successful (Chakravarty, 2012; Laary, 2012). In Ghana, farmers who were not aware of hazardous/inappropriate agrochemicals that were prohibited by the government due to lack of extension services, continued with their use, often handling them with less care and eventually leading to their misuse (Gill & Garg, 2014). According to the Institute of Economic Affairs (2006), community members who were not aware of the costs involved in Constituency Development Funds (CDF) projects were found to benefit less from such projects.

Bayard *et al.* (2007) and Mandleni & Anim (2011) noted a negative influence of farmers' level of education on farmer awareness on matters of climate change. They noted that educated farmers had alternative income and were less concerned about matters of agriculture. According to Deressa *et al.* (2009 & 2010), education level was positively associated with awareness of climate change. Similar results were reported by Hassan &

Nhemachena (2008) and Apata *et al.* (2009). Even though the aspect of farmer's awareness has been explored in several studies, none has focused on matters of devolution of agricultural extension services.

Up to 2013, Kenyan agricultural extension services were run by the central government, but now with decentralization, it is fundamental to evaluate to what extent these transformations have influenced the delivery of agricultural extension services and their contribution to agricultural productivity. Enhancing farmers' awareness on devolution of agricultural extension services, offers great potential to foster effective involution in designing policies or program suitable to their specific local situations.

2.2 Factors Influencing Delivery of Extension Services by the County Governments

Agricultural extension is delivered to the farmers through a set of people (including employees from both the county and national governments). The delivery of agricultural extension services in the devolved units is characterized by a lot of inefficiency (Balaguer-Coll *et al.* (2010). It is generally acknowledged that when a change is realized in a system, some possible reactions include: resistance, welcoming, or exhibiting a mixed feeling towards change (Kirkpatrick, 2011).

Any successful change in a system often undergoes a set of logical steps (Kotters, 1996). According to Myrna (2009), change demands a new set of skills and ways of thinking. Most devolved governments did not train their employees on change dynamics to enhance their effective adjustments (Momanyi *et al.*, 2018).

The National Government (in conjunction with SRC) has on several occasions aimed at reviewing the salaries and allowances of public servants. This has, in many cases led to panic among the employees. Most of the employees in County governments have not fully adopted the changes into their new working system, partly because the Transition Authority to Devolved *Government Act of 2012* did not achieve a smooth transition from the former governance structure. There have been constant delays in the disbursement of

funds by the National Treasury to the counties. According to Christopher *et al*. (2013), lack of timely access to devolution funds may hamper service delivery in the devolved units.

2.2.1 Employees Training and skills development

Training and skills development can influence the effectiveness of the delivery of services under devolution. Well trained and developed agricultural extension agents can deliver services effectively for their respective county governments. Kurt (2004) asserts that an employee who is well trained is more productive in his/her job functions. According to Myrna (2009), effective training must be strategic and aimed at improving the knowledge, skills, and abilities of employees to enable them to perform their roles. Effective training is designed to suit the organizations' goals. Agricultural extension agents must be trained in order to be able to contribute to general development of the agricultural system. Training needs analysis is key in knowing the training gaps on the part of the employees. Sean (2010) noted that training helps in the identification and growth of employees' personalities, and hence increases performance.

2.2.2 Employees Motivation

According to Rizwan *et al.* (2010), employees who are motivated perform better than their less motivated counterparts. Employee motivation is dependent on factors such as performance appraisals, satisfaction, compensation, job security, training and development, and organizational structure. Employees who are motivated are more productive in their organizations (Shadare *et al.,* 2009).

A motivated employee identifies himself or herself with the goals and objectives of his/her organization and consequently makes an effort to propel the organization in a particular direction. Rutherford (1990) reported that organizations that persuade and motivate their employees are often more successful and are able to execute improved practices in their work (Kalimullah *et al.,* 2010). According to Kalimullah *et al.* (2010), employees' motivation can result from rewards and consequently lead to job satisfaction

and hence high performance. Most organizations reward their employees through promotions, pay increases, bonuses, and other tools in order to motivate and promote high levels of performance (Reena & Shakil, 2009). Use of salaries in motivation must consider appropriate salary structures that are suitable for every employee (Adeyinka *et al.*, 2007).

2.2.3 Availability of Funds

The Maputo Declaration of 2003 commits countries to fund their agricultural sector by not less than 10 % of their national budget. Kenya is a signatory to Maputo Declaration of 2003. The country has however not been keeping its words. Kenya's share of agricultural sector budget has been decreasing and is hardly more than 10% (although the funding to the sector has been increasing annually). The lack of funds in the counties has often contributed to poor performance of devolved functions, including extension services. Although the constitution requires at least 15% of the national revenue be allocated to the devolved units, more than this minimum has been released (for instance about 40% in the 2013/14 financial year). However, most governors in the devolved units express their feelings that even the 40% of the revenue shared in the counties is not enough. With low budget allocation in the counties, the agricultural sector is not given key attention at the county level with the implications of poor rural development (Rogers, 2014).

In order to revitalize the agricultural sector at the county level, more funding is needed to boost production. There are many initiatives started by both the national and county governments with the aim of revitalizing the agricultural sector at the county level, but with little success. The rationale of budget allocation in Kitui County is often puzzling. For instance, in the 2013/14 financial year, development expenditure took an average share of 14% for the infrastructure sector against only four and two per cent for the agriculture and trade sectors, respectively (Njagi *et al.*, 2014).

2.3 Interactions between Agricultural Extension Functions Run by County and National Governments

The current constitution of Kenya was promulgated in the year 2010. This introduced a major change in the governance framework in Kenya. Two-tier system of governance was established, comprising of a single national government and new 47 county governments. The establishment of a two-tier system of governance was aimed at improving the access of public services to citizens and increasing their participation in governance and development matters. This included the transfer of some administrative functions and mandates (previously carried out by national departments and ministries) from the national government (headed by the president) to the county governments (headed by the governors). After devolution, county governments were allocated the significant responsibilities of promoting the agriculture sector, among other sensitive responsibilities such as health, roads, trade, planning and many other functions. There was a general feeling that the county governments had no capacity to undertake such responsibilities by then (Jessop, 1998).

Some of the challenges that faced the county governments in their execution of the new mandates included the operational challenges (lack of capacities by the county governments' staff) and inadequate budgets (county governments received budget allocation from the national government through an agreed formula). Although the counties were expected to raise their own revenues at their localities, such funds were perceived as meagre. There were concerns that the funds allocated to the counties were generally inadequate to facilitate discharge some of the devolved county functions (Njagi *et al.*, 2014). The six schedule of the constitution stipulated that the devolved county functions shall be: agriculture, health services, pollution, nuisances and advertising control, cultural activities, public entertainment and public amenities, transport, animal control and welfare, trade development and regulation, county planning and development, education and childcare, policy implementation, firefighting and disaster management, control of drugs and pornography; and county public works and services.

The devolved government is found in chapter eleven of the Kenya constitution, part 174 of the Section 29 of the Fourth Schedule, which states that the National government is responsible for agricultural policy making while the counties are supposed to act in accordance with the policies of the national government. According to Part 2 (Section 1 of the Fourth Schedule), the roles of county governments in agriculture include: crop and animal husbandry; managing the livestock sale yards; running abattoirs; plant and animal disease control; and fisheries, while the national government is mandated to act as a regulator of the agriculture sector by way of policy formulation. Counties are mandated to implement national policies on agricultural services and act as facilitators/providers of such services in their devolved units (Simiyu, 2015). This is explained in Table 2.1 below.

Table 2.1: **Functional distribution in agricultural sector between the national and county governments**

National government	County government	Functions not assigned and not clear who will carry them out
‣ Agricultural Policy ‣ Veterinary Policy (including regulation of the profession) *Related sector* ‣ Trade development and regulation including markets, fair trading practices, and cooperative societies ‣ Certain aspects of natural resources and environmental conservation including soil and water conservation, and forestry ‣ Water services including storm water conservation (damming, etc.)	‣ Crop and animal husbandry ‣ Livestock sale yards ‣ County abattoirs ‣ Plant and animal disease control ‣ Veterinary services (excluding The regulation of the profession) ‣ Animal control and welfare; and fisheries *Related sector* ‣ Protection of environment and natural resources including fishing, hunting and gathering, protection of animals and wildlife, water protection, securing sufficient residual water and safety of dams	‣ Regional Development ‣ Development of Northern, Arid, and Semi-Arid Lands ‣ Animal and plant health inspectorate ‣ Plant and animal research ‣ Livestock extension Programmes

Source: Constitution of Kenya, 2010. Fourth Schedule

2.4 Contribution of Extension to the Farmer's Household Well-being, Agricultural Productivity and Income

According to the Republic of Kenya (2004); ASDS (2010) and ASTGS (2018), agricultural extension is a major contributor of agricultural productivity, farmers' incomes and household well-being and thus a key tool in the fight against poverty as underscored in the national agriculture strategy and policy documents. Strategy for Revitalizing Agriculture (SRA) was a response to poor economic situation in the country (1992–2000). Strategy for Revitalizing Agriculture (2004), clearly identified extension services as a key area that required immediate action and one among the six interventions that required fast-tracking. The effectiveness of the agricultural extension services (especially public extension) was identified as a key factor that was identified to affect the growth of the Kenyan agricultural sector. Strategy for Revitalizing Agriculture (SRA) suggested some reforms of the extension service system that were aimed at creating better linkages between research, extension and farmers (the beneficiaries). Similarly, GoK (2019) recognizes the contribution of extension in promoting agricultural productivity and contributes significantly to poverty reduction through boost in food crops production and incomes of semi-arid and high rainfall areas of Kenya.

Smallholder farmers have traditionally benefited from the government extension system since independence (Bourne *et al*., 2021). The Ministry of Agriculture has for many years prioritized on food crops through agricultural extension services. Several agricultural dissemination methods and approaches have been implemented in Kenya since its independence (Kiptot & Franzel, 2019). Some of the key approaches in the Kenyan history include: field days, farmer field schools, mass media, information desks, training and visit, common interest groups, demonstration, and agricultural shows/exhibitions. Use of these approaches was criticized for not reaching as many farmers as possible as well as low technology adoption (Dixon, 2010). Some of the reasons for this trend were the low numbers of extension officers against an increasing number of farmers. Coupled with poor infrastructural support, the few available extension officers were not able to have a meaningful impact on the large population of farmers (Ireri *et al*., 2021).

Commodity-based extension is a profit motivated system that is operated by government parastatals, out grower companies, cooperatives and mainly deals with cash crops. Commodity-based systems work best when all parties (parastatals, out grower companies, and cooperatives) benefit from the extension expenditures. There is vertical integration of all aspects of production and marketing in terms of research, advisory, and material support.

After the implementation of structural adjustment programmes (SAPs) in the 1980s, the Kenyan government came under considerable pressure to scale down their dominant role in national economies (FAO, 1997). This included reducing the budget allocation to agricultural extension and a cut in the number of extension staff. Consequently, extension services had their budgetary allocations reduced from six percent to about two percent of the overall country's annual budget (GoK, 2005). This compromised the effectiveness of the public agricultural extension service in the country (Gautam &Anderson, 1999).

The National Agricultural Extension Policy (NAEP) was formulated in the year 2001 to help in improving the delivery of extension services (Toroitich, 2021). The National Agricultural Sector Extension Policy (NASEP) (2012) is aimed at diversifying, decentralizing, and strengthening extension services in Kenya while ensuring their sustainability and significance to farmers. The National Agricultural Extension Policy was to harmonize extension work and create a meaningful coordination mechanism between the government and other stakeholders in the agricultural sector. The National Agricultural and Livestock Extension Programme (NALEP) and the NALEP Implementation framework were products of NAEP. However, NAEP is criticized as being ambiguous and does not spell out the specific roles of various stakeholders in extension service delivery (Republic of Kenya, 2005).

2.5 Theoretical Framework

Active participation is a key factor in the realization of sustainability of rural development among the rural population (Uphoff *et al.*, 1979). Active participation calls for the involvement of all levels of government (both national and devolved) in the design, implementation, and evaluation of rural development programmes. The complex rural development process is not easily achieved through the conventional top-down approach to extension. Successful rural development calls for decentralization in programme planning, funding, implementation, and evaluation of interventions (Cheema & Rondinelli, 1983). Active participation of rural population in the development of intervention programmes requires the provision of extension services at both national and county levels.

Decentralization of intervention programmes could ensure the successful delivery of extension services (Wafula & Odula, 2018). A decentralized extension approach is more effective, efficient, and responsive to the needs of the targeted beneficiaries as compared to a centralized extension approach. Decentralization of agricultural extension services is a complicated process that requires careful planning, design, and implementation. A decentralized extension system requires a huge expenditure for successful implementation. Trinidad's decentralized extension system was noted to demand more levels of planning and management as compared to the non-decentralized system (Seepersad & Douglas, 2002). World Bank study of decentralization efforts in developing countries during the early 1990s found that only six out of nineteen countries showed varying levels of success in decentralizing their extension systems. `Colombia, Jiangxi (China), the Philippines, and Nusa-Tenggarra-Timor (Indonesia) were relatively highly decentralized, while Poland and Tunisia showed some evidence of decentralization (World Bank, 2000).

A successful decentralization process is a product of three major ingredients. The first ingredient requires a transfer of specific decision-making functions to a lower level (e.g. a local or county government) from a higher level (e.g. national or regional). Such

transferred functions should include both managerial functions as well as technical functions. The second ingredient is public participation. This implies the involvement of the intended beneficiaries in the decision-making process on matters of programme design, planning and implementation. The third ingredient is the involvement of the local governance system. This may include the involvement of the county government as well as other local institutions such as private companies and NGOs. Figure 2.1 shows the framework of the devolution process that was adopted in this study.

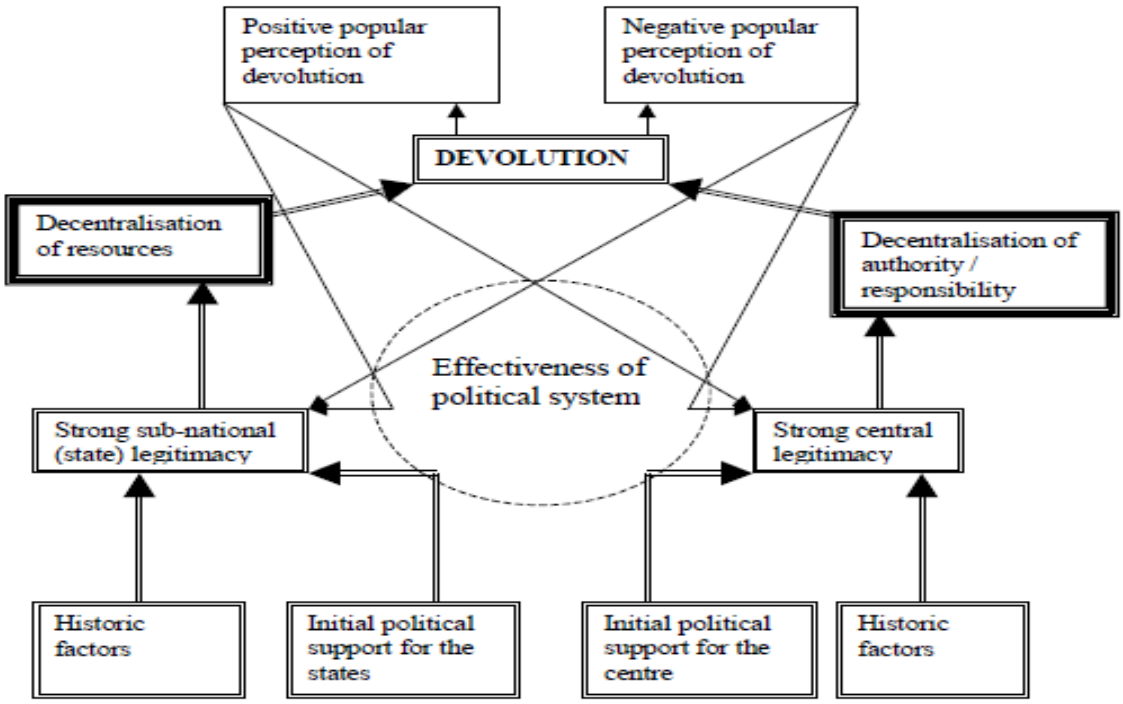

Figure 2.1: An illustration of the complex process of devolution
Source:http://www.tegemeo.org/index.php/component/easyblog/entry/how-has-dev/

Beginning at the bottom of the diagram, the legitimacy of sub national and national government is determined for the most part by processes of history and respective political support of the former culture language, and religion have traditionally been the factors behind a strong regional identity and determine the legitimacy of sub national claims.

2.6 Conceptual Framework

The conceptual framework outlines the approach that has been used to study the impact of agricultural sector devolution on the delivery of extension service and productivity in the study area as shown in Figure 2.2. The independent variables included in the study was to assess farmers' awareness of devolution of agricultural extension services, determine the factors influencing delivery of extension by the county government, to establish agricultural extension services run by the county and national government and link between them and their contribution to farmers agricultural productivity and incomes while the dependent variable was the delivery of extension service, dependent variable was measured as proportion of the farmers receiving extension service in the study area. Intervening variables were isolated to understand their effects on the dependent variable. These included the education levels of extension agent, agricultural policies by national government and extension programme of the national government. During hypothesis testing, the effects of education level of extension agent, agricultural policies by national government and extension programme of national government were isolated by testing any relation they have with the delivery of extension service in the study area.

