

**EFFECTIVENESS OF FARMERS' CALL CENTRE STRATEGY IN DELIVERY OF  
AGRICULTURAL EXTENSION SERVICES: THE CASE OF NAKURU FARMERS' CALL  
CENTRE, NAKURU COUNTY, KENYA**

**SHELMITH WARUGURU MUCOKI**

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

**EGERTON UNIVERSITY**

**MAY 2023**

## DECLARATION AND RECOMMENDATION

### Declaration

This thesis is my original work and has not been presented in this or any other university for the award of a degree.

Signature



Date 15<sup>th</sup> May 2023

Shelmith Waruguru Mucoki

EM12/3169/12

### Recommendation

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

Signature:



Date 20/05/2023

Dr. Agnes Oywaya Nkurumwa

Department of Agricultural Education and Extension,

Egerton University

Signature



Date 22.05.2023

Dr. Stephen Wambugu Maina

Department of Agricultural Education and Extension,

Egerton University

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## **DEDICATION**

To my beloved husband Peter Kariuki Kagema and our Children Sheryl Wanjiku, Sherleen Gathoni, and Sosniel Kagema.

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## ABSTRACT

Limited access to agricultural information is among the factors that contribute to low productivity and profitability in agricultural value chains in Nakuru County. To address this challenge, Nakuru County Government adopted Farmers Call Centre strategy by setting up Nakuru Farmers' Call Centre. The call centre is an Information Communication Technology based interactive and innovative strategy for delivering agricultural extension services. Despite the adoption of the strategy, farmers still complained about delays in responding to queries and requests, provision of low-quality services, lack of follow-ups, and low productivity. The unsatisfactory realization of the envisaged improvements could perhaps be due to the effectiveness of Nakuru Farmers' Call Centre in the delivery of extension services. This study investigated the effectiveness of Farmers Call Center strategy in the delivery of agricultural extension services in Nakuru. The study adopted the descriptive survey research design. The target populations were all the 3,473 farmers who had interacted with the NFCC and four agricultural extension experts from Nakuru Farmers' Call Centre. The accessible population was the four experts and 1993 farmers from Njoro, Subukia, Molo, and Rongai Sub-Counties farmers who had interacted with the center. Purposive sampling was used to select the four experts who were involved in the study while 110 farmers who participated in the study were chosen using proportionate and simple random sampling techniques. A farmers' questionnaire and call center experts' interview guide were used to collect data. The face and content validity of the two instruments were checked by experts from the Department of Agricultural Education and Extension. Reliability of the questionnaire was estimated using the Cronbach Alpha method. It yielded a reliability coefficient of 0.879. Data was analyzed with the aid of the Statistical Package for Social Sciences. Frequencies and percentages were used to summarise and describe qualitative data while means and standard deviations generated using a 5 points rating scale were used to determine effectiveness. The results showed that effectiveness of communication media used in the delivery of extension services was rated at  $M = 3.24$  ( $SD = 0.90$ ), the ability of Nakuru Call Center to link farmers with stakeholders was at  $M = 3.40$  ( $SD = 0.50$ ) while quality was at  $M = 3.81$  ( $SD = 0.26$ ). It was concluded that the center's communication media was effective in the delivery of extension services. The center was also effective in linking farmers to stakeholders and provided them with quality extensions service. It is expected that the findings of the study would inform Nakuru Call Center, farmers, and extension agents on the most effective communication media in the delivery of agricultural extension services. The findings could also be used by the County Government when reviewing policies that aim at strengthening provision of extension services in terms of facilities, funding and personnel.