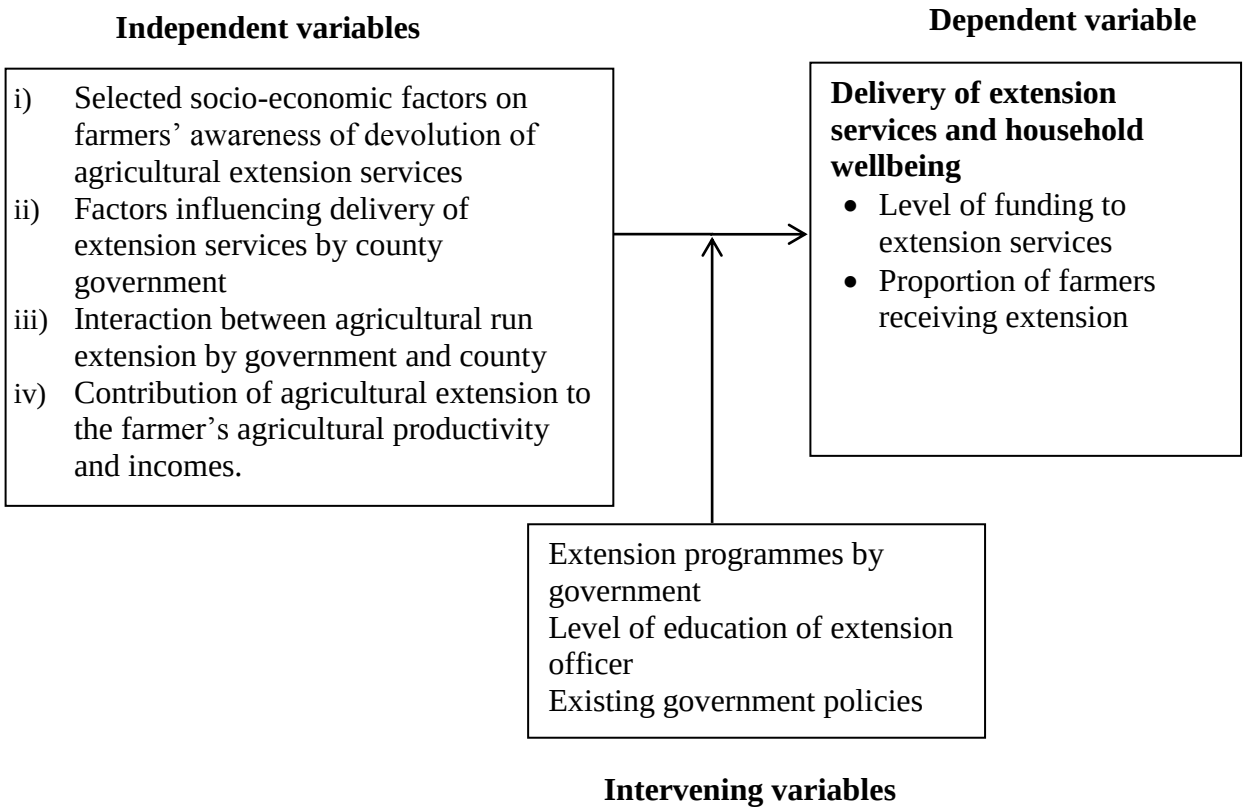

Figure 2.2: Conceptual Framework showing relationships among the variables

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

The study used an *ex post facto* descriptive survey design. This design was appropriate for the study because it enables the description and exploration of the effect of devolution of agricultural sector on the delivery of extension services in the selected study area. This type of design involves data collection after a naturally occurring event. It involves collection of information from a sample that has been drawn from a population that has received a natural treatment not designed by researcher (Fraenkel *et al.,* 2012). The study describes the factors that affect the devolution of extension services. This design is appropriate for the study since it facilitates the collection of information from a sample of a population in order to describe their characteristics as they relate to the facts (Kerlinger, 1979). In this study, the characteristics of the sampled extension agents were described and delivery of services clearly documented. In addition, the design provided an accurate descriptive analysis of the characteristics of a sample, which can be used to make inferences about the population.

3.2 Study Area

3.2.1 Location of Kitui County

This study was undertaken in Kitui County in Kenya (located in eastern region - lower part, about 160 km east of the country's capital city). Kitui County lies between $0^{\circ}10'$ and $3^{\circ}0'$ south in terms of latitudes and $37^{\circ}50'$ and $39^{\circ}0'$east in terms of longitudes. The county is the sixth largest in Kenya in terms of land area (approximately 30,496.4 square kilometres) – however, about 6,369 Km^2 is part of Tsavo East National Park. The county is bordered by Taita Taveta (South), Makueni (West), Machakos (Northwest), Tana River (East), Embu and Tharaka Nithi (North). Administratively, Kitui County has eight sub-counties: Mwingi Central, Mwingi West, Kitui Central, Kitui East, Kitui Rural, Kitui South, Kitui West and Mwingi North. The county has a total of 40 administrative wards and 247 local villages. The county has a population of 1,136,187 according to 2019

census comprising 262,942 households (Kitui County Government, 2021). The map of Kitui County is shown in Appendix C.

3.2.2 Physical and Topographic Features

The general landscape of Kitui County is flat and gently slopes down towards the east and northeast where altitudes are as low as 400 meters. The county is predominantly arid and semi-arid with very erratic and unreliable rainfall. There are several highlands in the county such as Mutitu Hills, Migwani, Mumoni, Kitui Central, Mui and Yatta plateau that receive high rainfall relative to the lowlands of Kyuso, Nguni, and Tseikuru. Kitui County has an altitude ranging between 400m - 1800m above sea level (Kitui County Government, 2021).

3.2.3 Ecological Conditions

Kitui County has numerous natural resources such as forests, rivers (permanent and seasonal), hills, wildlife, and rocks. The county is divided into four agro ecological zones: Arid-Agro-pastoral area, Semi-Arid farming zone, Semi-arid ranching areas and Arid-Pastoral Zone. The Semi-Arid farming zone is further divided into: UM3, UM3-4 (transitional marginal coffee zone), UM4 (sunflower-maize zone or Pigeon peas maize zone), LM3 (cotton zone), LM4 (marginal cotton zone), LM5 (livestock-millet zone), LM6 and IL6 (semi-arid ranching zones) and IL5 (livestock and millet production zone). (ADRA, 2016).

3.2.4 Climatic Condition

Kitui County is hot, dry with erratic low rainfall. The county is largely arid, with a few parts classified as semi-arid. The county experiences temperatures that range from 14°C to 34°C. The hot months are between September and October, and from January to February. The county's annual rainfall ranges from 500 – 1050 mm. The pattern of rainfall is mainly bi-modal - two major seasons of rain per year. The long rain season is experienced between March to May while the short rains season is experienced between

October and December. The short rain season is more reliable than the long rain season (Jaetzold *et al*., 2006).

3.2.5 Socio – Economic Setting

Socio – economic status of any locality is very key in rural development (Li *et al*., 2019). According to the population and household census report of 2019, Kitui County's population of 1,136,187 was comprised of 587,151 females, 549,003 males and 33 intersex. The county population growth rate stands at 2.1% (lower than Kenya's growth rate of 2.6%). High population can raise pressure on the resources of a study area. There is high dependency ratio in the county. The county has a high population of children, as shown in the 2019 census report, where the population between the ages of 0-14 years, was 238,928 males and 232,820 females that represented 46.6% of the total population.

Major economic activities in the county include small scale farming, beekeeping, trade, and ecotourism. Some of the major agricultural products from Kitui County include fruits, cowpeas, maize, beans, pigeon peas, and lentils. The key fruits from the county include mangoes, paw paws, and watermelons (Masila, 2015).

3.3 Population of Study

The study population consisted of farmers and extension officers. The target population was all farming households (262,942) and extension officers (228) in Kitui County.

Sample size determination and Sampling Procedure

To come up with an appropriate sample size, the Nassiuma (2000) formula for Sample size determination was used.

$n = NC^2 \div C^2 + (N-1)\, e^2$

Note:

n=sample size;

N=population size;

C=Coefficient of variation which is ≤30%;

e=margin of error which is fixed between 2-5%).

The study sample was calculated at 20% coefficient of variation and 2% margin of error. Twenty percent coefficient of variation was used to ensure that the sample was wide enough to justify the results being generalised for the Kitui County. Higher coefficients of variation were not used to avoid very large samples due to limitation of research funds. Two percent margin of error was used because the study used an ex-post facto survey, whereby the independent variables could not be manipulated, and hence necessitating a relatively higher margin of error. Population size was 228 extension officers and 262,942 households in Kitui County.

Calculation of sample size

Farmers

$n = NC^2 \div C^2 + (N-1)\ e^2$

n = 262942× 400 ÷ 400+ (262942- 1)4

105176800 ÷ 1052164 =

99.96

Extension officers

$n = NC^2 \div C^2 + (N-1)\ e^2$

n = 228× 400 ÷ 400+ (228 - 1)4

91200 ÷ 1308 = 69.72

The final calculated sample size comprised a total of 69.75 extension officers and 99.96 farmers. A stratified random sampling approach was used to get the study sample. An additional two extension officers and nine farmers were also included in the final sample size in order to compensate for natural attrition.

3.4 Instrumentation

A questionnaire was designed and used as the main instrument of data collection for extension officers in Kitui County. The questionnaire which was used for the agricultural extension officers and farmers are presented as Appendix A and appendix B, respectively. Questionnaires were used simply because they can reach a large number of respondents within a short time, they give the respondents adequate time to respond to the items, offers a sense of security and confidentiality to the respondents and lastly they tend to be objective since there is no bias resulting from the personal characteristics (Ogula, 2005). It is also useful in that the type of response to each question facilitates consistency across the respondents (Casley & Kumar, 1988). The items of the questionnaire were developed on the basis of the objectives of the study. The instrument was self-administered to the agricultural extension officers, farmers, but the researcher was available to assist in case of difficulty in filling questionnaires. The questionnaire consisted of structured and closed ended questions.

3.4.1 Validity

Peers at South Eastern Kenya University were requested to review the instrument to address aspects of validity, including content, construct, and face validity. The validation of the instrument was aimed at ensuring the instrument measured what it was intended to measure (Kathuri & Pals, 1993).

3.4.2 Reliability

The instrument was pre-tested for its reliability with a sample of twenty farmers and twenty agricultural extension officers in parts of Machakos County. Twenty farmers and Twenty extension officers was chosen for pre-test because according to Kathuri & Pals (1993), it is the smallest number that can yield meaningful results on data analysis in a survey research. Consistency of reliability alpha coefficient of 0.70 or more was acceptable. According to Fraenkel, & Wallen (1993), reliability alpha coefficient should be at least 0.70 for research purposes in social sciences. If reliability alpha coefficient was less than 0.70, revision of the instrument was done accordingly. A high alpha

coefficient of 0.70 and above implies that the items correlate highly among themselves and there is consistency among the items in measuring the concept of interest. Desk-review and Secondary data were collected from relevant national and county government offices to complement the primary survey data.

3.5 Data Collection Procedures

Upon receiving an authority letter from the Board of Postgraduate Studies of South Eastern Kenya University and a research permit from the National Commission for Science, Technology, and Innovation (NACOSTI), field work was initiated to collect relevant data for this study. The researcher sought authority to collect data from the County Commissioner. A schedule for the visits to meet the respondents was then prepared with the assistance of agricultural extension coordinators and frontline extension workers. The questionnaire was administered to the sampled extension officers and farmers.

3.5.1 Objective one: To assess the influence of socio-economic factors on farmers' awareness of devolution of agricultural extension services

Stratified sampling and simple random sampling procedures were used to identify the farmers. In each ward, at least 2 farmers were selected for the study based on the size of the Ward, which was reflected by the number of villages. Table 3.1 shows the distribution of the farmers sampled per ward.

Table 3.1: Sample size determination of farmers

SUB-COUNTY/ CONSTITUENCY	NO. OF WARDS	WARDS	SAMPLE POPULATION
Kitui Central	5	Miambani, Kitui Township, Kyangwithya West, Mulango, Kyangwithya East	10
Kitui West	4	Mutonguni, Kauwi, Matinyani, Kwamutonga/Kithumula	8
Kitui East	6	Zombe/Mwitika, Nzambani, Mutitu/Kaliku, Chuluni, Voo/Kyamatu, Endau/Malalani	18
Kitui South	6	Ikanga/Kyatune, Mutomo, Kanziko, Athi Mutha, Ikutha,	24
Kitui Rural	4	Kisasi, Mbitini, Kwavonza/Yatta, Kanyangi.	8
Mwingi North	5	Ngomeni, Kyuso, Mumoni, Tseikuru, Tharaka	10
Mwingi West	4	Kyome/Thaana, Nguutani, Migwani, Kiomo/Kyethani	8
Mwingi Central	6	Kivou, Nguni, Nuu, Mui, Waita, Mwingi	12
Total	40		98

Source: Kitui County Villages Act, 2015

3.5.2 Objective two: To determine the factors influencing delivery of extension services by the County Government of Kitui

Stratified sampling and simple random sampling procedures were used to identify the extension officers. In each ward, at least 2 extension officers were selected for the study based on the size of the Ward, which was reflected by the number of villages. Table 3.2 shows the distribution of the farmers sampled per ward.

Table 3.2 Sample size determination of extension officers

SUB-COUNTY/ CONSTITUENCY	NO. OF WARDS	WARDS	SAMPLE POPULATION
Kitui Central	5	Miambani, Kitui Township, Kyangwithya West, Mulango, Kyangwithya East	10
Kitui West	4	Mutonguni, Kauwi, Matinyani, Kwamutonga/Kithumula	6
Kitui East	6	Zombe/Mwitika, Nzambani, Mutitu/Kaliku, Chuluni, Voo/Kyamatu, Endau/Malalani	12
Kitui South	6	Ikanga/Kyatune, Mutomo, Kanziko, Athi Mutha, Ikutha,	12
Kitui Rural	4	Kisasi, Mbitini, Kwavonza/Yatta, Kanyangi.	8
Mwingi North	5	Ngomeni, Kyuso, Mumoni, Tseikuru, Tharaka	10
Mwingi West	4	Kyome/Thaana, Nguutani, Migwani, Kiomo/Kyethani	8
Mwingi Central	6	Kivou, Nguni, Nuu, Mui, Waita, Mwingi	12
Total	40		70

Source: Kitui County Villages Act, 2015

3.5.3 Objective three: To establish the interactions between agricultural extension functions run by county and national government

Same procedure as objective two was used.

3.5.4 Objective four: To assess the impact of agricultural extension services to the farmers' agricultural productivity and incomes before (2012) and after devolution (2016/2017). Same procedure as objective one was used.

3.6 Data Analysis Procedures

The coded data was exported into STATA program version 16.0 for subsequent analysis. Before the actual analysis, the data was cleaned of any outliers and entry errors. In this study, descriptive and inferential statistics through econometric models were used to analyze data. The inferential statistics modeling, binary logistic regression, Chi-square test, linear regression, and Stochastic Frontier Analysis (SFA) were used.

Table 3.3: Hypothesis testing matrix

Hypothesis	Independent variable	Dependent variable	Statistical tool	Reason
H_{o1}	Selected socio-economic factors	Farmers' awareness of devolution of agricultural extension services	Binary logistic regression Chi-square test	Binary dependent variable
H_{o2}	Factors influencing delivery of extension services by county government	Delivery of extension services and productivity	Binary logistic regression Chi-square test	Binary dependent variable
H_{o3}	Interaction between agricultural run extension by government and county	Delivery of extension services and productivity	Linear Regression	How selected factors influence the interactions
H_{o4}	Contribution of agricultural extension to Farmer's agricultural productivity	Delivery of extension services and productivity	Stochastic Frontier Analysis	Technical efficiency to assess productivity

3.6.1 Binary logistic regression

This regression modeling was used to assess the influence of selected socio-economic factors on farmers' awareness of devolution of agricultural extension services (objective one) and to determine and prioritize the factors influencing delivery of extension services by the county governments.

Letting Y be the binary response variable, it was assumed that $P(Y=1)$ is possibly dependent on $\vec{x}$, a vector of predictor values. The goal is to model

$$p(\vec{x}) \equiv P(Y=1 \mid \vec{x}) \qquad \text{Equation 3.1}$$

Since Y is binary, modeling $p(\vec{x})$ is really modeling $E(Y \mid \vec{x})$, which is what is done in OLS regression, with a numerical response.

If we model $p(\vec{x})$ as a linear function of predictor variables, e.g.,

$$\beta_0 + \beta_1 x_1 + \ldots + \beta_p x_p + \text{e} \qquad \text{Equation 3.2}$$

Then the fitted model can result in estimated probabilities which are outside of [0,1]. What tends to work better is to assume that

$$p(\vec{x}) = \frac{\exp(\beta_0 + \beta_1 x_1 + \ldots + \beta_p x_p)}{1 + \exp(\beta_0 + \beta_1 x_1 + \ldots + \beta_p x_p)} \qquad \text{Equation 3.3}$$

where $x_1,\ldots,x_p$ may be the original set of explanatory variables, but the predictors may include transformed and constructed variables.

It can be noted that

$$\log\left(\frac{p(\vec{x})}{1-p(\vec{x})}\right) = \beta_0 + \beta_1 x_1 + \ldots + \beta_p x_p . \qquad \text{Equation3.4}$$

$\log\left(p(\vec{x})/[1-p(\vec{x})]\right)$ is called the *logit*. The model for the logit is linear in the predictors. Therefore:

$$\hat{\beta}_0 + \hat{\beta}_1 x_1 + \ldots + \hat{\beta}_p x_p \qquad \text{Equation 3.5}$$

is, the corresponding estimate of $p(\vec{x})$ will be between 0 and 1.

The unknown parameters (the coefficients, $\beta_0, \beta_1, \ldots, \beta_p$) are typically estimated by maximizing the likelihood,

$$\prod_{i=1}^{n} \left\{ p(\vec{x})^{\,y_i} \left[1 - p(\vec{x}_i) \right]^{1-y_i} \right\}, \qquad \text{Equation 3.6}$$

which is just an expression for

$$P(Y_1 = y_1, \ldots, Y_n = y_n \mid \vec{x}_1, \ldots, \vec{x}_n). \qquad \text{Equation 3.7}$$

3.6.2 Linear Regression

Linear regression was used to establish the factors that influence the interactions between agricultural extension functions run by county and national governments. The effectiveness of communication and linkages between national and county governments was quantified and selected factors were assessed on how they influenced the interactions. In multiple regression, the dependent variable, Y, was defined as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon \qquad \text{Equation 3.8}$$

Where;

Y = Dependent variable (extent of interactions between national government and county government);

β_0 = Constant term;

X_1 = Level of involvement of extension staff in development of work plan in the national government

X_2 = Level of involvement of extension staff in implementation of work plan in national government

X_3 = Level of involvement of extension staff on monitoring/supervision of agricultural extension programmes/projects in the national government

ε = error term of the model.

3.6.3 Stochastic Frontier Analysis

The study considered the technical efficiency of the smallholder farmers as the outcome variable in measuring the influence of devolution of agricultural extension services on

farmers' agricultural productivity (Wassie, 2014). In this study, technical efficiency refers to the ability of a given level of inputs to produce maximum output at the frontier, and any deviation from these frontier outputs is considered as technical inefficiency (Coelli *et al*., 2005).

The study employed a threefold Blinder–Oaxaca (B-O) decomposition of Stochastic Frontier Analysis (SFA) in analyzing influence of devolution of agricultural extension services on farmers' agricultural productivity. The B-O decomposition developed by Blinder (1973) and Oaxaca (1973) is popular in the decomposition of differences in outcome variables based on different groups in a counterfactual manner (Jann, 2008). Further, Stochastic Frontier Analysis (SFA) introduces the stochastic term to represent the effect of statistical noise into the deterministic model to form a composite error term and thus a superior method of productivity analysis.

Several studies have employed B-O decomposition to assess differences in agricultural productivity due to adoption of devolved agricultural extension services, while numerous others have employed the Stochastic Frontier Analysis (SFA) method in agricultural productivity (Nonthakot & Villano, 2008).

Crop yield (output) is a function of a set of inputs. This production function can be illustrated as follows:

$$Ln(Y_{ij}) = X'_{ij}\beta_j + \mu_{ij}$$

Equation 3.9

Where $Ln(Y_{ij})$ is the crop yield (in logs), X'_{ij} is a vector of determinants of yield, β_j are the parameter vectors and $\mu_{ij}$are i.i.d. error terms that follow a bivariate normal distribution.

Given two groups of smallholder farmers based on adoption of devolved agricultural extension services (adopters and non-adopters), outcome variable, agricultural productivity $Ln(Y)$; and a set of independent variables ($X_i\beta_i$), the first step of the B-O

decomposition is to estimate agricultural productivity regressions for adopters and non-adopters of devolved agricultural extension services separately.

$$Ln(Y_A) = X_{Ai}\beta_A + \mu_{Ai}$$

$$Ln(Y_{NA}) = X_{NAi}\beta_{NA} + \mu_{NAi}$$

Equation 3.10

where A and NA represent adopters and nonadopters respectively; $Ln(Y)$ represents the outcome variable (agricultural productivity); Xi is a set of independent variables; βi represent the slope parameters and the intercept; and μi are the error terms.

To determine the respective outcome equations, this study used the stochastic frontier production function using the translog specification for technical efficiency estimation.

It is acknowledged that several other studies have specified a Cobb-Douglas production function in representing the frontier function. However, this study takes Cobb-Douglas as not an ideal choice since it imposes a severe prior restriction on the farm's technology by restricting the production elasticities to be constant and the elasticities of input substitution to unity (Nonthakot &Villano, 2008).

Coelli *et al*. (2005) developed a stochastic frontier production model that includes a decomposition of the error term, e_i into v_i and μ_i. The model is specified as:

$$lnY_i = \beta_0 + \sum_n \beta_{ni} lnX_{ni} + e^{\ln(v_i - \mu_i)}$$

Equation 3.11

Where:

Y_i are a set of outputs from a specific farm

X_{ni} are a set of inputs from a specific farm

v_i is the usual two-sided random error

$u_i$is the non-negative (one-sided) technical inefficiency component of the error term

$e^{\ln(vi - ui)}$ = is the usual error term

The noise component of the error term is assumed to be *iid* and symmetric, distributed independently of u_i. Premised on the *iid* assumption, the use of OLS to estimate the above equation would yield consistent estimates of the β_n, but not of β_0, since E (e_i) = $-E(u_i) \leq 0$. Therefore, farm-specific technical inefficiencies cannot be estimated using OLS regression alone.

Just like Coelli *et al*. (2005) model, the estimation of technical inefficiency depends on the assumed distribution of the one-sided error term u_i. Four possible distribution assumptions have been proposed among which the half-normal distribution of the one-sided error term has been frequently applied. The other three assumptions (exponential, truncated-normal, or gamma-normal distributions) are not highly assumed. This study assumed a half-normal distribution of the one-sided error component due to its wide usage in agricultural production economics with cross-sectional data.

The translog stochastic frontier model can be specified as follows: (Coelli *et al*., 2005).

$$LnY_i = \sum_{k=1}^{4} \beta_k \ lnX_{ik} + \frac{1}{2}\sum_{k=1}^{4}\sum_{k=1}^{4} \beta_k \, lnx_{ik} + \ v_i - u_i$$

Equation 3.12

Where LnY_i denotes the natural logarithm for crop yield of the i^{th} farmer, X_{ik} represents inputs used by the i^{th} farmer. These include: labour, seed, land size, manure and fertilizers. β is a vector of the parameters to be estimated, $v_i - u_i$ is the composed error term where, $u_i \geq 0$

The density function of $u \geq 0$ *(*assuming a half-normal distribution of u *(*i.e. $\mu_i \sim iidN^{+}0.\sigma_\mu^2$) and normal distribution of (i.e. $v_i \sim iidN(0.\sigma_v^2$)) can be written as follows:

$$f\ (u) = \frac{2}{\sqrt{2\pi\delta_u}} . \exp\left\{-\frac{u^2}{2\sigma_u^2}\right\}$$

Equation 3.13

This implies that the log likelihood function can be expressed as follows:

$$lnL = Constant - \frac{1}{2}\ ln\sigma_u^2 - \frac{1}{2\sigma_u^2}\sum_i u_u^2$$

Equation 3.14

The density function of *v* will be the standard density function. Given the assumption of independence between *u* and *v*, the joint density function of the two error components will be the product of the two individual density functions. When the decomposition of the error term is accounted for, the joint density function of *u* and *ε* will be expressed by:

$$f(u, \varepsilon) = \frac{2}{2\pi\sigma_u\sigma_v}\ .exp\left\{-\frac{u^2}{2\sigma_u^2} - \frac{(e+u)^2}{2\sigma_v^2}\right\}$$

Equation 3.15

Integrating the above equation with respect to u gives the marginal density function from which the log likelihood function could also be obtained. The technical efficiency estimates for a specific farmer can be obtained from point estimates of u_i by:

$$TE_i = exp\{-\hat{u}_i\}$$

Equation 3.16

Where:

TE_i is farm-specific technical efficiency estimates

$\mu_i$is either $E(ui|\varepsilon i)\ orM(ui|\varepsilon i)$.

All input and output variables were transformed into their corresponding log values. Therefore, the Coelli *et al*. (2005) inefficiency model was specified as:

$$u_i = \delta_o + \sum_{i=1}^{n} \delta_o Z_i + w_i$$

Equation 3.17

Where, $u_i$is the inefficiency component, Z_i is the vector of exogenous variables including: household head characteristics such as gender, age and education, access to

extension services, off/non-farm income and other factors that are likely to affect efficiency, δ's are the parameters to be estimated, and w_i is the error term of the inefficiency model. A farm-specific variable associated with the negative coefficient had a positive impact on technical efficiency and vice versa. In the interpretation of the coefficients (Z_i) of the inefficiency variables, positive coefficients imply the variable leads to productivity inefficiency while negative coefficients imply otherwise.

B-O decomposition was employed using "oaxaca" stata command (Jann, 2008). The mean productivity difference between the two groups can then be written as:

$$E\left(Ln(Y_A)\right) - E\left(Ln(Y_{NA}\right) = [E\left(X_A\right) - (E$$

$$(X_{NA})]\beta^* + [E(X_A)(\beta_A - \beta^*)] + [E(X_{NA})(\beta^* - \beta_{NA})] \qquad \text{Equation 3.18}$$

The decomposition illustrates the mean predictions by adopter and non-adopter groups and their difference as E(Ln (Y_A)) – E(Ln (Y_{NA}). The right hand side of the decomposition equation shows the productivity difference gap, divided into three parts. The first right side component, [E (X_A) − [E (X_{NA})] β*, represents the endowment effect or the explained component. This part reflects the mean increase in non-adopters productivity if they had the same characteristics as the adopters. The second term [E (X_A) (β_A - β*)] quantifies the change in non-adopter's productivity when applying the adopter's coefficients to the non-adopter's characteristics. The third part [E(X_{NA})(β* - β_{NA})], is the interaction term that measures the simultaneous effect of differences in endowments and coefficients. The second and third part (combined), [E (X_A) (β_A - β*)] + [E (X_{NA}) (β* - β_{NA})], belongs to the structural effect or unexplained part. This amounts to the differential not explained by the differences in observed characteristics (attributed to adoption of devolved agricultural extension service, but may also result from the influence of unobserved variables).

CHAPTER FOUR

4.0 RESULTS

4.1 Socio-economic characteristics of the respondent's in relation to the awareness of agricultural extension devolution

The characteristics of the respondents were identified in relation to farmers and extension officers in Kitui County. The relationship between selected socio-economic factors and respondents' awareness of agricultural extension devolution in Kitui County are presented in Table 4.1.

Table 4.1: Relationship between selected socio-economic factors and respondents' awareness of agricultural extension devolution in Kitui County

Variable	Categories	Awareness of Extension devolution		Total	χ^2	Df	P-Value
		Aware	Not aware				
Age of the household head	Less than 30	3*(3.1)***	0 (0.0)	3 (3.1)	32.27	3	0.000
	31-40	8 (8.2)	1 (1.0)	9 (9.2)			
	41-50	39 (39.8)	4 (4.1)	43 (43.9)			
	Above 50	17 (17.3)	26 (26.5)	43 (43.8)			
	Total	67 (68.4)	31 (31.6)	98 (100)			
Gender of the household Head	Male	34 (34.6)	6(6.2)	40 (48.8)	11.44	1	0.003
	Female	33 (33.7)	25 (25.5)	58 (51.2.0)			
	Total	67 (68.3)	31 (31.7)	98 (100.0)			
Level of education of the household head	No formal education	3 (3.1)	9 (9.3)	12 (12.4)	34.37	4	0.000
	Primary	16 (16.3)	2 (18.2)	3 (34.7)			
	Secondary	40 (40.8)	4 (4.1)	44 (44.9)			
	Tertiary/college	8 (8.2)	0 (0.0)	8 (8.2)			
	Total	67 (68.4)	31 (31.6)	98 (100.0)			

Household income (Kes)	Less than10,000	21 (21.4)	15 (15.6)	36 (37)	6.71	5	0.035
	10,000-20,000	30 (30.6)	14 (14.2)	44 (48.8)			
	20,000-30,000	5 (5.1)	1 (1)	6 (6.1)			
	30,000-40,000	6 (6.1)	1 (1)	7 (7.1)			
	40,000-50,000	3 (3)	0 (0.0)	3 (3)			
	60,000-70,000	2 (2)	0 (0.0)	2 (2)			
	Total	67 (68.2)	31 (31.6)	98 (100.0)			
Household engagement in off and non-farm activities	Yes	36 (36.7)	15 (15.3)	51 (52)	0.95	1	0.622
	No	31 (31.6)	16 (16.4)	47 (48)			
	Total	67 (68.3)	31 (31.7)	98 (100.0)			
Household diversification status	≤0.5	34 (34.7)	17 (17.3)	51 (52.0)	0.70	1	0.706
	>0.5	33 (33.7)	14 (14.3)	47 (48)			
	Total	67 (68.4)	31 (31.6)	98 (100.0)			
Land size (acres)	0-5	23 (23.5)	24 (24.5)	47 (48)	18.25	2	0.006
	5-10	30 (30.6)	6 (6.1)	36 (36.7)			
	Above10	14(14.3)	1 (1)	15 (15.3)			
	Total	67 (68.4)	31 (31.6)	98 (100.0)			

*** - Figures in brackets represent percentages and * represent frequencies

4.2.1. Age of the sampled respondents and awareness of agricultural extension devolution

The results in Table 4.1 show that the majority of the respondents interviewed were over 40 years old, while the remaining respondents were below 40 years. The average age of the respondents was 49.43 years, while the youngest was 30 years old and the oldest was 70 years. Age influenced the awareness of agriculture extension devolution. The chi-square test (χ^2= 32.27; df =3 and p-value=0000) showed a significant relation between age and awareness of agriculture extension devolution.

4.2.2 Level of Education of the farmers and awareness of agricultural extension devolution

From Table 4.1, shows that majority (59%) of the sampled farmers had below secondary education. The chi-test showed a significant difference in education levels and awareness on agricultural extension devolution. There was a relationship between education and awareness of agricultural extension devolution, where all those respondents who had tertiary education were aware of agriculture extension devolution compared to those with less than tertiary education.

4.2.3 Gender of the farmers and awareness of agricultural extension devolution

The results of the current study show that there is a relationship between gender and awareness of agricultural extension. The chi-square test results show that male respondents interviewed were more aware of agriculture extension devolution than their female counterparts, as shown in table 4.1 above.

4.2.4 Levels of Income of farmers in relation to awareness of devolution of agricultural extension devolution

Household awareness of the devolution of agricultural extension services increases with farmers' income. Table 4.1 reveals that there was a relationship between farmers' income and awareness of devolution, based on the chi-square test.

4.2.5 Land size and awareness of devolution of agricultural extension devolution

Table 4.1 reveals that farmers on smaller pieces of land were unaware of agricultural extension devolution. The chi-square test ($\chi 2 = 18.25$; $df = 5$; $P \leq 0.006$) shows there was a significant relationship between land size owned by the farmers' and awareness of agricultural devolution.

4.2.6 Engagement in off-farm and on-farm activities in relation to awareness of devolution of agricultural extension devolution

The chi-square test demonstrates that there was no significant relationship between respondents' participation in off-farm and non-farm activities and awareness of agricultural extension devolution, as shown in Table 4.1.

4.2.7 Diversification status and awareness of agricultural extension devolution

The chi-square test ($\chi^2 = 0.70$; df = 1; $P \geq 0.706$) showed that there was no significant relation between respondents diversification status and awareness of agricultural extension devolution as shown in Table 4.1.

4.2.7.1 Main Occupation of the Farmers

As indicated in Figure 4.1 below, mixed farming (crop and livestock farming) was the main occupation in the study area.

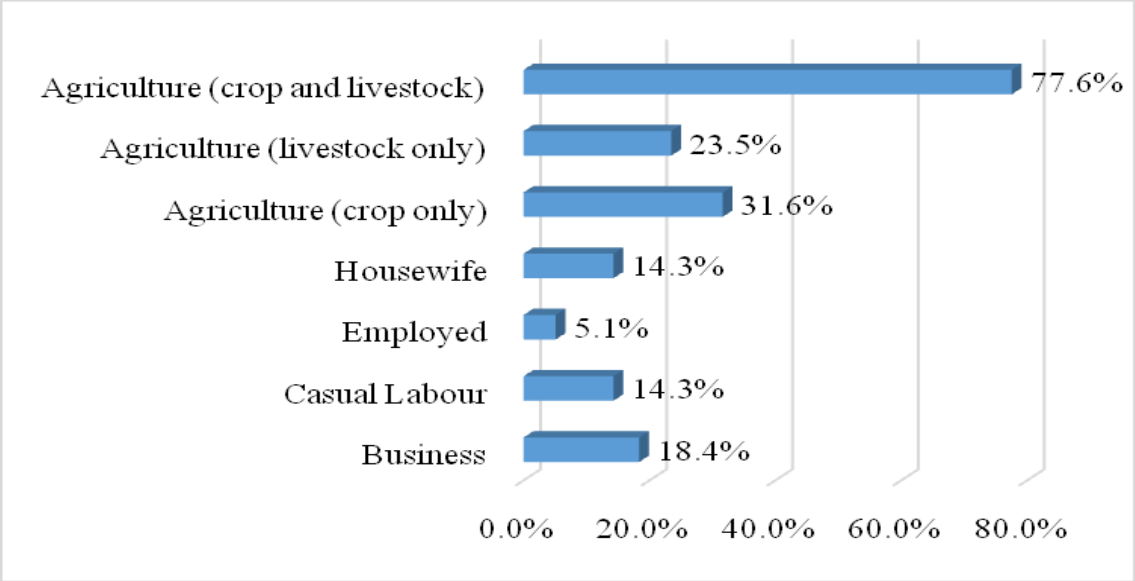

Figure 4.1: The main occupation of the farmers

NB: The percentages in Figure 4.1 are based on the responses of the respondents. Because some respondents provided multiple responses, each of these responses was examined separately.

4.2.7.2 Crops grown by farmers

The most popular crops in the study area include maize (*Zea mays*), green grams (*Vigna radiata*), cow peas (*Vigna unguiculata*), and pigeon peas (*Cajanus cajan*), as shown in Figure 4.2.

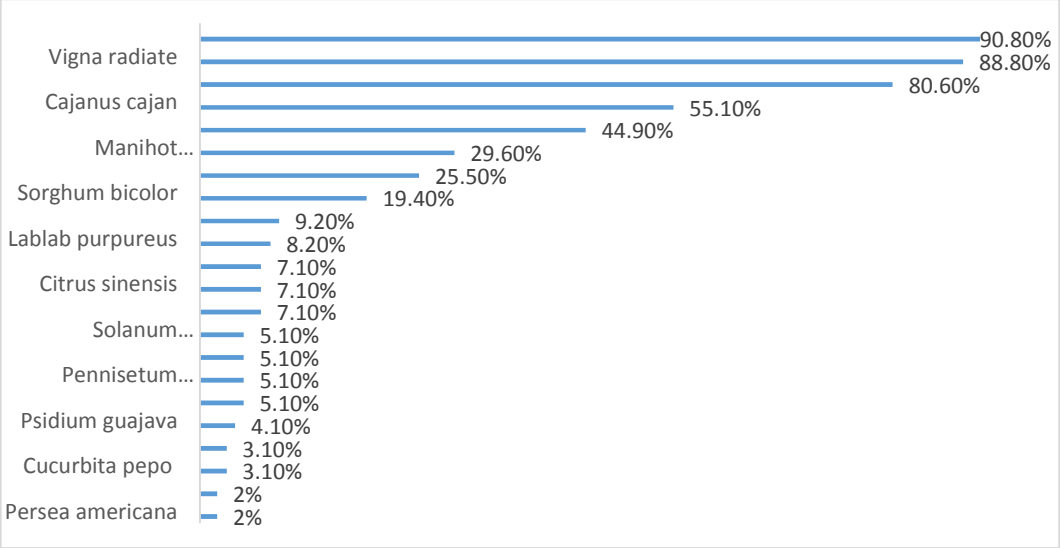

Figure 4.2: Crops grown by farmers

NB: The percentages in Figure 4.2 are based on the number of times a response was reported by each of the respondents because some respondents provided multiple responses.

Table 4.2: Crops grown in relation to awareness of devolution of agricultural extension services

Crops grown	Awareness of devolution of agricultural extensions	
	Aware	Not aware
Food crops		*Zea mays*, *Phaseolus vulgaris*, *Cajanus cajan*
Cash crops	*Phaseolus vulgaris L. Gossypium hirsutum*	*Vigna unguiculata*, *Mangifera indica*
Fruit trees	*Mangifera indica*, *Persea Americana*	*Citrus sinensis*, *Carica papaya*

The research findings revealed that the farmers growing food crops were less aware of the devolution of agricultural extension than their counterparts farming cash crops.