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## LIST OF ABBREVIATIONS AND ACRONYMS

<b>AKIS</b>	Agricultural Knowledge and Innovation System
<b>ATC</b>	Agriculture Training Centre
<b>DAC</b>	Department of Agriculture and Cooperation
<b>DOALF</b>	Department of Agriculture, Livestock and Fisheries
<b>EUREC</b>	Egerton University Ethics Review Committee
<b>FAO</b>	Food and Agricultural Organization of the United Nations
<b>FCC</b>	Farmers Call Centre
<b>HRM</b>	Human Resource Management
<b>ICT</b>	Information and Communication Technology
<b>KCC</b>	Kisan Call Centre
<b>KNBS</b>	Kenya National Bureau of Statistics
<b>NACOSTI</b>	National Commission for Science, Technology, and Innovations
<b>NFCC</b>	Nakuru Farmers Call Centre
<b>SPSS</b>	Statistical Package for Social Science
<b>SSA</b>	Sub-Saharan Africa
<b>TAM</b>	Technology Acceptance Model
<b>US</b>	United States
<b>USDA</b>	United States Department of Agriculture
<b>WB</b>	World Bank

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the Study

The agriculture sector plays a critical role in the economy of many countries. In India, it employs more than half of the population (Thar et al., 2021). Agriculture contributes significantly to Brazil's economy as the country ranks as the number one exporter of soya beans, sugar, and coffee (United States Department of Agriculture [USDA], 2022). In Nigeria, it accounts for about 23% of the Gross Domestic Product (GDP) (Food and Agriculture Organization [FAO], 2022). Agriculture accounts for 20 percent of Kenya's GDP and employs over 40 percent of the total population and more than 70 percent of the rural populace (Central Bank of Kenya, 2022). It is important to ensure that the agriculture sector is vibrant given the critical role it plays in the Kenya economy. This can be achieved through effective agricultural extension services since it has a significant impact on the performance of agriculture (McCormack, 2018). Danso-Abbeam et al. (2018) argue that the efficiency of a country's agriculture extension services determines the success of its agriculture sector, because, through it, farmers are provided with information, technology, and innovation which if well utilized leads to increased productivity.

Agricultural extension is a system designed to build and strengthen the capacity of rural farmers and other stakeholders through the provision of information and technology as well as enhancing agricultural skills and practices, the capacity to innovate, and address varied rural development challenges (Barber et al., 2018). Extension services are delivered to farmers by public and private entities, Non-Governmental Organizations (NGOs), and foreign development partners (Steinke, 2020). Agricultural extension services play a key role in sharing knowledge, and technologies, and linking farmers to other actors in the agriculture sector (Anang et al., 2020). The provision of quality extension services to farmers is important since it enhances agricultural productivity and their socioeconomic well-being (Cheplogoi, 2021). Despite its importance, provision of agricultural extension services to farmers has been facing various challenges in many African countries. These challenges include inadequate funding, poorly trained personnel, ineffective agriculture research extension linkages, inappropriate agricultural technologies, low

extension agents to farmer ratio, and lack of clientele participation in program development (Krell et al., 2021; Munthali et al., 2018).

Studies conducted in Kenya show that the country has also been facing challenges in providing quality extension services to farmers. The challenges include low extension agents-to-farmer ratio, inadequate resources (personnel and funds), irregular evaluation of extension programs and policies, and institutional and program instabilities of the national agriculture extension system (Chimoita, 2014; Kyambo et al., 2021). The same challenges faced nationally are also encountered in several counties such as Nakuru (Department of Agriculture, Livestock and Fisheries [DOALF], 2020). A promising solution for the shortcoming in the delivery of agricultural extension services may be found in the increasing utilization of Information and Communication Technology (ICT) and mobile phone technology in agriculture (Lajoie-O'Malley et al., 2020).

The proliferation of mobile telephony has provided new opportunities for delivering timely and relevant agricultural information and advisory services to farmers (Sharma et al., 2021). The advent of mobile telephone technology has provided the agriculture sector with an alternative platform for providing timely agricultural information and advisory services to farmers (Mapiye et al., 2021). The technology has enabled the setting up of Farmers Call Centers (FCC) which support large numbers of farmers across wide geographical locations. FCC can be considered a strategy that relies heavily on ICT to provide agricultural extension services. Adoption of this strategy requires a center equipped with physical and ICT facilities, policies and a team of experts to run it (Thar et al., 2021). The ICT facilities include computers, mobile phones and accessories, and related software.

The aim of FCC strategy is to disseminate quality agricultural information on all aspects of the crop, livestock, fish production, processing, and marketing (Rajasri et al., 2013). A variety of communication media are used to deliver services. They include Phone calls, Short Message Services (SMS), WhatsApp, Twitter, and Facebook. These communication media should be reliable, affordable, and easy to use for them to be effective communication channels. Often, the advisory services from call centers are accessed by farmers through their mobile phones. Such information includes those about agricultural inputs, soil testing, control of crop pests and diseases, livestock breeding and husbandry, control of parasites and diseases, fish pond design, and management among others (Kwapong et al., 2020).

Linking farmers to agricultural extension stakeholders is also one of the roles of FCCs. Stakeholders are groups of people, organizations, institutions, or individuals that are influenced by and have abilities to significantly impact directly or indirectly on an area of interest (Mozumder et

al., 2018). In the context of agricultural extension, stakeholders refer to farmers, research institutions, agriculture university scientists, and private and government entities engaged in the delivery of extension services, provision of inputs, processing, and marketing of agricultural produce (Sutherland & Labarthe, 2022). Linkages to agricultural extension stakeholders are initiated because farmers are not able to singly solve the multi-faced problems they encounter in their farming activities (Ladele & Akinwale, 2016). Connecting farmers to stakeholders enhances their access to extension services, technology, inputs, and markets (Nalumu et al., 2021). Rose et al. (2021) contend that farmers should be connected to multiple stakeholders because farming requires information from diverse sources. They aver that linkages connect farmers to those who can provide the information needed in diverse areas such as pests, parasites and diseases control, animal husbandry, post-harvest management, and markets among others.

Farmers Call Centre strategy has also been associated with provision of quality extension services (Khan et al., 2017). Quality refers to the totality of features and characteristics of a product or service that bear on its ability to satisfy specified needs (Agholor et al., 2013). In the context of this study, quality of extension services was expressed in terms of five indicators, timeliness, relevance, adequate, easy to understand, and implementation. Truong (2022) noted that the use of ICT and telephone technology enhanced the quality of agricultural extension services delivered to farmers. The enhanced quality was attributed to use of a blend of ICT and face-to-face extension models, which ensured timely and reliable delivery of services. Similarly, Mwombe et al. (2014) noted that the use of ICT-based agricultural innovations helped call centers codify and repackaged extension services to suit the needs of target groups. The repackaging made the information provided to farmers easy to understand and implement.

Farmer Call Centre strategy has been found to be effective in delivery of information and technology transfer to smallholder farmers (CoLab, 2018). A study in Pakistan by Khan et al. (2017) showed that use of agricultural call centers was effective in delivering information to farmers in a wide range of areas such as market prices, financial management, and methods of irrigation. In Kenya, FCCs have been set up in several counties such as Nakuru, Laikipia Nyeri, and Nandi (DOALF, 2020). Langat et al. (2018) study in Kenya showed that ICT-based communication platforms were increasingly being used to complement extension services provided to farmers by public and private entities.

In its endeavor to enhance the delivery of extension services, the Nakuru County government adopted the FCC strategy. This entailed setting up Nakuru Farmers Call Centre (NFCC) in 2018. The

aim of setting up NFCC was to upscale agricultural extension service delivery to farmers and its quality, boosting agricultural productivity and reducing the effects of the low Farmer to Extension Officers ratio in Nakuru County which stood at 1:1400 (DOALF, 2020). It was also aimed at enhancing the linkage between farmers and various agricultural extension stakeholders such as other farmers, agro-dealers, and agriculture marketing services.

Nakuru Farmers Call Center is operated by four technical officers; a crops officer, a livestock production officer, Fisheries Officer, and a technical officer-in-charge who on daily basis answers farmers' queries. The technical team is expected to respond to the farmer's queries in real time or within twenty-four hours (NFCC, 2020). Subject matter specialists answer farmer queries on best agronomic practices, pest outbreaks, or other queries using telephones. These queries are analyzed and if there is any endemic problem, timely advice is relayed by the state agencies through the television, radios among other channels (Das, 2016). There is a Coordinator who ensures the smooth running of the Call Centre. NFCC operates five days a week, from Monday to Friday between 8.00 a.m and 5.00 p.m (DOALF, 2021). The centre uses mobile telephony in form of calls, SMSs, and social media platforms (WhatsApp, Twitter, and Facebook) to reach farmers with extension advisory services. The farmers use the same communication media to reach NFCC.