4.3 Socio-Economic Profile of the extension officers in the Kitui County

The demographic characteristics of the sampled extension officers were assessed with respect to the following: age, gender, level of education, job title, institution/organization, specialization, and working experience.

4.3.1 Age of the respondents

The study established that the majority of respondents were above the age of fifty as shown in Table 4.3 below.

Table 4.3: Distribution of respondents by age

Age group of the respondents (years)	Frequency	Percentage (%)
21-30	10	14.3
31-40	21	30.0
41-50	13	18.6
Above 51	26	37.1
Total	70	100.0

4.3.2 Gender of sampled extension officers

Results of the current study have established that male agricultural extension officers were the majority as compared to their female counterparts, as shown in Table 4.4.

Table 4.4: Distribution of respondents by gender

Gender of the respondent	Frequency	Percentage (%)
Female	6	8.6
Male	64	91.4
Total	70	100.0

4.3.3 Education level of the sampled extension officers

The results from Table 4.5 indicated that most of the sampled extension officers had diploma levels of education, a first degree, and the rest had master's degrees.

Table 4.5: Education level of the respondents

Level of education	Frequency	Percentage (%)
College	37	52.9
University level	31	44.3
Master	2	2.9
Total	70	100.0

4.3.4 Job titles of the extension officers

The sampled extension officers in this study had various Job titles in agriculture as shown in Table 4.6.

Table 4.6: Job titles of the sampled respondents

Job titles	Frequency	Percentage (%)
Assistant Agricultural Officer	22	31.4
Chief Livestock Production Assistant (CLPA)	2	2.9
Irrigation Officer	2	2.9
Livestock Health Assistant	4	5.7
Livestock Production Officer	3	4.3
Senior Assistant Agricultural Officer	4	5.7
Senior Livestock Production Officer	2	2.9
Village Extension Officer (VEO)	11	15.7
WAES (Ward Agric. Ext Supervisor)	20	28.6
Total	70	100.0

Results from the above Table 4.6 above show that most of the respondents were agricultural officers, Ward Agricultural Extension Supervisors and Village Extension Officers.

4.3.5 Respondents' employer

Table 4.7 shows that agricultural extension officers were employed by the County Ministry of Agriculture, Livestock, Fisheries and Cooperatives, Water and Irrigation, Caritas, and the national government.

Table 4.7: Current employers of agricultural extension officers

Name of employer	Frequency	Percentage (%)
Caritas –Kitui	2	2.9
Kitui County Ministry of Agric., Water & Irrigation	60	85.7
Government of Kenya – National	8	11.4
Total	70	100.0

As shown in Table 4.7 above, the majority of the extension officers were employed by the Kitui County Ministry of Agriculture, Livestock, Fisheries and Cooperatives, Water and Irrigation, and the national government, while the remainder were employed by non-governmental organizations.

4.3.6 Working experience of the sampled respondents

The results of the current study indicate that a majority of extension officers had less than 10 years of working experience.

Table 4.8: Distribution of sampled respondents by years of work experience

Respondents' years of work experience	Frequency	Percentage (%)
1-10	35	50.0
11- 20	12	17.1
21-30	14	20.0
Above 31	9	12.9
Total	70	100.0

4.3.7 Area of specialization

Respondents in this study had varying areas of educational training as shown in Table 4.9. The respondents' various areas of training are shown in Table 4.9 above, with extension officers trained in general agriculture leading, followed by livestock-related areas, while fisheries and home-economics are the least.

Table 4.9: Area of specialization

Specialization	Frequency	Percentage (%)
General agriculture related training	28	36.9
Agribusiness management	9	12.9
Agricultural extension	5	7.1
Livestock related training	21	30.1
Agriculture and biotechnology	2	2.9
Agronomy, soils and horticulture	2	2.9
Farm management	2	2.9
Water and environmental engineering	2	2.9
Home economics	1	1.4
Total	70	100.0

4.3.8 Source of information on devolution of agricultural extension services

Sampled farmers said that they learned about the devolution of agricultural extension services from farmers' groups and meetings, as shown in Figure 4.3. Radio, political

rallies, television, and neighbors or fellow farmers were some of the sources of respondents' information.

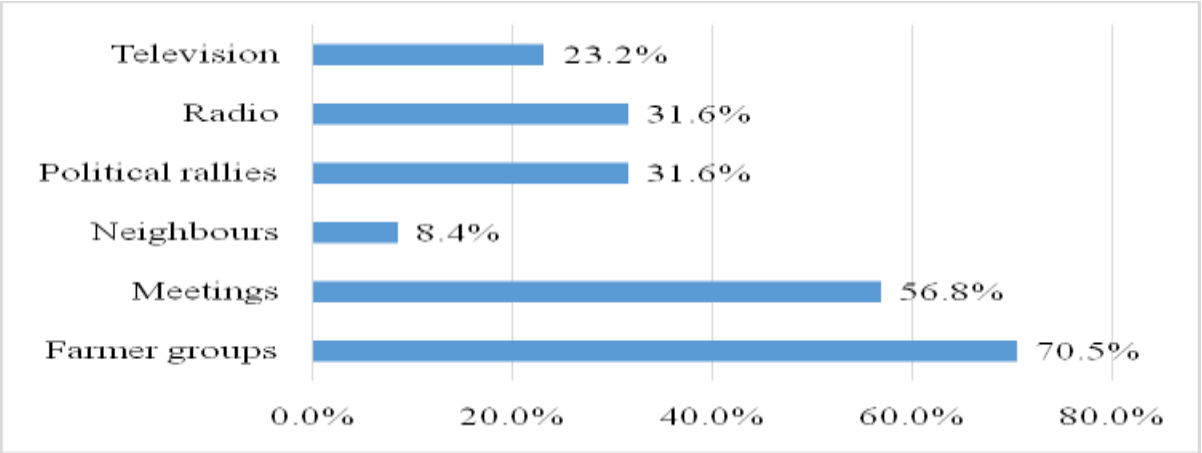

Figure 4.3: Respondents sources of information on devolution of agricultural extension services

NB: The percentages in Figure 4.3 were based on the number of times a response was reported by the respondents and was analysed separately.

4.3.9 Household use of extension education on crop and livestock enterprises

From the current study, more farmers had access to extension services in their various crops and/or livestock enterprises, as shown in Figure 4.4.

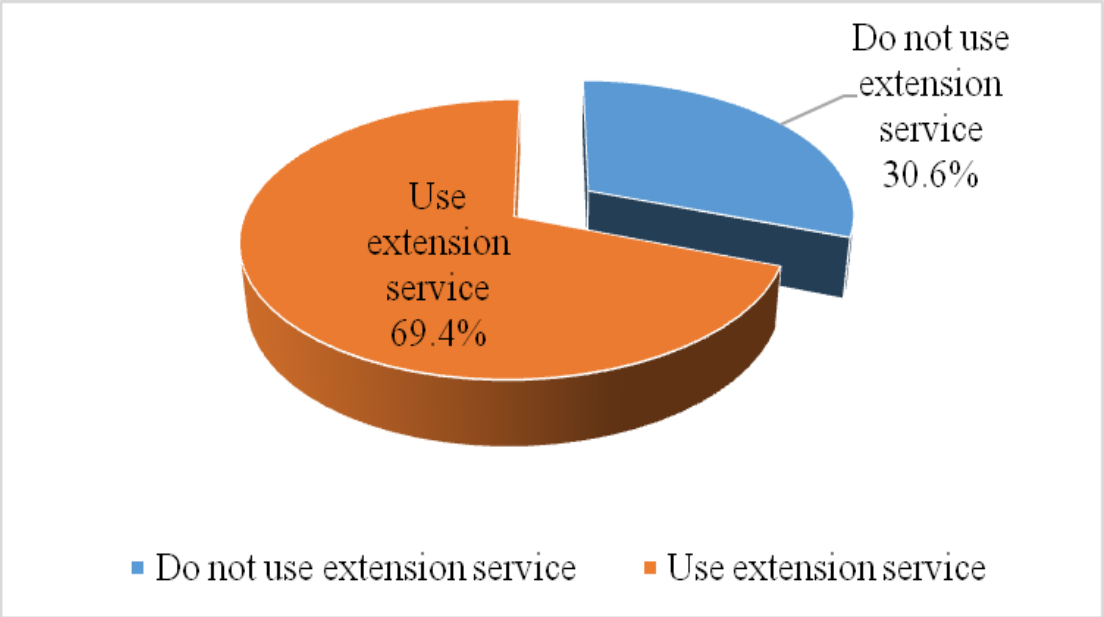

Figure 4.4: Farmers' use of extension services in their crop and or livestock enterprises.

4.3.10 Source of agricultural extension information

The respondents who had accessed and used extension services within the last 12 months indicated that they had received the service from various sources as shown in Figure 4.5.

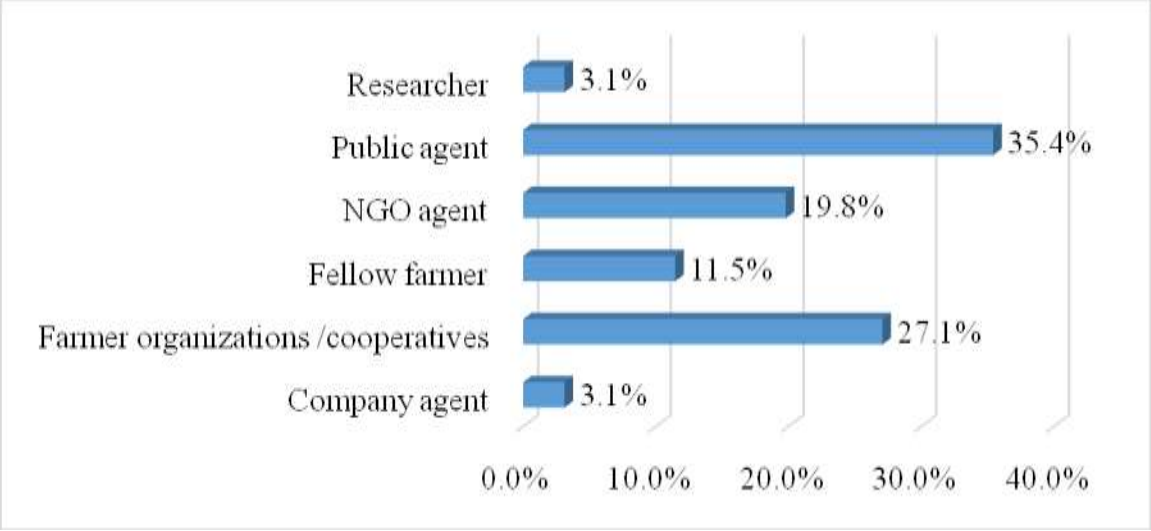

Figure 4.5 Respondent's source of agricultural extension information

According to the results of the current, the respondents got extension services from government representatives (government extension officers), farmers' groups or cooperatives, NGO agents, fellow farmers, researchers, and firm representatives as shown in figure 4.5 above.

4.3.11 Farmers' ways of accessing agricultural extension services

Respondents who had received extension services received the information via the channels shown in figure 4.6. The results show that most of the sampled farmers received extension education through agents who were on their extension program. Other sampled farmers got extension education through agents who came on their own (farmers') schedule.

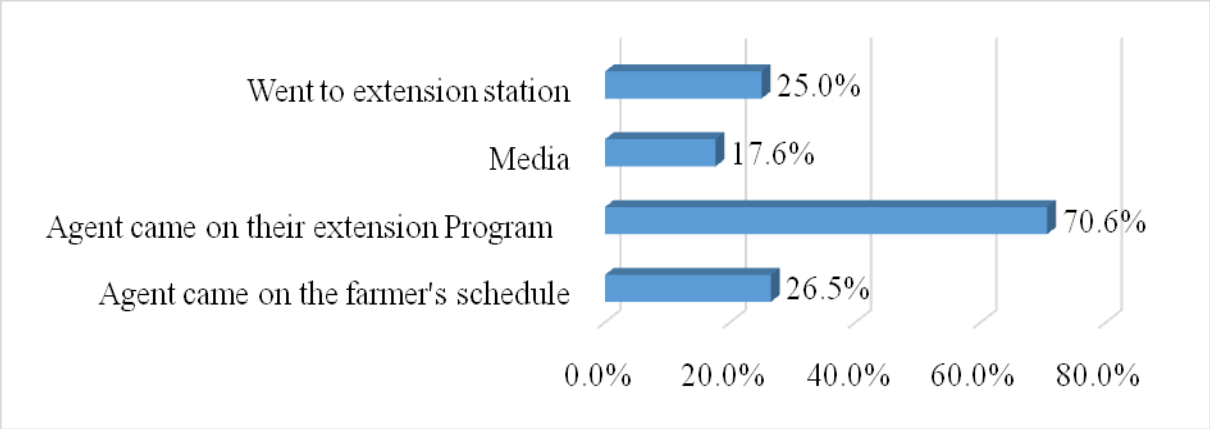

Figure 4.6: Farmers' ways of accessing agricultural extension services

4.3.12 Channels used to deliver extension services

The channels used to deliver extension services to the farmers are shown in Figure 4.7. Field days/demonstrations being the most common while ASK shows was the least used.

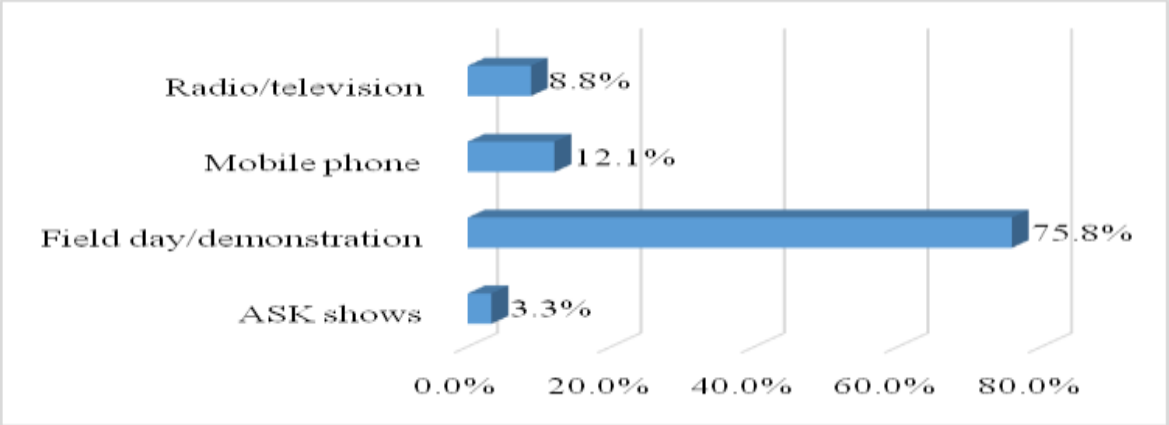

Figure 4.7: Channels used to deliver extension services

4.3.13 Respondents reasons for the choice of the different extension service providers

The reasons farmers preferred service providers included proximity, provision of relevant information, cost, and accessibility as shown in figure 4.8 below.

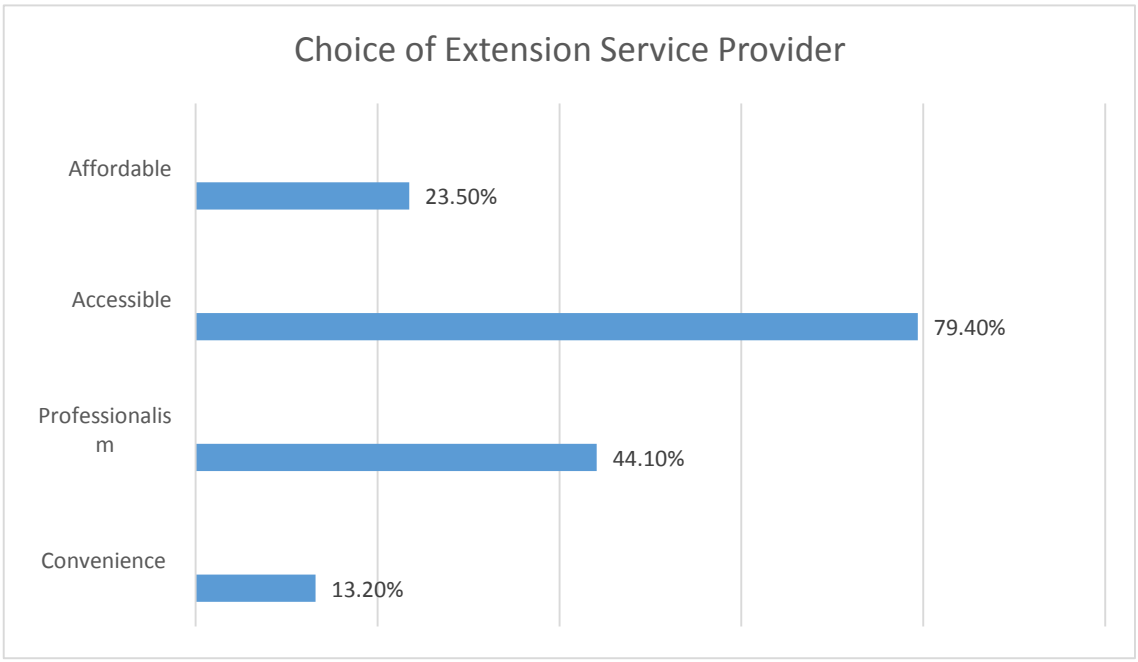

Figure 4.8: Respondents reasons for the choice of different extension service providers

4.3.14 Farmers level of satisfaction with the performance of agricultural extension service

As shown in table 4.10 below, the timeliness of information, adequacy of information, professionalism of the agent, and relevancy of the information received on agricultural extension services were all rated as satisfactory by the respondents.

Table 4.10: Farmers' level of satisfaction with the performance of agricultural extension service

Satisfaction levels	Not Satisfied	Somehow Satisfied	Satisfied	Very Satisfied	Total
Timeliness of information	9(13.2)	3(4.4)***	40(58.8)	16(23.5)	68(100.0)
Information is adequate/enough	3(4.4)	6(8.8)	41(60.3)	18(26.5)	68(100.0)
Agent knowledgeable (professionalism)	6(8.8)	16(23.5)	38(55.9)	8(11.8)	68(100.0)
Relevancy of information	3(4.4)	12(17.6)	44(64.7)	9(13.2)	68(100.0)

*** Figures in brackets represent percentages

4.3.15 Farmers' application of recommendations received from the extension officers

This study found that majority of the sampled respondents who received extension services had applied all the recommendations made by the extension workers as shown in Figure 4.9.

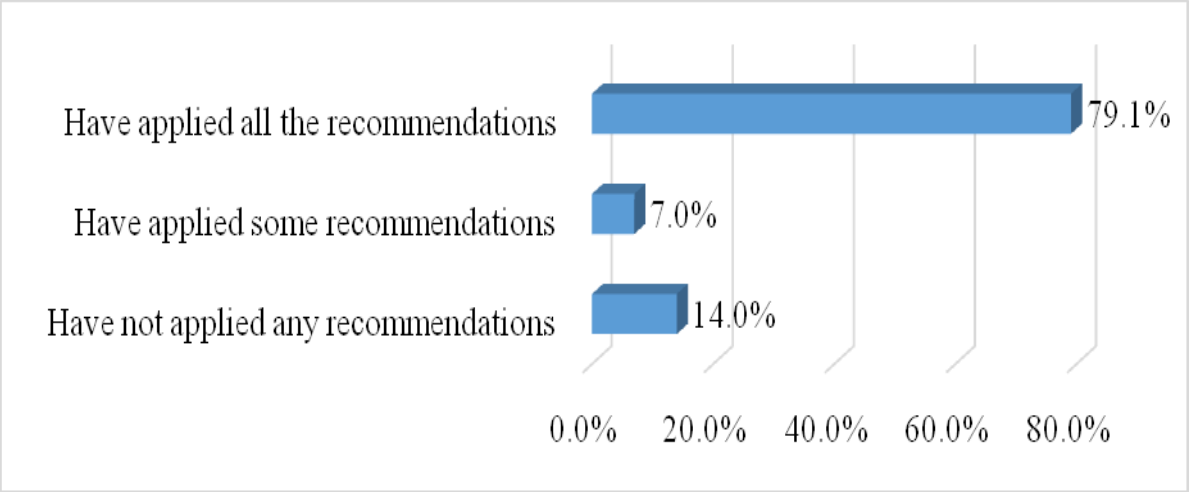

Figure 4.9: Farmers' application of recommendations received from the extension officers

4.3.16 Extension recommendations applied by farmers

Some of the recommendations that were reported to have been applied by farmers are summarized in Figure 4.10 below. The most adopted recommendations were pesticide application, soil fertility management while the least adopted were drip irrigation and livestock breeding.

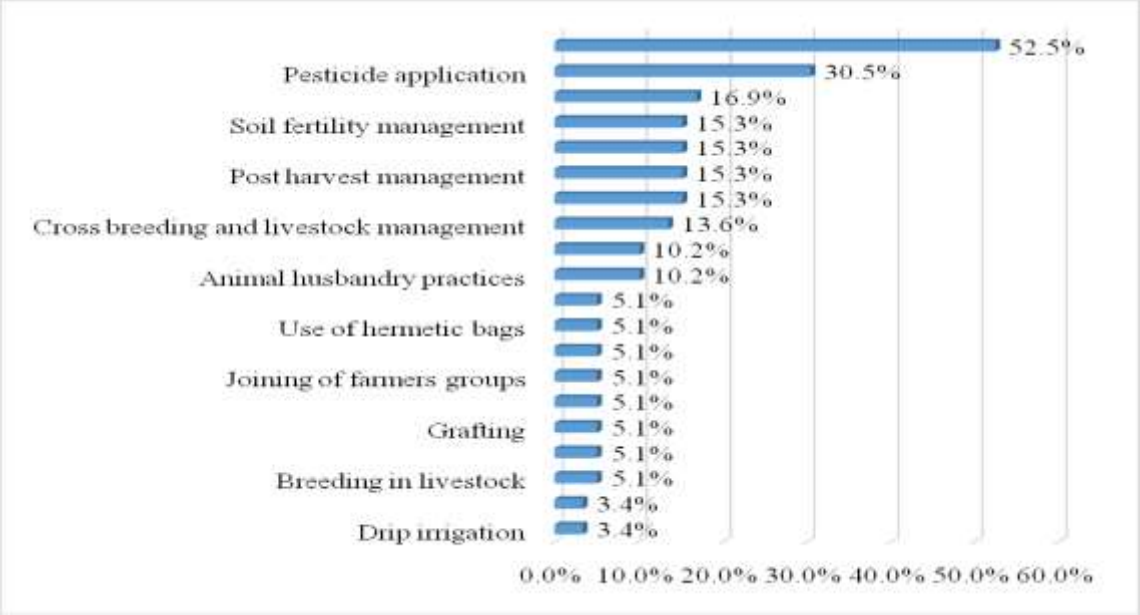

Figure 4.10: Extension recommendations applied by farmers

4.3.17 Farmers' reasons for non-application of extension recommendations

Some of the reasons why some extension recommendations were not applied by farmers are summarized in Figure 4.11.

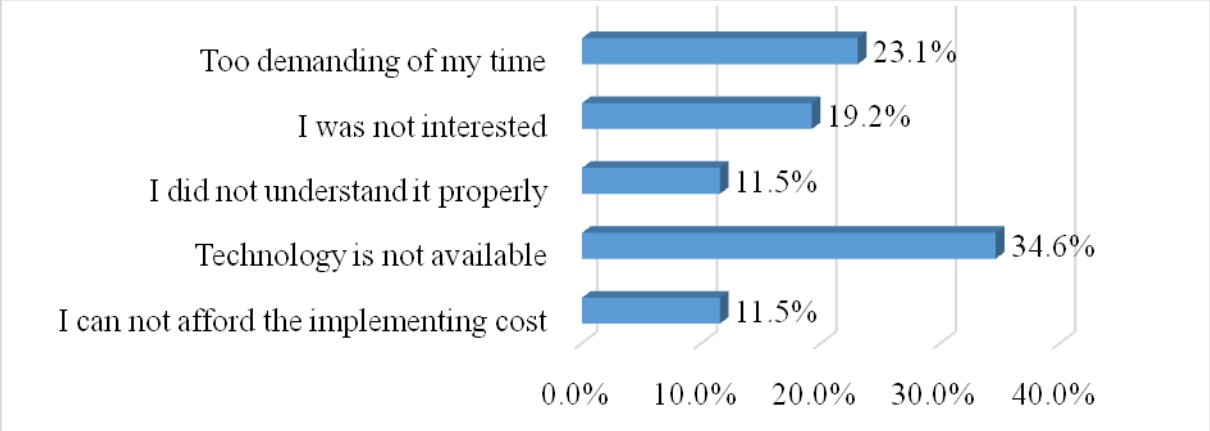

Figure 4.11: Farmers' reasons for non-application of extension recommendations

The most frequent justification given for not implementing some recommendations was the lack of technology because it was cumbersome and tedious.

4.3.18 Farmer's preference on packaging of the agricultural extension information

Results of the current study show that a bigger percentage of the farmers preferred use of printed information, the extension officer himself/face-to-face, radio, television, internet, Barazas, farm visits and self-explanation as shown in table 4.11 below.

Table 4.11: Farmer's preference on packaging of the agricultural extension information

Preferred extension information package	Frequency	Percentage (%)
Call *Barazas*	3	3.1
Farm visit	3	3.1
Extension Officer Himself (Face-To-Face)	26	26.5
Internet	6	6.1
Print (Brochures, Pamphlets, and leaflets)	52	53.1
Radio	25	25.5
Self-explanation	3	3.1
Television	9	9.2

NB: The percentages in Table 4.11 are based on the responses of the respondents. Since some respondents provided multiple responses, each was examined separately.

4.3.19 Farmers preferred language in extension information

As shown in Figure 4.12 below, respondents preferred that extension information be packaged in a variety of languages.

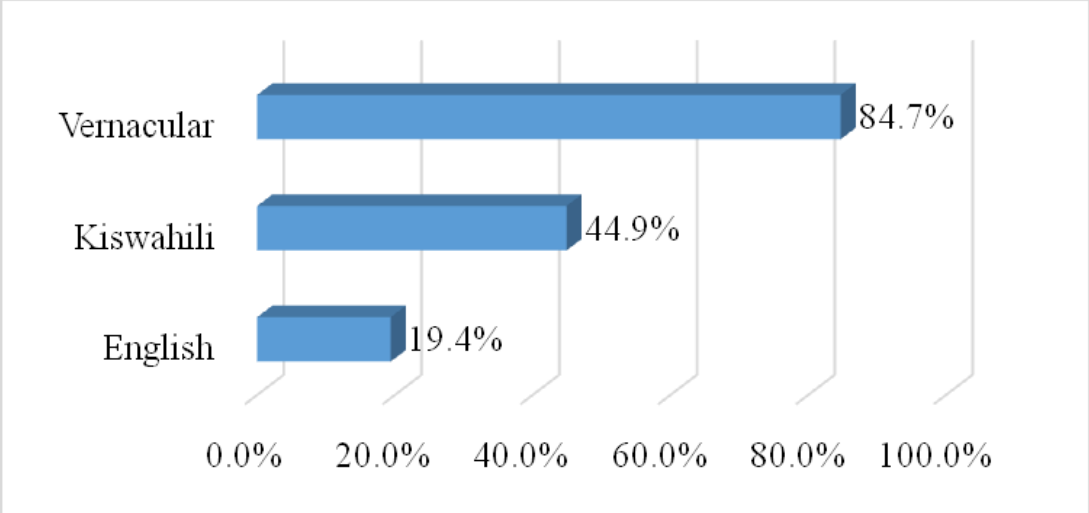

Figure 4.12: Farmers preferred language in extension information

4.3.20 Respondents' average expenditure on livestock and crop extension services

Respondents who had used extension services indicated that they had incurred expenses as summarized in Table 4.12. Transport both for the farmer to the service provider's office and for the service provider to the farm, were the major expenses in livestock and crop agricultural extension.

Table 4.12: Respondents' average expenditure on livestock and crop extension services

Variable	Mean(Kshs)	Std. Dev. (Kshs)	Min(Ksh)	Max(Kshs)
Livestock	7,307.69	659.43	500	20,000
Crop	8,492.31	705.97	1,000	25,000

Test of Hypothesis H_{O1}

This study was interested in examining the factors that influence farmers' awareness of devolution of agricultural extension services. To achieve this, a null hypothesis, "Ho_1: Selected socio-economic factors do not significantly influence farmers' awareness of devolution of agricultural extension services" was formulated and tested using binary logistic regression. Table 4.13 shows the influence of selected socio-economic factors on farmers' awareness of devolution of agricultural extension services.

Table 4.13: Binary logit model on influence of selected socio-economic factors on farmers' awareness of devolution of agricultural extension services

Awareness of devolution of agricultural extension services	Coef.	Std. Err.	Z	P>z
Household head age	-1.956	0.241	-8.116	0.000*
Gender of the household head (male = 1; 2= female)	0.121	0.047	2.574	0.000*
Level of education of the household head (years)	1.763	0.587	3.003	0.000*
Household income (Kshs/kes)	0.981	0.074	13.257	0.000*
Engagement in off and non-farm activities (Yes = 1)	0.189	0.147	1.286	0.128
Diversification (index 0-1)	0.121	0.123	0.984	0.154
Land size (log)	0.443	0.071	6.239	0.000*
Constant	2.385	0.632	3.773	0.000

N = 98, Log Likelihood = 108.20, LR chi^2 (7) = 29.63, Prob> chi^2 = 0.000, Pseudo R^2=0.378

*Significance level at 5%

Results in Table 4.13 reveal that the coefficients for household head age, household head gender, household head education, household income, and land size were statistically significant at 5% level. The negative sign on the variable implies that farmers' awareness of devolution of agricultural extension decreases with household head age. The coefficient of household head gender, household head education, household income, and land size indicates significant and a positive influence on awareness of the devolution of agricultural extension services.

4.4 Factors influencing delivery of extension services by the county governments

The second objective of this study was to determine and prioritize the factors influencing the delivery of extension services by the county governments. In pursuing this objective, a null hypothesis, 'Ho_2: Selected factors do not significantly influence delivery of extension services by the county governments after devolution' was formulated and analyzed using binary logistic regression. The dependent variable in this study was the

effectiveness of extension service delivery by the county government. In order to determine respondents' perception of extension service delivery effectiveness, respondents were requested to indicate if they could move to the national government or whether they would remain with county government employment, given a chance. The results are shown in Figure 4.13 below. An overwhelming majority of the respondents preferred moving to the national government if given a chance.

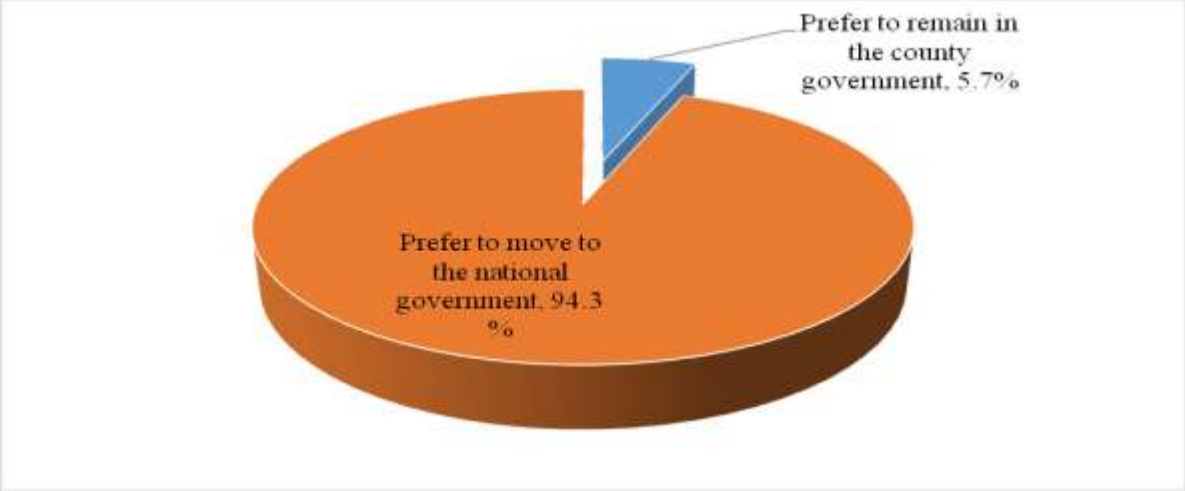

Figure 4.13: Respondent preference between national and county government management of extension services

Table 4.14: Factors influencing the effectiveness of agricultural extension officers in service delivery

Statements	Agree	Undecided	Disagree	Totals	Mean	Std. dev
Availability of transport for extension services	26(37.1%)	4(5.7%)	40(57.1%)	70(100.0%)	1.31	0.58
Availability of housing facility for extension staff has improved	9(12.9%)	2(2.9%)	59(84.3%)	70(100.0%)	1.10	0.63
Payment of salaries in time for extension officers	3(4.3%)	1(1.4%)	66(94.3%)	70(100.0%)	1.03	0.71
Proper promotion for extension officers	10(14.3%)	3(4.3%)	57(81.4%)	70(100.0%)	1.10	0.62
Fair and transparent transfers	11(15.7%)	4(5.7%)	55(78.6%)	70(100.0%)	1.10	0.56
Well outlined duties with no duplication	13(18.6%)	7(10%)	50(71.4%)	70(100.0%)	1.09	0.45
Favorable and conducive work environment	10(14.3%)	2(2.9%)	58(82.9%)	70(100.0%)	1.11	0.73
Facilitation for extension activities	10(14.3%)	4(5.7%)	56(80%)	70(100.0%)	1.09	0.54
Training and capacity building for extension staff	18(25.7%)	7(10%)	45(64.3%)	70(100.0%)	1.16	0.38

The majority of extension employees disagreed that there was more transportation, housing, timely salary payment, fair and transparent transfers, no duplication of jobs, a suitable and conducive work environment, facilitation, greater training, and capacity building for extension operations.

Test of Hypothesis H_{O2}

Objective two was translated into the following hypothesis: "Ho_2 Selected factors do not significantly influence delivery of extension services by the county governments after devolution". The hypothesis was tested using binary logistic regression. Table 4.15 shows the influence of selected factors on delivery of extension services by the county governments after devolution.

Table 4.15: The impact of various factors on the delivery of devolved extension services

Delivery of extension services	Coef.	SE	Z	P-value
Availability of transport for extension services	1.53	0.60	2.54	0.011*
Availability of housing facility for extension staff	1.47	0.89	1.66	0.097
Timely payment of salaries for extension officers	2.15	0.57	3.75	0.000*
Proper promotion for extension officers	1.56	0.49	3.16	0.002*
Fair and transparent transfers	1.52	1.27	1.2	0.228
Well outlined duties with no duplication	1.76	0.55	3.18	0.001*
Favorable and conducive work environment	2.31	1.05	2.19	0.028*
Increased facilitation for extension activities	2.93	0.74	3.96	0.000*
Increased training and capacity building for extension staff	1.57	0.82	1.92	0.055
Constant	1.93	0.47	4.11	0.000

Calculated chi^2 (9) = 30.04, Critical chi^2 (9) = 16.92; Prob> chi^2 = 0.000; Adj R^2= 0.264

*Significance level at 5%

Results in Table 4.15 reveal that all coefficients were statistically significant at 5% level except for the availability of housing facilities for extension staff, fair and transparent transfers and an increase in training and capacity building for extension staff.

The calculated likelihood ratio Chi-square (chi^2 (9) = 30.04), for the fitted model with a probability value of 0.000 was significant at 5% level (Critical chi^2 (9) = 16.92). The adjusted R^2 of 0.264 was above the statistical threshold of 5% confirming that delivery of extension services was significantly influenced by selected factors. It further implies that selected factors collectively account for about 26.4% of the variance in the delivery of extension services, other factors notwithstanding.

The coefficients for the availability of transport, timely payment of salaries for extension officers, proper promotion for extension officers, well-outlined duties with no

duplication, favorable and conducive work environment and increased facilitation for extension activities were positive and statistically significant at 5% level (P<0.05).

4.5 Interactions between agricultural extension functions run by county and national governments

Table 4.16: Extent of involvement of the extension staff in selected areas

Areas of service delivery	High	Moderately	Low	Not Involved	Total	Mean	Std. dev.
Development of work plan	16* (22.9)**	18 (25.7)	26 (37.1)	10 (14.3)	70 (100)	1.60	0.33
Implementation of work plan	19 (27.1)	27 (38.6)	23 (32.9)	1 (1.4)	70 (100)	2.09	0.85
Monitoring/supervision of agricultural extension programmes/projects	17 (24.3)	26 (37.1)	21 (30.0)	6 (8.6)	70 (100)	1.96	0.98
Overall						1.88	0.82

(* represents frequencies while **Figures in brackets represent percentages)

The majority of the extension personnel interviewed reported that they were involved in the development, implementation, and monitoring/supervision of agricultural extension programs/projects at the national level.