This study focused on Nakuru because it is heavily involved in agriculture and is considered with other counties like Trans Nzoia, Uashin Gishu, and Nyeri as bread baskets of Kenya (Kiptot & Franzel, 2015). It is also among the first Counties to adopt FCC strategy and set up a call centre. Further, Nakuru County Government established the FCC to deliver quality extension services, enhance linkage between farmers and agricultural extension stakeholders, and improving productivity. This has not been achieved as evidenced by several complaints about NFCC operations such as delays in responding to farmers' queries and requests, lack of follow-ups, and provision of low-quality services (NFCC, 2021). This suggests that the performance of NFCC in delivery of extension service has been unsatisfactory. The unsatisfactory realization of the envisaged improvements could perhaps be due to the effectiveness of FCC strategy in the delivery of extension services. It is against this background that the study sought to investigate the effectiveness of FCC strategy in the delivery of agricultural extension services to farmers.

## **1.2 Statement of the problem**

Limited access to timely, accurate, and relevant agricultural information is among the major factors that have resulted in low productivity and profitability in agricultural value chains in Nakuru

County. Adopting FCC strategy and setting up Nakuru Farmers Call Centre was one of the mitigating measures put in place by the County Government of Nakuru. FCC is an alternative and innovative ICT technology-based extension strategy, which aims at improving extension service delivery by providing farmers with information on the production and marketing of agricultural produce. It is supposed to be interactive, responsive to farmers' concerns, and able to respond to emerging issues such as pests and disease infestation which have largely emanated from climate change challenges, among others. Despite the adoption of this strategy, no significant improvement in productivity and profitability in the agricultural value chain have been realized among the farmers in Nakuru County. In addition, farmers still complain about delays in responding to their queries and requests, provision of low-quality services, and lack of follow-ups. The unsatisfactory realization of the envisaged improvements could perhaps be due to the effectiveness of FCC strategy in the delivery of extension services. This study sought to investigate the effectiveness of FCC strategy in the delivery of agricultural extension services, using the NFCC case. It should be noted that since the inception of the NFCC, no study had been conducted to determine its effectiveness in delivery of extension services. This study, therefore, sought to address this gap as a way of enhancing provision of quality of services, which is key to agricultural productivity.

### **1.3 Purpose of the Study**

The purpose of this study was to determine the effectiveness of the Farmers' Call Centre strategy in the delivery of agricultural extension services.

### **1.4 Specific Objectives of the Study**

The specific objectives of the study were:

- i. To establish the effectiveness of the communication media used by the Nakuru Farmers' Call Centre in delivering agricultural extension services to farmers in Nakuru County.
- ii. To determine the effectiveness of the Nakuru Farmers' Call Centre in linking farmers to stakeholders in Nakuru County.
- iii. To determine the quality of agricultural information delivered to farmers through the Nakuru Farmers' Call Centre in Nakuru County.

### **1.5 Research Questions of the Study**

The research questions that guided the study were:

- i. How effective is the communication media used by NFCC in delivering agricultural extension services to farmers in Nakuru County?
- ii. How effective is the NFCC in linking farmers to various stakeholders in Nakuru County?
- iii. What is the quality of agricultural information delivered to farmers in Nakuru County through the NFCC?

### **1.6 Significance of the Study**

It is expected that the findings of this study may give farmers, NFCC, and extension agents' insight of the effectiveness of FCC strategy in the delivery of agricultural extension. This insight may assist them to come up with mechanisms for enhancing the exchange of information among NFCC, farmers, and stakeholders in the agricultural extension sector in Nakuru. The findings on quality of agricultural extension may assist farmers in solving some of the problems they encounter on their farms, especially those that are due to climate change or related to adoption of new technologies. The findings may assist farmers in sourcing inputs at competitive rates, accessing credit and markets, and quality services from stakeholders they have been linked to. The finding may also be used by the Nakuru County government when reviewing its policy on the provision of extension services to farmers in terms of quality, funding, manpower, and effectiveness.