This study also sought to establish how the extension officers' rated the effectiveness of communication and linkages of the national government and county government. The results are summarized in Table 4.17.

Table 4.17: Extension officers rating of its communication and linkages with national and devolved government

Linkages between county and national government in agriculture	Very Poor	Poor	Good	Very Good	Total
Communication within the Ministry	*5(7.1)	32(45.7)	30(42.9)	3(4.3)	70(100.0)
Linkages between national government and county government on extension services	3(4.3)	37(52.9)	27(38.6)	3(4.3)	70(100.0)

(Figures in brackets represent percentages and * frequencies)

The majority of the extension officers sampled indicated that communication within the Ministry of Agriculture, Livestock, Fisheries, and Cooperatives was "poor" at the county and national levels. The effectiveness of communication was assessed as "good" by only a few of the extension officers. The overall ratings score of the devolved government on its effectiveness in communication and linkages with national government on a scale of 0-10 is summarized in Table 4.18 below.

Table 4.18: Respondents' ratings score of the devolved government on its effectiveness in communication and linkages with national government.

Scores	Frequency	Percentage (%)
0 – 2.5	28	40.0
2.5 – 5.0	37	52.9
5.0 – 7.5	4	5.7
7.5 – 10.0	1	1.4
Total	70	100.0

The devolved government's effectiveness in communication and links with the national government was rated poor by respondents on the rating scale.

Test of Hypothesis H_{O3}

Objective three was translated into the following hypothesis:

Ho_3 Selected factors do not significantly influence interactions between national government and county government.

The hypothesis was tested using linear regression. Table 4.19 shows the influence of selected factors on extent of interactions between national government and county government.

Table 4.19: Factors influencing the degree to which national and local governments interact

Extent of interactions between national government and county government	Coef.	SE	t-value	Sig.
Level of involvement of extension staff in development of work plan in the national government	1.81	0.13	13.600	0.000*
Level of involvement of extension staff in implementation of work plan in national government	0.97	0.39	2.510	0.015*
Level of involvement of extension staff on monitoring/supervision of agricultural extension programmes/projects in the national government	0.71	0.30	2.411	0.019*
Constant	2.07	0.21	9.88	0.000

Calculated $F_{(3,66)} = 7.68$, Critical $F_{(3,66)} = 2.74$; Prob> F = 0.000; Adj R-squared= 0.348

*significant at 5% level ($P \leq 0.05$)

Results in Table 4.19 reveal that all coefficients were statistically significant at 5%. The F – ratio (3, 66) for the fitted model was 7.68 with a probability value of 0.000. The adjusted R^2 of 0.348 was above the statistical threshold of 5%, confirming that the extent of interactions between the national government and county government was significantly influenced by the selected factors. It further implied that the selected factors collectively account for about 34.8% of the variance in interactions between the national government and county government, other factors notwithstanding.

The coefficients for level of involvement of extension staff in the development of work plans in the national government level of involvement of extension staff in implementation of work plans in the national government and level of involvement of county extension staff in monitoring/supervision of agricultural extension programmes/projects in the national government were positive and statistically significant at 5% level ($P<0.05$).

The figure below shows the Interactions between agricultural extension functions run by national and county government of Kitui. At the national level, the Ministry of Agriculture, Livestock, Fisheries and Cooperatives (MOALF&C) provides the overall leadership for the agriculture sector in the country.

The county governments are responsible for implementation of agriculture policies and legal frameworks. In this regard, the counties have established institutional structures and systems to support implementation of various agriculture sector policies and development plans, including at the local levels. (Figure 4.14).

Interactions between agricultural extension functions run by national and county government of Kitui

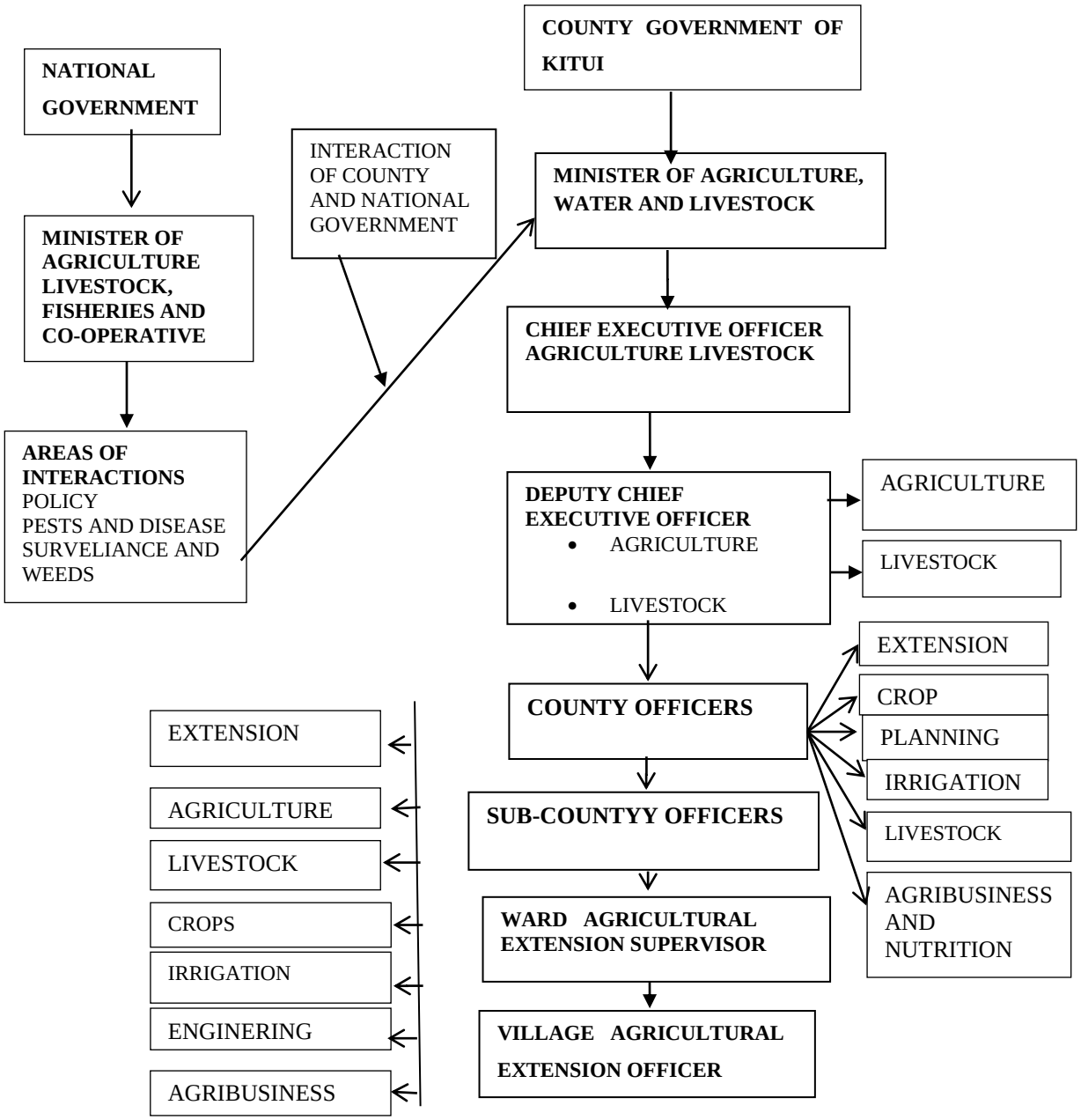

Figure 4.14: Interactions between agricultural extension functions run by national and county government of Kitui.

Source: CIDP, Kitui County

4.6 Assessment of the impact of agricultural extension services to the farmers' agricultural productivity and incomes before (2012) and after devolution (2016/2017).

4.6.1 Impact of devolution of agricultural extension services on farmers' agricultural productivity

Table 4.20 summarizes the relative crop productivity in 2017 cropping year (after devolution) and 2012 cropping year (before devolution). From the study results, there was an increase in the yield of major crops in the year 2017 compared to the year 2012.

Table 4.20: Crop yield in bags per acre in year 2012 and 2017

Crop/acre	Year 2012	Year 2017
Maize	7.56	8.80
Beans	1.67	2.31
Green gram	5.28	9.05
Mangoes	17.21	18.89
Oranges	2.22	3.22
Cow peas	3.02	4.36
Pigeon peas	2.22	3.28
Cassava	1.29	1.89

Test of Hypothesis H_{O4a}

Objective four was translated into the following hypothesis:

Ho_{4a}: There is no significant contribution of devolution of agricultural extension services to the farmer's agricultural productivity.

The hypothesis was tested through blinder Oaxaca decomposition of the translog stochastic frontier model. This study used the translog stochastic frontier model in the estimation of the agricultural productivity (technical efficiencies scores) as well as the influence of selected factors on agricultural productivity. The maximum likelihood

estimates of parameters of the stochastic frontier production function (SFPF) and inefficiency model were simultaneously obtained and reported in Tables 4.21 and 4.22.

Results in Tables 4.21 show truncated normal (first column), half normal (second column) and specification of the inefficiency term (μ_i) was assumed and estimated. Land size (X_1) and expenditure on extension services (X_2) have the expected positive impact on household maize yield.

Table 4.21: Maximum Likelihood Estimates for the stochastic frontier model

	Truncated normal		Half normal	
	Coef.	SE	Coef.	SE
Dependent variable (Maize yield in year 2017)				
Constant	0.137**	0.031	0.163**	0.031
Ln Land size (X_1)	0.328**	0.029	0.318**	0.029
Ln Expenditure on extension (X_2)	0.246**	0.016	0.247**	0.016
0.5 x Ln Land size (X_1) 2	0.034**	0.008	0.036**	0.008
0.5 x Ln Expenditure on extension (X_2)2	0.025**	0.003	0.026**	0.003
Ln Land size (X1) x Ln Expenditure on extension (X2)	0.004**	0.001	0.004**	0.001
(σ)2	0.321**	0.009	0.321**	0.012
γ	0.855**	0.037	0.831**	0.042
Log-Likelihood		133.24		135.81
Chi		29.95		35.62
Prob Chi^2		0.000		0.000
N		98		98

Note: ** significant at 5% level - p ≤0.05

Maximum likelihood estimator was used to estimate the coefficients for technical inefficiency (Table 4.22). All variables were significant except the age of the household head and levels of education (lower primary; upper primary, and secondary).

Table 4.22: Maximum Likelihood Estimates for the inefficiency model

	Truncated normal		Half normal	
Variable	Coefficient	SE	Coefficient	SE
Constant	1.245**	0.127	1.187**	0.133
HH gender (male)	-0.024**	0.005	-0.055**	0.011
HH Age (years)	0.023	0.411	0.031	0.413
HH Education (no formal education)	0.336**	0.126	0.304**	0.134
HH Education (lower primary)	0.019	0.058	0.024	0.059
HH Education (upper primary)	-0.012	0.024	-0.018	0.028
HH Education (secondary)	-0.115	0.139	-0.132	0.141
HH Education (tertiary)	-0.279**	0.007	-0.288**	0.012
Crop diversification index	-0.348**	0.028	-0.359**	0.029
Enterprise diversification index	0.430**	0.126	0.433**	0.127
Extension services (1 = Yes)	-0.347**	0.039	-0.352**	0.044
HH Income	-0.083**	0.042	-0.093**	0.047
Non-farm activities (1 = Yes)	-0.152**	0.031	-0.156**	0.032
N		98		98

Note: ** significant at 5% level - $p \leq 0.05$

From the analysis, the coefficients for gender (male) of the household head, level of education (tertiary), crop diversification index, extension services, income, and non-farm activities had a negative influence and were statistically significant at 0.05 alpha level. On the other hand, the coefficient for level of education of the household head (no formal education) and enterprise diversification index had a positive influence and were statistically significant at 0.05 alpha level.

Farm-specific indices of technical efficiency were estimated assuming both half normal and truncated normal specification on the inefficiency component of the composed error term as, summarized in Table 4.23 below. The results reveal that there is substantial technical inefficiency among the sampled smallholder farms concerning maize farming. The main implication of this result is that farmers could increase their output by 40.13% on average without using additional resources, simply by improving their technical efficiency.

Table 4.23: Farm-specific indices of technical efficiency scores

	Truncated – Normal		Half – Normal	
Efficiency indices range	Frequency	Percentage (%)	Frequency	Percentage (%)
0.1-0.2	1	1.0	2	2.0
0.2-0.3	19	19.4	24	24.5
0.3-0.4	16	16.3	21	21.4
0.4-0.5	5	5.1	6	6.1
0.5-0.6	2	2.0	3	3.1
0.6-0.7	10	10.2	8	8.2
0.7-0.8	18	18.4	14	14.3
0.8-0.9	27	27.6	20	20.4
Mean		59.87		57.35
SD		15.57		15.43
Minimum		1.87		1.96
Maximum		92.18		89.72
N		98		98

Table 4.24 below shows aggregate results from the B-O decomposition for maize productivity.

Table 4.24: Blinder-Oaxaca (B-O) aggregate decomposition of Maize productivity

Description	LnYield	Percentage
Adopters	2.203	
Non-adopters	2.009	
Difference	0.194 (24.89)**	52.3%
Decomposition		
Explained	0.053	27.2%
Unexplained	0.141	72.8%

The B-O decomposition further showed that the gap in maize productivity between adopters and non-adopters of devolved agricultural extension services resulted because of the differences in observable characteristics (explained component of the B-O decomposition).

4.6.2 Impact of devolution of agricultural extension services on farmers' farm income

The results in Table 4.25 show that there was a significant difference in incomes from all the major crops, with the farmers who were accessing devolved agricultural extension services receiving higher incomes than their counterparts who had no access to extension services.

Table 4.25: Crop income (per acre) and livestock incomes (KSh.) in year 2017

		Adoption status				
	Crop names	Non-adopters	Adopters	Diff	t-value	P-value
Crop	Maize	14,597.62	18,900.00	4,302.38	2.08	0.040
	Beans	6,576.47	13,558.82	6,982.35	2.04	0.044
	Green gram	30,540.70	43,492.94	12,952.24	4.49	0.000
	Mangoes	8,631.58	10,834.48	2,202.90	2.00	0.048
	Oranges	1,714.29	3,285.71	1,571.42	2.02	0.046
	Cow peas	9,857.83	13,100.55	3,242.72	2.10	0.038
	Pigeon peas	6,373.47	12,986.96	6,613.49	2.37	0.020
	Cassava	2,050.25	9,250.15	7,199.90	4.66	0.000
	Overall crop income	**37,423.56**	**42,589.43**	**5,165.87**	**2.14**	**0.035**
Livestock	Dairy cattle	35,891.50	41,205.50	5,314.00	4.06	0.000
	Beef cattle	9,428.38	12,942.38	3,514.00	3.87	0.000
	Indigenous cattle	11,689.20	15,481.20	3,792.00	3.95	0.000
	Dairy goats	6,231.76	8,479.76	2,248.00	2.06	0.042
	Indigenous goats	4,382.10	7,280.10	2,898.00	1.75	0.083
	Poultry	7,208.90	10,656.90	3,448.00	2.14	0.035
	Sheep	5,590.44	7,438.44	1,848.00	1.70	0.092
	Donkeys	4,789.55	4,909.55	120.00	1.17	0.246
	Others	2,154.57	2,108.57	-46.00	0.20	0.841
	Overall livestock yield	**58,961.13**	**64,382.48**	**5,421.35**	**2.02**	**0.046**
Total		96,384.69	106,971.91	10,587.22	2.07	0.041

The crop income from farmers who were using devolved agricultural extension services increased by KSh.5165.87 per acre compared to farmers who were not using the services. The livestock incomes from farmers who were using devolved agricultural extension services increased by KSh.5421.35 per acre compared to farmers who were not using the

services. There was a significant mean difference between both crop and livestock incomes for farmers using devolved agricultural extension services and those not using the service.

Test of Hypothesis H_{O4b}

Objective four was translated into the following hypothesis:

Ho_{4a}: There is no significant contribution of devolution of agricultural extension services to the farmer's incomes.

The hypothesis was tested using simple linear regression. Table 4.26 shows the influence of devolution of agricultural extension services on farmer's income.

Table 4.26: Linear Regression results for the influence of devolution of agricultural extension services on farmer's incomes

Variable	Coef.	SE.	T	P>t
Use of devolved agricultural extension services (1 = Yes)	0.27	0.03	10.538	0.001
Constant	2.98	0.21	14.4	0.001

Calculated $F_{(1, 96)} = 4.27$, Prob> F = 0.04, Critical $F_{(1, 96)} = 3.94$; Adj R-squared= 0.31

Results in Table 4.26 reveal that the coefficient for the use of devolved agricultural extension services was significant at 5%. The adjusted R^2 was above the statistical threshold of 5% confirming that farmers' income was significantly influenced by the use of devolved agricultural extension services.

CHAPTER FIVE

5.0 DISCUSSIONS

5.1 Influence of socio-economic factors on farmers' awareness of devolution of agricultural extension services

The results of the current study established that older farmers were less aware of the devolution of agricultural extension services. The results are consistent with Asres *et al*. (2013) who found that age had a positive and significant influence on the probability of participation in agricultural extension programmes. This concurs to the notion that older farmers do not easily accept new information and ideas (Asres *et al*., 2013; Genius *et al*., 2006). The results disagree with Danso-Abbeam *et al*. (2018), who in their study aimed to find out the factors that affect the awareness of extension service delivery for use in Good Agricultural Practices (GAP) among banana growers in Chitwan, Nepal noted that age was not an important factor that significantly affected the farmer's knowledge of the availability of agricultural extension services for application in GAP. The results of the current study are also inconsistent with the finding of Tiwari *et al*. (2008) as well as Mendola (2007), who discovered that older farmers with more farming experience are more likely to participate in good agricultural practices because they are aware of the benefits of agricultural extension programs.

The findings of the current study showed a significant relation between age and awareness of agriculture extension devolution. Age was found to positively influence the adoption of sorghum in Burkina Faso (Adesina & Baidu-Forson, 1995). It is also believed that the age of a household head is crucial for his or her decision-making in determining what and how to produce on a given piece of land and season. A study based on age was carried out by Van Liere & Dunlap (1980), who argued that younger people were more likely to embrace the social change necessary for environmental protection, whereas older people were more established in their habits and less malleable.