### **1.7 Scope of the Study**

This study was conducted in Nakuru County, Kenya, and investigated the effectiveness of FCC strategy in the delivery of agricultural extension services to farmers. The investigation involved examining the effectiveness of communication media used by NFCC to deliver agricultural extension services, its ability to link farmers with stakeholders, and the quality of information given to farmers. The study involved 110 farmers and four NFCC experts. The farmers were drawn from Njoro, Subukia, Molo, and Rongai Sub-Counties only.

### **1.8 Assumptions of the Study**

The following assumptions were made during the study:

- i. The respondents were honest when providing information sought from them.
- ii. Farmers value extension services because of the role it plays in enhancing agricultural productivity.

### **1.9 Limitations of the Study**

During data collection, some of the technical terms in the questionnaire, such as WhatsApp, Facebook, pond design, had to be translated into local languages and explained to farmers who had challenges comprehending them. There were difficulties in translating and explaining such terms to the farmers as they do not exist in local languages, this could have affected the quality of data. This study was conducted in Nakuru County; therefore, its findings should be generalized to other Counties, which have call centers such as Laikipia, Nandi, and Nyeri with caution because of differences in socio-economic and environmental settings.

## 1.10 Definition of Terms

The study defined and operationalized the following terms:

**Agricultural extension:** was defined as the application of scientific research and knowledge to agricultural practices through farmer education (Pretty et al., 2010). This study adopted the same definition which involves the dissemination of information and building capacity of farmers through use of a variety of communication channels to help them make informed decisions.

**Communication media** refers to the ways, means, or channels of transmitting a message from sender to receiver (Wang et al., 2016). In this study communication media were those used by NFCC, namely; phone calls, SMS, WhatsApp, Facebook, and Twitter, in the delivery of extension services to farmers in Nakuru.

**Effectiveness:** According to the Oxford Dictionary (2018), effectiveness is the degree to which something is successful in producing desired results. In this study, effectiveness was measured in terms of how successful the communication media was in delivering extension services to farmers and NFCC in linking farmers to stakeholders. Success meant internalizing information or skills acquired or getting connected to a stakeholder, so that the farmer had the potential to solve related problems encountered in the farm.

**Farmer Call centre:** is a telecommunication complex, computers and human resources organized to answer effectively and efficiently the queries raised by farmers instantly (Ray & Chowdhury, 2015). It enables farmers to call in and ask specific questions about agriculture practices. In this study, it means the ICT based extension strategy at Nakuru Farmers Call Centre that aims at complementing other extension approaches to enhance service delivery.

**Linkages:** Making, forming, or suggesting a connection with or between (Oxford Dictionary, 2018). In this study, linkages entailed NFCC connecting farmers with actors in agriculture such as other farmers, government and private extension services providers, agro-dealers, research institutes and universities, credit providers, and agriculture marketing services providers. The respondents were asked to indicate the extent of success of NFCC in linking farmers to various stakeholders using a five points rating scale (Not successful (1), Somehow successful (2), Moderate (3) Successful (4), Very Successful (5).

**Quality:** Quality refers to the totality of features and characteristics of a product or service that bear on its ability to satisfy specified needs (Agholor et al., 2013). In this study, it referred to whether the provided extension information met farmers' needs with respect to five indicators,

namely, timeliness, relevance, adequate, easy to understand, and implement. Quality was measured using a 5 points rating scale (very low, low, moderate, high, very high).

**Stakeholder:** refers to a thing, individual, group, or party that has an interest in an organization and the outcomes of its actions and can either affect or be affected by its business (Fassin, 2012).

In the context of this study, stakeholders are those entities, such as public and private extension service providers, agro-dealers, research institutes and universities, and credit providers, agriculture marketing services providers that affect and are affected by agricultural activities by farmers in Nakuru County.

**Strategy:** has been defined as the determination of the purpose or a mission, basic long-term objectives of an enterprise, and development of courses of action and allocation of resources necessary to achieve these aims (Johnson, 2010). In this study it refers to selection and adoption of FCC strategy, through NFCC, for purposes of effective delivery of extension services to farmers in Nakuru County.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

The literature review is presented in this chapter under four thematic areas, namely; the role of extension service delivery, the role of farmers in agricultural production, farmers' information needs and sources of agricultural information, information and communication technology in agricultural extension services delivery, Farmers Call Centre (FCC) strategy and agricultural extension service delivery, Kisan Call Centres (KCC) in India, Nakuru Farmers' Call Centre, effectiveness of FCC's communication media in delivery of agricultural extension services, effectiveness of FCC strategy in linking farmers to stakeholders, effectiveness of FCC strategy in provision of quality extension services. The theoretical and conceptual frameworks are also presented in the chapter.

#### **2.2 Role of Extension Services Delivery in Agriculture**

Agricultural extension services play a key role in providing farmers with information, skills and technologies on production that leads to enhanced incomes and food security (Adejo et al., 2012). Despite this key role, public extension services around the world are under pressure to increase their usefulness and efficacy in supporting sustainability of rural and agricultural livelihoods in a context of rising economic, social, and ecological risk (Sebopetsa, 2018). According to Munyua (2011), it is widely recognized that extension services in developing countries are weak, constrained, ineffective, and under pressure. Munthali et al. (2021) opined that extension has been changing over time and has become a part of knowledge and information systems in a social system. Kamara et al. (2019) also noted that links between extension and knowledge generation institutions, extension, and research were weak. He acknowledged that public extension was not necessarily the most efficient source of information. In addition, case studies on Agricultural Knowledge and Information Systems (AKIS) in developing countries revealed that there was a need to establish strong linkages between extension and agricultural universities, colleges and training institutions, other ministries and departments, and the private sector (Agbontale & Issa, 2017).

According to Rahaman et al. (2021), agricultural extension services have to be competently delivered to improve farmer income and an overall reduction in rural poverty. Sebopetsa (2018)

stated that the improvement of agricultural productivity can be enhanced through the proper implementation of agricultural extension and advisory services provided to the farmers. According to Asiedu-Darko (2016), dissemination of the right information at the appropriate time among farmers is key to providing a change in agriculture. Naika et al. (2021) opined that Information and Communication Technologies (ICT) have created an opportunity for the marketing of agricultural information which can be made available in various forms and channels for the end users.

Public agricultural extension remains the most crucial and critical means to reach farming households in rural areas globally (Leeuwis, 2013). Arouna et al. (2017) estimated that about 389 million persons out of 904 million in Sub-Saharan Africa (SSA), corresponding to 43% of the population, live under the poverty line of one US dollar per day. Rural areas account for the majority of impoverished people in SSA, who depend on agriculture for both their food and their means of subsistence (FAO, 2015). Agriculture is a major economic sector in the region, employing 65% of the labor force and contributing 32% to the country's national gross domestic product. It is characterized by low productivity and a lack of modern farming technologies (Fuglie et al., 2019). The value of information about improved technologies in agricultural extension organizations in sub-Saharan Africa cannot be overlooked. Timely and reliable information will determine the kind of decisions that are made by extension agents and the overall performance of the extension organizations (Aker et al., 2016). This study focused on the role of the Nakuru Farmers' Call Centre in public extension service delivery.

### **2.3 Role of Farmers in Agricultural Production**

Globally, an estimated 475 million farmers cultivate land that is less than 2 hectares; as a result, many of them obtain meager yields, experience food insecurity, and live in perilous conditions (Lowder et al., 2016). Small farms account for most of the farming systems in Africa (Lowder et al., 2014). These systems engage millions of people whose subsistence depends on low-yielding agriculture owing to increasingly erratic precipitations and climate change (Mancini et al., 2017). Farmers in Africa are highly susceptible to climate change, since most of them depend on rain-fed agriculture, cultivate in marginal areas, and lack access to technical and economic support that could help them invest in more climate-resilient agriculture (Harvey et al., 2018). Modern high yield seed varieties that can boosted productive are available but their

adoption has been low because of marginal conditions, diversity of environments and end-user needs in the small farmers (Mancini et al., 2017).