The results of the current study have shown that male farmers were more aware of the devolution of agricultural extension services compared to their female counterparts. The

results of the current study agree with Ragasa *et al*. (2012), who found that female heads of families are less likely to receive extension services and access quality services than their male counterparts due to disparities in awareness levels. The evidence from most literature has proved that education and new technology use are directly correlated (wolf, 2010).

The level of awareness about the devolution of agricultural extension services was greater among the more educated farmers compared to less educated farmers. These results are consistent with Catherine *et al*. (2012), who noted that a favourable mental attitude is created through education, which fosters greater awareness about extension service delivery. The acceptability of new techniques, particularly information-intensive and management-intensive methods, is closely linked to education and has been shown to have a favorable impact on extension access. According to Girma *et al*. (2019), the education of a farmer has a positive effect on the probability of seeking agricultural extension services and by extension, adoption of improved technologies in agriculture. Consequently, there is more information about the advantages and disadvantages of alternative technologies among the more educated farmers as compared to their less educated counterparts (Doss & Morris, 2001). Formal education was found to significantly influence farmers' awareness of decentralization (devolution) of extension services in other study by Turyahabwe *et al*. (2017) and Saikia *et al*., (2013).

Household heads who were wealthier were more aware of the devolution of agricultural extension services as compared to household heads from low-income households. The results are in agreement with Kidanemariam *et al*. (2015), who observed that asset holdings significantly influenced farmers' awareness of issues to do with the delivery of agricultural extension services. Likewise, wealthier household heads were more willing to participate in the agricultural extension programmes since they had resources at their disposal.

The results of the current study also agree with Muatha *et al*. (2017), who found that household income had a significant positive effect on farmers' awareness of agricultural extension devolution. In their study, the majority of the respondents with more income were more aware of agricultural extension devolution. In addition, Munyua & Stilwell (2009) also found that people with more income were more aware of new developments in different economic sectors.

The results of the current study have shown that Households with large sizes of land were more aware of the devolution of agricultural extension services as compared to household with smaller sizes of land. These results are consistent with Khonje *et al*. (2015) and Sodjinou *et al*. (2015) who separately documented the influence of household size on farmers' access to agricultural services (including their extent of awareness about agricultural extension services). However, the results of the current study are not consistent with Anang & Asante (2020) who found that household size did not significantly influence both access and awareness of agricultural extension services in northern Ghana.

5.2 Factors influencing delivery of extension services by the County Government of Kitui

The finding of the current study found that availability of transport services for agricultural extension staff is a good way of enhancing service delivery in the county governments. The results of the current study are consistent with Tladi-Sekgwama (2019) who found that effective delivery of agricultural extension services is constrained by four groups of factors: physical, administrative, extension worker related and farmer related. Among the constraints related to administration and logistics of extension services include a lack of a transport system for use by the extension staff. Tladi-Sekgwama (2019) recommended institutional and market reforms that included privatization of agricultural extension services as a good approach to attaining efficient delivery of agricultural extension services.

The finding of the current study found that extension officers' salaries should be attractive and paid on time. Better and timely salaries are a key ingredient for better service delivery in agricultural extension. The results of the current study agree with Machiadikwe *et al*. (2016) who noted that a key motivating factor for agricultural extension staff includes better and timely salaries. In their study, the lack of impressive performance of extension delivery in research-extension-farmer linkage activities in the study area was attributable to the poor motivation of extension staff due to low salaries that were not paid in time. Extension agents in the area of study who were fairly motivated were found to be effective in doing their work. The extension agents that received timely payment of salaries reported being happy doing their job and would not leave for another (Machiadikwe *et al*., 2016).

The finding of the current study found that when extension officers are properly promoted in their respective job groups, their motivation tends to be better, and consequently, they better deliver extension services. Mwangi & McCaslin (1994) observed that proper promotion among the agricultural extension staff was an important factor that influenced their quality of service delivery. In their study, Mwangi & McCaslin (1994) found that most extension agents believed that a lack of fair promotion was a key factor in low job morale and, consequently, high job turnover among Kenya's public extension staff in the Rift Valley Province.

The finding of the current study found that agricultural extension staff who are assigned with duties and responsibilities that have no duplication tend to deliver better for farmers. This is consistent with MOALF&C (2018) who argued that in their execution of extension functions, governments (both at national and county levels) should put more effort into streamlining the coordination mechanisms so that there is no duplication of duties and responsibilities. Lack of a structured and distinct coordination function within national and county agricultural sector policies, limited interest and weakness in coordination, possibly because it is perceived as a loss of authority/independence, difficulties in coordination of activities by organizations with vastly different work

cultures, and mutual suspicion among service providers are just a few of the key challenges (Aydin & Buthe, 2016). According to MoALF&C (2018), the results of ineffective coordination are manifold and include a lack of mutually agreed set of sector performance indicators and joint performance review mechanisms, duplication, inconsistencies in the quality of service delivery, and inefficient use of resources and sub-optimal attainment of objectives. Past national initiatives on agricultural sector coordination, attempted by the National Agricultural and Livestock Extension Programme (NALEP) as well as the Agricultural Sector Development Support Programme (ASDSP) through the Agricultural Sector Coordination Unit (ASCU) have not been sustained as they lacked systemic institutionalization (Maina *et al*., 2013).

The finding of the current study found that superior service delivery by agriculture extension staff to the farmers requires that the latter is offered with a good work environment. The current findings are in line with those made by Mwangi & McCaslin (1994), who found that a good working environment was a crucial element in determining the motivation of extension employees. The absence of good work environment eventually leads to poor performance of agricultural extension services as was observed in Rift valley province of Kenya (Mwangi, 1993). A favorable and conducive work environment should be characterized by fair allowances and a responsive health insurance scheme (Njoroge, 2007).

The findings of the current study found that for extension staff to be effective in their work, increased facilitation of their activities is key. The results of current research agree with Harvey (2021) who noted that increased facilitation was a key factor that enhanced the long-term consistency in service delivery of agricultural extension services. With a range of interventions that are geared towards supporting extension activities in rural areas, the government is able to facilitate necessary movement, further training and demonstration activities of its staff, something that can enhance the extension service delivery (Anandajayasekeram, 2008).

The current study also established agricultural extension service providers in Kitui County, which included: County government of Kitui, Agro-dealers (Syngenta, Kemagro, Agrichem), CARITAS, European Committee for training and agriculture (CEFA), Kitui Development Centre (KDC), Food and Agriculture organization (FAO), Kenya Red Cross Society, Agriculture Sector Development Support Programme (ASDSP II), Kenya Cereal Enhancement Programme- Climate Resilient Agricultural Livelihoods (KCEP-CRAL), National Agricultural and Rural Inclusive Growth Project (NARIGP), NGOs Adventist Development And Relief Agency (ADRA), IMPACT AFRICA), African Development Service (ADS), religious organizations, Sahelian Solutions Foundation(SASSOL), United States Agency for International Development **(**USAID), World Food Programme **(**WFP**)**, World Vision, Hand in Hand and Samaritan Purse.

5.3 Interactions between agricultural extension functions run by county and national governments

Results of the current study indicate that there was greater involvement of extension staff in the development of work plans in the national government is attributed to better interactions between the national government and county government. The Results of the current study are in agreement with the Ministry of Devolution and Planning (2016), which found that proper execution of the county's devolved functions on agriculture is dependent on enhanced interaction between the county and the national government. For good interaction, staff from the devolved units should be involved in the development of a work plan in the national government. According to the Ministry of Devolution and Planning (2016), the 2010 Constitution of Kenya is a good roadmap to various institutional reforms and implementation. The adoption of a devolved system of government that is coherent with the functioning of the national government can fundamentally enhance the country’s governance structure. Coordination of activities and institutional roles are facilitated and conveyed, through institutions within the government as provided in the constitution. Proper coordination of the work planning process can be a good move towards delivering better services to the citizens.

Results of the current study indicate that greater involvement of county extension staff in the implementation of work plans in national government is attributed to better interactions between the national government and county government. According to the COG (2017), more benefits can be realized through the enhancement of interactions between the national government and county government. This corroborates the findings of the current study that involvement of county extension staff in executing national functions is in line with the constitution of Kenya (2010) as contained in *Article 190*, and the County Governments Act (2012) offers a framework that enables the performance of devolved functions, including the agricultural extension services. The legal framework that supports the devolution of agricultural extension services envisaged that proper coordination mechanisms were necessary and should be established.

Greater involvement of extension staff in monitoring and supervision of agricultural extension programmes/projects in the national government is attributed to better interactions between the national government and county government. According to the COG (2017), more benefits can be realized through the enhancement of interactions between the national government and county government. This corroborates the findings of the current study that such interactions could lead to a lack of duplication of activities and better coordination of agricultural extension services to farmers.

5.4 Impact of devolution of agricultural extension services on farmers' agricultural productivity and farmers' incomes

5.4.1 Devolution of agricultural extension services and farmers' agricultural productivity

The findings of the current study, greater technical efficiency is associated with greater diversification in crops. Nguyen (2014) agrees with the study's conclusions that more varied agricultural farms in Vietnam are more productive. Non-diversified farms are not very productive in their agricultural activities as compared to diversified farms. Even though crop diversification calls for additional skills in terms of management, the results

include better input utilization, production of better and marketable crops and less reliance on a single crop (Pingali, & Rosegrant, 1995)

Famers who have contact with agricultural extension services produce higher with greater technical efficiency (Elias *et al*., 2013). Access to extension services avails useful advice about diversification and the adoption of appropriate modern farming technologies.

According to Langyintuo & Mekuria (2008), farmers who benefit from agricultural extension services often access key technical knowledge and skills on a wide range of crop husbandry practices that enhance their production and associated management practices – this enhances their level of productivity. Similarly, according to Elias *et al*. (2013), in their study in Ethiopia, agricultural extension services have the potential to increase farm productivity by about 20%. In their separate studies, Bozolu & Ceyhan (2007) and Mango *et al*. (2015) observed that the availability of agricultural extension services had a statistically significant positive influence on technical efficiency in Turkey and Zimbabwe, respectively

Male-headed households, according to the current study, have higher technical efficiency compared to their female counterparts. These results are consistent with Wongnaa (2016) who found that the male gender improves technical efficient of maize productivity in Ghana. Farmers' use of technologies that often enhance productivity such, as improved seeds and animal power is associated with the gender of the household head. Women are generally disadvantaged in land and property ownership due to socioeconomic and cultural considerations, and they do not have access to extension. This puts them at a further disadvantage in using productivity-enhancing technologies in their agricultural activities (Appleton & Scott, 1994).

According to the current study, household heads who have no formal education have lower technical efficiency compared to their counterparts with formal education (lower primary, upper primary, secondary and tertiary). The results of the current study agree

with findings by Tabi *et al*. (2010) who found that more educated farmers have better adoption of productivity-enhancing technologies since they can easily access their related information as well as comprehend their associated benefits. Less-educated farmers are often less able to get information about new technologies and are also poorer in the acceptance of such technologies (UBoS, 2010). In the same way, more educated farmers are better able to get extension-related information which by extension enhances their agricultural production. According to UBoS (2010), the level of education of a farmer influences their ability to afford and use several productivity-enhancing technologies in developing and less developed countries. More educated farmers are therefore more efficient in their understanding and use of superior farming technologies than their less-educated counterparts. Elsewhere in Ghana, Wongnaa (2016) noted that productivity (as measured through the level of technical efficiency) is associated with the level of education of farmers in maize farming.

The current study found that households with heads who have a tertiary level of education have higher technical efficiency compared to their counterparts with less than a tertiary level of education (no formal education, lower primary and upper primary, secondary). The results of the current study agree with Wongnaa (2016) who found that higher levels of education such as college and university education influenced the technical efficiency of maize farmers in Ghana. The finding of the current study also agrees with Rogers (2003) who found that complex technologies do not support and enhance the adoption of improved input. Education is a key factor that reduces the complexity of agricultural technologies. Tura *et al*. (2010) disagree with this current study, which found that households with more educated heads are less likely to adopt improved maize seed varieties.

According to the results of the current study, households with both crop and livestock enterprises have lower technical efficiency compared to their counterparts who are specialized in either crop or livestock according to the current study. This is consistent

with the finding by Nguyen (2014), who found that specialized farms in Vietnam have lower productivity.

Results of the current study indicate that households with higher incomes have higher technical efficiency compared to their counterparts with less income according to the current study. This corroborates findings by Wongnaa (2016) who found that household income was a key factor in increasing the technical efficiency of maize farmers in Ghana. Similarly, Mpawenimana (2005) found that farmers who have more income can use improved agricultural technology and achieve higher productivity. For this reason, the use of productivity-enhancing technologies in maize farming is associated with high household incomes. Availability of income among the farming households closes the liquidity gaps faced by farmers in their purchase and use of agricultural inputs. This facilitates the timely application of agricultural inputs and enhances crop productivity and consequently, farming income (Oseni & Winters, 2009).

According to the findings of the current study, households engaging in non-farm activities have higher technical efficiency compared to their counterparts who are not engaged in non-farm activities. This disagrees with Amaza, *et al*. (2007) who found that farmers with larger families attach greater importance to nonfarm activities than those with smaller households. Consequently, most households engaging in non-farm activities have lower productivity.

The current research shows that there is substantial technical inefficiency among the sampled smallholder farms with respect to maize farming. Farmers could increase their output by 40.13% on average without using additional resources, simply by improving technical efficiency. These estimates of technical efficiency are not consistent with the findings of Mwajombe & Mlozi (2015), Elias, *et al*. (2013), Amaza, *et al*. (2006), and Kudaligama &Yanagida (2000) who separately estimated the average technical efficiency levels ranging between of 65% and 78% in Tanzania, Bangladesh, Ethiopia, Nigeria and India.

This research's findings are consistent with Faguet (2014) who found that devolution of administration structure spurred the provision of public services to the less privileged and positively impacted on their level of income. Key among the beneficiaries of devolution in Kenya were farmers through the devolution of the agriculture sector. According to Faguet (2014), devolution leads to more unity between the people, leadership and the local administration personnel and therefore, enables them to comprehend their particular desires and preferences as to realistically mirror these in the development issues. Due to the decentralization of authority, devolution sufficiently allocates monetary assets and ensures effectiveness in the provision of services, especially to the less privileged and susceptible segments of the public where most smallholder farmers fall. The results of the current study also agree with Gunderson *et al.* (2014) who also found that the devolution of agricultural sector had realized better service delivery in the United States of America thereby guaranteeing greater incomes for farmers. Diverse needs and preferences across the United States justified the devolution, or decentralization, of many Federal Government programs to the State or local level (Rogers, 2003). The move toward devolution of the U.S. agricultural policy, due to significant differences across States in such areas as commodity production, production costs, income distribution, and opportunities for off-farm work already reflect an appreciation of the gains from devolution, with some programs accommodating differences in State and regional preferences (Goyal &Nash, 2017). This agrees with Muhumed & Minja (2019) who found that the household incomes were significantly improved among the farming households as a result of the devolution of agricultural extension services in Wajir County. As a result of the devolution of agricultural extension services, the Wajir County government was able to perfect the delivery of extension services, provide greater funding to the agriculture sector and facilitate inputs subsidy programmes (e.g. fertilizers and certified seeds). Consequently, as a result of devolution, there was an increase in food production, improved food security and enhanced farmers' incomes.

5.4.2 Devolution of agricultural extension services and farmers' incomes

According to the findings of the current study, devolution of agricultural extension services has a statistically significant contribution to the farmer's income. As a result, the aquaculture sector that has the potential of enhancing food security and employment creation in Laikipia County is now faced with declining productivity (Atsiaya, 2017).

The study findings agree with Muhumed & Minja (2019) who found that the devolution of agricultural activities in Wajir County had significantly improved agricultural productivity in the county. Due to the devolution of the agricultural activities, farmers in Wajir County can produce more at a lower cost due to support derived from the county government which comes in form of extension services, funds, and inputs (e.g. seeds and fertilizers) and credits. Due to closer attention to the sector by the county government, agricultural activities have started becoming fruitful resulting in greater food security due to an increase in productivity.

The results of the current study agree with Goyal & Nash (2017) who found that a devolved system of governance is associated with better public spending and more so in extension, provides a greater likelihood of supporting agricultural productivity. As part of its recommendation, the study proposed support for devolution as a move to raise agricultural productivity in sub-Saharan Africa.

The results of the current study agree with Birch (2018) who found that the greatest improvement in agricultural productivity, and on reducing poverty and malnutrition, may be achieved through greater support for devolution.

The results of the current study disagree with Mutuga (2018) who found that even after devolution, there is continued lack of support to aquaculture by the devolved county government to keep the sector on the growth path. Lack of inputs necessary for aquaculture and declining extension services had a negative impact on production.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The majority of sampled respondents were aware that the agriculture extension service was devolved to the county government. The most popular channel used in the delivery of information to the farmers was field day/demonstration. Most farmers' choice of the service provider was attributed to distance, with most farmers preferring providers who were located near them. Most farmers were satisfied with the timeliness, adequacy, professionalism, and relevance of information received on agricultural extension services. The majority of farmers who received extension services followed all of the extension worker/s' recommendations. Some did not due to the size of their farms, income, education levels, and the relative advantage of the recommendation.

The most widely applied agricultural extension recommendation was for good agronomic practices. Some of the extension recommendations were not implemented by farmers due to the non-availability of associated technology, being time-demanding, being uninterested, a lack of understanding of the technology, and implementation cost. The majority of the respondents indicated that they preferred extension information packaged in the form of print (brochures, pamphlets, and leaflets). The majority of the respondents preferred it if extension information could be packaged in vernacular language. The major cost area in livestock and crop extension is transport, both for farmers to the service provider's office and for the service provider to the farm.

The coefficients for household head age, household head gender, household head education, household income, and land size were statistically significant, thus they were important factors that influenced farmers' awareness of the devolution of agricultural extension services.

An overwhelming majority of the respondents preferred to move to the national government if given a chance. This translates to dismal performance in extension service

delivery in the study area. A majority of the extension staff disagreed that there was increased availability of transport for extension services. Most of the extension staff disagreed that housing facility for extension staff has improved.

Majority of the extension staff disagreed that there is timely payment of salaries for extension officers. Most the sampled extension staff disagreed that there was proper promotion for extension officers. A majority of the extension staff disagreed that there were fair and transparent transfers. Extension staff sampled disagreed that there are well outlined duties with no duplication. Most of the extension staff disagreed that there is favorable and conducive work environment. Sampled extension staff disagreed that there is increased facilitation for extension activities. Extension staff sampled disagreed that there is increased training and capacity building for extension staff.