According to Belay et al. (2017), farmers in the sector are geographically spread and have limited national resources to support extension services resulting in limited or no access to relevant technical support. Extension farmer ratios in many countries are alarming with countries such as India documenting that on average only 6.8% of farmers receive extension support, often resulting in low productivity, low income, and poor livelihoods (Mittal, 2012). According to Nakuru County DOLAF annual extension report (2020b), the extension to farmers ratio stands at 1:1400 as opposed to the recommended ratio of 1:400 by the World Bank and it is not getting better as most extension officers approach retirement age. This high extension worker-to-farmer ratio necessitated the establishment of the NFCC, as a way of improving the coverage of the farmers. This study, therefore, sought to determine the effectiveness of the NFCC in delivering extension services and improving farmer coverage.

#### **2.4 Farmers' Information Needs and Sources of Agricultural Information**

Understanding farmers' information needs helps in designing appropriate policies, programs, and organizational innovations (Babu et al., 2012). According to Aker and Fafchamps (2014), the average small-scale farmer suffers from large information gaps in the field. Farmers may not have access to information on how to respond to new pests and diseases (Nyaga, 2021). In addition, they may not know which local market is offering the best price for their product. This is attributed to an unavailable information sources such as a government extension agent and hence the farmers must rely on representatives of input suppliers who lack the necessary technical expertise (Ipara et al., 2021). This leads to lower production, higher input costs, misuse of chemicals, and lower profitability (Langfelder et al., 2011).

During each stage of their operations, farmers require many forms of information, which includes weather forecasts, pest attacks, inputs, cultivation techniques, pest and disease management, and prices (Sajesh & Padaria, 2017). Information needs can be categorized according to the crop cycle or the agricultural value chain. Both approaches work through the different phases of decision-making that a farmer faces; acquisition of inputs, production planning, cultivation, harvesting, packing and storing, transportation, and marketing (Babu et al., 2012). Production-oriented information, off-farm income generation decisions and the implications of changing policies, and information on sustainable natural resource management

are also important information needs (Babu et al., 2012). According to Dinesh et al. (2018), it is important to recognize the benefits of doing an information requirements assessment by speaking with actual information users. Farmers can include their knowledge base by sharing lessons learned and best practices relevant to their farm business through a two-way approach. Climate change has also posed more serious challenges like new pests and diseases in crops and allied sectors, unpredictable weather patterns, and variations in market prices. As a result, crop yields, the nutritional value of main cereals, and livestock output have all decreased.

Barber et al. (2018) contend that agricultural advisory systems have evolved and drastic changes have taken place in terms of how information is received, processed, packaged, and disseminated to the intended end users. According to Das (2016), farmers were getting agricultural information from a variety of sources. Fafchamps and Minten (2012) noted that the main source of information for agricultural prices, weather forecasts, and advice on agricultural practice is the farmer's observation and experimentation followed by conversations with other farmers. Furthermore, popular information sources include radio and television, particularly for weather-related topics. The foregoing studies show that public agricultural extension system responsible for disseminating agricultural information to farmers has become less effective, more time-consuming, and unsuccessful in meeting the requirements of those involved in agricultural production. There is a gap between the public agricultural extension agents and the farmers (Mruthunjaya & Adhiguru, 2005). A promising solution for the shortcoming in the delivery of agricultural extension services may be found in the increasing utilization of ICT and mobile phone technology in agriculture (Lajoie-O'Malley et al., 2020).

## **2.5 Information and Communication Technology in Agricultural Extension Services Delivery**

According to Aker and Mbiti (2010), nearly 40% of the global population has access to the internet and among the bottom fifth of the poor, 7 out of 10 households have a mobile phone. According to Castañeda and Selwyn (2018), Information and Communication Technology (ICT) has become a global tool that has increasingly influenced the development of human activities. Its application is evident in the advancement of developed nations of the world as compared to underdeveloped countries. The use of ICT in facilitating knowledge acquisition and dissemination has been enhanced whereby information can be transmitted to the intended clients

timely (Aker & Mbiti, 2010). They can even develop knowledge regarding crop choices, develop products for niche markets, and even can market the products directly to the consumers.