The coefficients for the availability of transport for extension services (1.53), timely payment of salaries for extension officers (2.15), proper promotion for extension officers (1.56), well-outlined duties with no duplication (1.76), favorable and conducive work environment (2.31) and increased facilitation for extension activities (2.93) were positive and statistically significant at 5% level ($P<0.05$) influencing better delivery of extension services.

The majority of the extension staff indicated to be involved on a scale of medium and low with respect to the three major areas of service delivery (development of work plan, implementation of work plan and monitoring/supervision of agricultural extension programmers/projects) at the national level. Majority of the sampled extension officers poorly rated the effectiveness of communication within the ministry of agriculture at the county and national level and linkages between the national government and county government on extension services.

The coefficients for the level of involvement of extension staff in the development of work plan in the national government (1.810), level of involvement of extension staff in

the implementation of work plan in national government (0.970), level of involvement of county extension staff in monitoring/supervision of agricultural extension programmes/projects in the national government (0.714) were positive statistically significant at 5% level ($P<0.05$). This implies that greater involvement of extension staff in the development and implementation of work plans at the national level as well as monitoring/supervision is attributed to better interactions between the national government and county government.

A substantial technical inefficiency among the sampled smallholder farms concerning maize farming was observed. Farmers could increase their output by 40.13% on average without using additional resources, simply by improving technical efficiency.

About 27.2% of the gap in maize productivity between adopters and non-adopters of devolved agricultural extension services resulted because of the differences in observable characteristics as explained component of the B-O decomposition.

There was a significant difference in incomes from all the major crops, with the farmers who were accessing devolved agricultural extension services receiving higher incomes than their counterparts who were not using the service.

An overwhelming majority of the farmers were aware that agriculture extension service was devolved to the county governments. Age of household, gender, education, income and size of the land were important factors that influenced farmers' awareness of devolution of agricultural extension services. Male and young farmers who are more educated and wealthier households (with greater income) were aware about devolution of agricultural extension services as compared to their counterparts from low income households. Households with large sizes of land were aware about devolution of agricultural extension services as compared to household heads with smaller sizes of land.

Most of agricultural extension providers disclosed minimal performance in extension service delivery by the county government. Respondents sampled disclosed that given chance they can be comfortable working with the national government. Extension service delivery in the study area is affected by several factors such as lack of transport to do extension work efficiently, delayed salaries, timely promotion of agricultural extension officers, clear terms of service with no duplication, appreciative and enabling working atmosphere and increased facilitation for extension activities. This translates to allocation of more funds to agricultural extension to facilitate transport, salaries payment in time, promotion, training and avoidance of work duplication for better extension service delivery in Kitui County.

There is minimal interaction between agricultural extension functions run by county and national governments. Most county extension staffs are involved in a scale of medium and low with respect to development of work plan, implementation of work plan and monitoring/supervision of agricultural extension programmes/projects. Greater involvement of extension staff in development and implementation of work plan in the national level as well as monitoring/supervision can significantly contribute to better interactions between national government and county government.

A substantial technical inefficiency among the sampled smallholder farms with respect to maize farming was observed. Farmers could increase their output by 40.13% on average without using additional resources, simply by improving technical efficiency. The mean agricultural productivity by adopters of devolved agricultural extension services was 52.3% greater than that of non-adopters. Adoption of devolved agricultural extension services resulted in significant improvement in agricultural productivity. On the other hand, there was a significant difference in incomes from all the major crops with the farmers who were accessing devolved agricultural extension services receiving higher incomes than their counterparts who were not using the service. Devolution of agricultural extension services has a statistically significant contribution to the farmer's income.

6.2 Recommendations

Based on the findings and the conclusion drawn above, this research makes these recommendations:

i. More campaigns should be made in the vast Kitui County to create awareness about the devolution of agricultural extension services and encourage more smallholder farmers to take advantage of the service. Key campaigns should especially be implemented through women groups, since women are the ones who are less aware.

ii. More funds should be allocated to agricultural extension to cater for transport, promotion of agricultural extension officers, timely payment of salaries, well-defined terms of service with no duplication and a conducive work environment. For efficient delivery of extension service in Kitui County, extension officers should be well facilitated through timely payment of their salaries, adequate transport facilities and access to technologies. Agricultural Extension work requires more funds to reach most of the farmers in vast Kitui County. The study recommends some deliberate measures by the devolved county governments geared towards tackling the problem of lack of inputs and low input subsidies (especially feed) in a similar manner to subsidies existing for agricultural crop and livestock production.

iii. Greater involvement of extension staff in the development and implementation of work plans as well as monitoring/supervision at the national level should be enhanced to contribute to better interactions between the national government and county government.

iv. A determined budget support by Kitui County government to enhance agricultural extension services as a way of improving agricultural productivity and increasing farmers' incomes.

6.3 Future research

The findings of this study would act as a base for more research on the impact of devolution of the agriculture sector on delivery of agricultural extension services and

productivity in Kitui County. This study was not exhaustive and recommends further research on:

i. The effect of politics on farmers' awareness of devolution of agricultural extension work.
ii. To evaluate the areas of weaknesses of the agricultural extension functions run by county and national governments.
iii. The influence of devolved agricultural extension services on poverty alleviation amongst subsistence farmers in Kitui County.

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APPENDICES

Appendix A: Extension Officers Questionnaire

You have been selected among other extension officers to assist in providing information on the impact of agricultural sector devolution on Agricultural extension services delivery in Kitui County. The information you provide will be used for study purposes in South Eastern Kenya University. Successful study may promote agricultural extension service provision in Kitui County and other regions of Kenya. Please give information as correct as possible for it to be useful in the research and will be kept highly confidential.

I would therefore appreciate if you spare some of your time. Thank you.

SECTION A PROFILE OF RESPONDENTS

Instructions: Tick and/or fill where appropriate Date ……

1. Respondents name …… (optional)
2. Gender male ☐
   Female ☐
3. Job title……
4. Which institution /organization has employed you…….
5. What is your educational level?

- Have not gone school ☐
- Lower primary ☐
- Primary level ☐
- Secondary level ☐
- College ☐
- University level ☐
- Masters ☐
- PhD ☐
- Prof. ☐

6. Respondent area of training / specialization

……

……

……

7. Age in years

……

……

8. Years of service/ Working period in years

……

……

(Agricultural extension functions run by county and national governments and the links between them)

9. Who runs Agricultural extension services in the County?

County government ☐

National government ☐

Sassol ☐

Religious ☐

Others……

……

10.Which extension services are run by the following organizations?

County government ……

National government……..

Sassol …….

Religious……..

NAGRIB……

FAO……..

Others……

11. Which of the above mentioned extension services providers; which is the most preferred.

County government ☐

National government ☐

Sassol ☐

Religious ☐

NAGRIB ☐

FAO ☐

Others Specify……

12. Give reasons for your answer

---

13. Comparing financing of the extension services under national and county government, which one has a better financing?

National ☐

County ☐

14. Give reasons for your answer

15(a). How is the involvement of extension staff in development of work plan in the National and county levels/governments?

National government

Not involved ☐

☐

Low

Medium ☐

High ☐

b) County government

Not involved ☐

Low ☐

Medium ☐

High ☐

16(a). How is involvement of agricultural staff in implementation of work plan in national and county government?

National government

Not involved ☐

Low ☐

Medium ☐

High ☐

(b) County government

Not involved ☐

Low ☐

Medium ☐

High ☐

17(a). In your opinion, what is the level of involvement of extension staff on monitoring/supervision of agricultural extension programmes/projects

National government

Not involved ☐

Low ☐

Medium ☐

High ☐

(b) County government

Not involved ☐

Low ☐

Medium ☐

High ☐

18(a). How do you rate communication in the agricultural sector especially extension services before and after devolution?

Before devolution

Very good ☐

Good ☐

Poor ☐

Very poor ☐

(b) After devolution

Very good ☐

Good ☐

Poor ☐

Very poor ☐

19. Give reasons for your answer above

20**.** In your view what are the linkages between national government and county government on extension services?

……

……

……

21**.** How do you rate the linkages between national and county government

Very good ☐

Good ☐

Poor ☐

Very poor ☐

22. Explain the answer given above

……

……..

(Factors influencing effectiveness of agricultural extension officers in service delivery)

23. What is the status of transport availability for extension services in the county?

i) Transport facility has increased

Increased ☐

Decreased ☐

No change ☐

No idea ☐

ii) Housing facility has increased

Agree ☐

Disagree ☐

Undecided ☐

iii) Salaries for extension officers are paid on time

Agree ☐

Disagree ☐

No idea ☐

iv) Promotion are done as before devolution

Agree ☐

Disagree

No idea ☐

v) Transfers in the county are fair and transparent

Agree ☐

Disagree ☐

No idea ☐

vi) There is no duplication of duties in the county and national government

Agree ☐

Disagree ☐

No idea ☐

vii) Extension staff work in favourable and conducive environment

Agree ☐

Disagree ☐

Undecided ☐

viii) Facilitation for extension activities has increased

Agree ☐

Disagree ☐

No idea ☐

ix) Training and capacity building for extension staff has increased

Agree ☐

Disagree ☐

Undecided ☐

24. Given chance can you move to national government or will remain with county government employment

National government ☐

County government ☐

25. Give reasons for answer given above

……

……

……

……

Appendix B: Farmers' Questionnaire

You have been selected among other farmers to assist in providing information on the impact of agricultural sector devolution on Agricultural extension services delivery in Kitui County. The information you provide will be used for study purposes in South Eastern Kenya University. Successful study may promote agricultural productivity in Kitui County and other regions of Kenya. Please give information as correct as possible for it to be useful in the research and will be kept highly confidential.

I would therefore appreciate if you spare some of your time. Thank you.

(TICK AND/OR FILL WHERE APPROPRIATE)

Date----------

1. Location----------
2. Division----------
3. What is your educational level?
   - Have not gone school ☐
   - Lower primary ☐
   - Primary level ☐
   - Secondary level ☐
   - College ☐
   - University level ☐
4. Gender
   - Male ☐
   - Female ☐
5. What is your monthly income?
   - <1000 ☐
   - 1001-3000/= ☐
   - 3001-10,000/= ☐
   - Above 10,000. ☐

6. What is your age?

Less than 20 years ☐

21-30 years ☐

31-40 years ☐

41-50 years ☐

Above 51 years ☐

7. What size is your farm in acres?

< 1 ☐

1- 1.9 ☐

2 - 2.9 ☐

3- 3.9` ☐

4 – 4.9 ☐

> 5 ☐

8. What is your occupation?

Crop farmer ☐

Livestock keeping ☐

House wife ☐

Business ☐

Employed ☐

Casual labor ☐

Others----------

9. What crops do you grow normally in your farm?

Maize ☐

Beans ☐

Cowpeas ☐

Green grams ☐

Pigeon peas ☐

Mangoes ☐

Oranges ☐

Cassava ☐

Vegetables ☐

Others specify----------

10. Among your list of crops, which ones have benefited from extension services?

……

……

11. What type livestock do you keep on your farm?

Dairy cows ☐

Beef cows ☐

Indigenous cows ☐

Dairy goats ☐

Indigenous goats ☐

Poultry ☐

Sheep ☐

Others specify----------

12. Among your list of crops, which ones have benefited from extension services?

……

13. What was your crop productivity in the periods indicated below?

Crop/ha/acre	Year 2012 (in bags)	Year 2017 (in bags)
Maize		
Beans		
Green gram		
Mangoes		
Oranges		
Cow peas		
Pegion peas		
Vegetables		
Cassava		
Others		

14. What were your incomes from crops in years shown below?

Crop/ha/acre	Year 2012 (Kshs)	Year 2017 (Kshs)
Maize		
Beans		
Green gram		
Mangoes		
Oranges		
Cow peas		
Pegion peas		
Vegetables		
Cassava		
Others		

15. Indicate your livestock numbers as shown below

Livestock	Year 2012 (in numbers)	Year 2017(in numbers)
Dairy cows		
Beef cows		
Indigenous cows		
Dairy goats		
Indigenous goats		
Poultry		
Sheep		
Donkeys		
Others		

16. What are your incomes from livestock?

Livestock	Year 2012 (Kshs)	Year 2017(Kshs)
Dairy cows		
Beef cows		
Indigenous cows		
Dairy goats		
Indigenous goats		
Poultry		
Sheep		
Donkeys		
Others		

17. How do you use your income from agriculture?

…….

……..

……..

18. What is the average amount spent per year on the items mention above?

……

……

……..

19. Are you aware that agricultural sector was devolved and extension will be administered form the county level? 1= Yes, 2=No

20. Who informed you about devolution of agricultural extension to county level? 1= Political rallies 2= Radio and/or television 3=farmer groups/meetings 4= Neighbors 5= Others (specify)_____

21. Do you use agricultural extension services on crop and livestock production? 1= yes 2= No. `

22. If you use agricultural extension services answer the question below

Agricultural extension information	Did you seek extension in the last 12 months? 1=Yes 2=No	Where did you get extension Service from? 1=government officer 2=Non-governmental officer 3=Company agent 4=CBO /cooperatives 5=Agrovet dealers 6=Researcher 7=fellow farmer 8= media	How did you receive it? 1= farm and home visit 2= officer organized extension program 3=Visited extension offices 4= media	Channel used to deliver the information 1=Field day/demonstration 2=ASK shows 3=radio/television 4=print media 5= mobile phone	Please give reasons for choosing the extension provider 1= accessible 2=it is always there for me 3=Not costly 4=Knowledgeable about extension services 5=other(specify)_____

23. How do you rate the following agricultural extension advice? Tick where applicable

	Very satisfied	satisfied	Not satisfied
Extension information given In time			
Completeness of extension advice			
officers competency			
Compatibility of information			

24. Have ever practiced any agricultural extension advice given by agricultural officer?_____ 1=Yes 2=No 3=Some

25. If yes, what was the recommendation?

……..

…….

……..

26. If you have not used the extension recommendation, what were the reasons?

1 =Expensive 2= Not appropriate 3=Not important 4=Not different from what I've been doing 5=It is laborious 6=Other (specify) _____

27. What are the reasons why your house hold did not use agricultural extension services 1=Not important 2=Not easy to get, 3=costly, 4=Not useful, 5=Other (specify)_____

28. What is your advice on extension material and other farming information preparation so that it's of benefit to you for improving productivity and farm decision making?

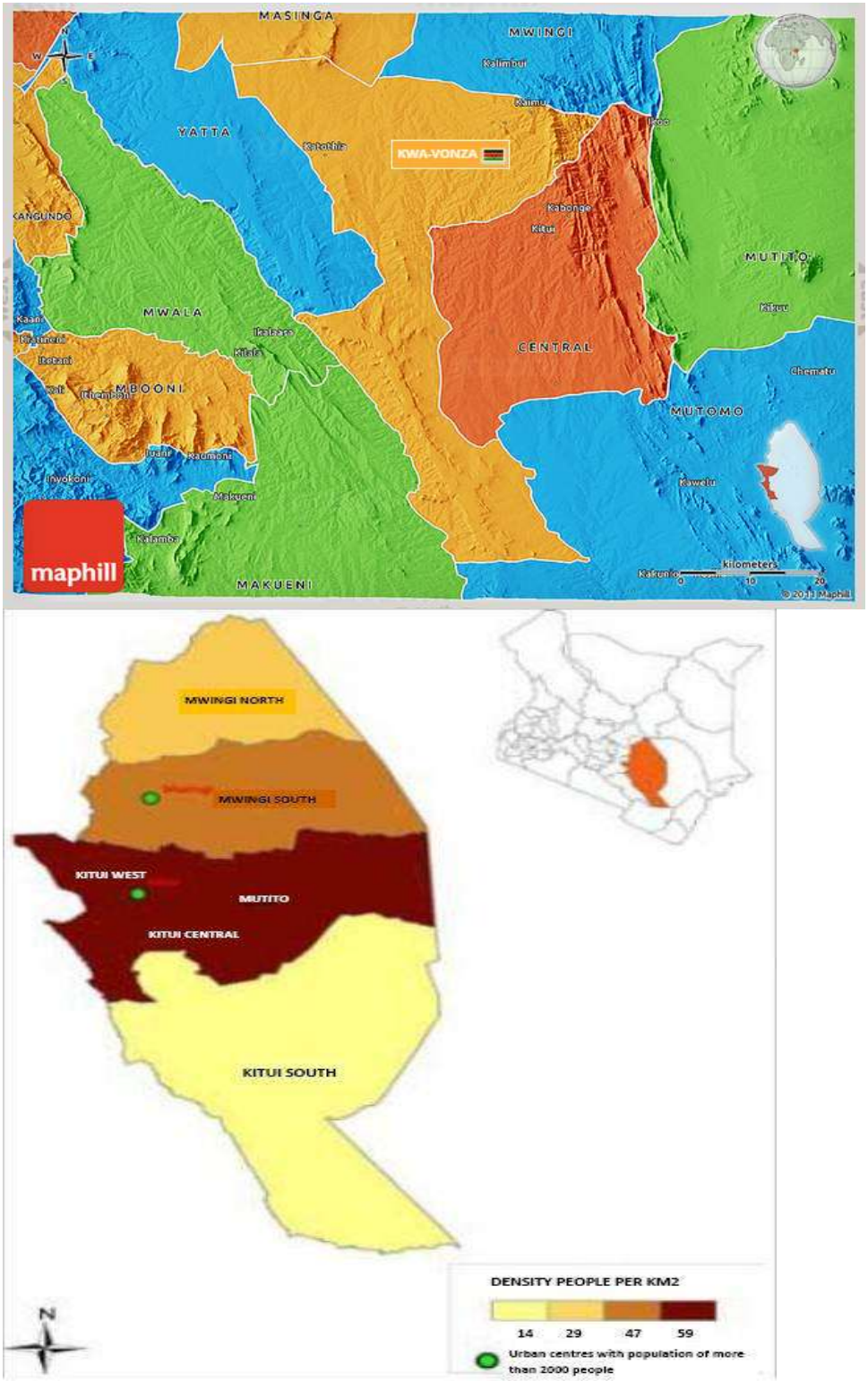
Information preparation: 1=Print (circulars, Bulletins, and leaflets) 2= Radio 3= Television 4= Internet 5= Others, Specify_____

And in which language?_____

Codes for languages: 1= English 2=Kiswahili 3= Vernacular

29. How much money have you spent on livestock extension Ksh _____.crop extension? Ksh_____ over the past 12 months.

Appendix C: Map of Kitui County



Source: Kenyaplex (2021)