Lack of access to knowledge and communication capabilities the farmers remain at the mercy of the global market forces (Kabir, 2015 ). As opined by Kabir (2015) mass media and ICT channels have made a positive impact on farming communities. According to Bell (2015), ICT will address the shortage of extension agents reaching smallholder farmers thus contributing to agricultural development by reducing the cost implication of extension dissemination to farmers. Information and Communication Technology such as mobile technology has been harnessed to extend the reach of agricultural extension services. Farmers have been enabled to contact hotlines for technical agricultural advice or to receive market information, such as market locations and prices (Aker & Mbiti, 2010). The growth of ICT in developing countries empowers users to communicate and access vital information, especially small-scale farmers and rural communities (Aker et al., 2016). However, this all depends on the affordability and content and whether it will address the highly localized nature of agriculture (Bell, 2015; McNamara et al., 2011).

Mobile phone is one of the modern ICT tools that has helped in providing new opportunities and improvement in service delivery (Duncombe, 2016). Fu and Akter (2016), reported mobile phone contributes to the quantity, quality, and speed of service delivery in addressing an intervention. In addition, they are user-friendly hence enhancing greater knowledge and awareness of new agricultural practices. Fu and Akter (2016) opined that mobile phones can serve as tools for inclusive development. According to Mittal and Hariharan (2018), it is assumed that mobile-phone-enabled agro-advisory services have the potential to reduce information gaps and generate awareness about improved technologies which leads to improved adoption of technology. ICT today plays a crucial role in agricultural extension services meeting the information required for farmers.

The high adoption and integration of ICTs have reduced information and transaction costs, improved service delivery, created new jobs, generated new revenue streams, and saved resources. Due to high adoption rates, the mobile phone has become a valued means of communication for both extension workers in the field and small-scale agriculture producers. One of the recent advancements in ICT is the development of FCC strategy in delivery of agricultural extension services to farmers. This strategy aims at disseminate quality agricultural information

on all aspects of the crop, livestock, fish production, processing, and marketing (Rajasri et al., 2013).

## **2.6 Farmers Call Centre Strategy and Agricultural Extension Service Delivery**

The advent of the mobile telephone technology has provided the agriculture sector with an alternative platform for providing timely agricultural information and advisory services to farmers (Mapiye et al., 2021). The technology has enabled the development of FCC strategy which aims at supporting large numbers of farmers across wider geographical locations. Strategy has been defined as the determination of the purpose or a mission, long-term objectives of an enterprise, development of courses of action and allocation of resources necessary to achieve these aims (Johnson, 2010). With regard to agricultural extension, it can be considered as adoption of FCC strategy, which involves setting up and operating a call center for purposes of effective delivery of extension services to farmers.

FCC strategy relies heavily on ICT to deliver agricultural extension services to farmers. Adoption of this strategy requires setting up of a center equipped with physical and ICT facilities, policies and operational guidelines, a team of experts and funds to run it (Thar et al., 2021). The ICT facilities include computers, mobile phones and accessories, and related software. A variety of communication media are used by FCCs to deliver services. They include Phone calls, Short Message Services (SMS), WhatsApp, Twitter, and Facebook. Similarly, advisory services from call centers are accessed by farmers through their mobile phones. CoLab (2018) recommends that several channels of communication be integrated in FCCs to maximize interaction between them and farmers. FCCs should be able to send and receive agricultural information from farmers to the experts and vice versa.

The key role of the FCC strategy is to disseminate agricultural information to farmers (CoLab, 2018). This strategy have been found to be among the most cost effective means of delivering extension services farmers (van Dijk et al., 2022). van Dijk et al. attribute the effectiveness of the strategy to use of ICT based communication platforms that enable FCC experts to package information using simple words that are easy to understand by most farmers. As a result, farmers find agricultural information communicated relevant and are able to copy or modify them to suit their farming needs. Mlozi et al. (2016) attributes effectiveness of the strategy to the fact that most of FCCs use mobile phones, which were affordable and allow farmers to communicate directly with extension workers, and share using SMS technology.

Many countries have adopted the FCC strategy because of the advantages associated with it. Two cases, KCC in India and NFCC in Kenya, are examined in the subsequent sub-sections.

### **2.6.1 Kisan Call Centres in India**

India is among the countries in the world that pioneered use of FCC strategy in delivery of extension services ((Koshy & Kumar, 2016). The country has a population of 1.21 billion people and over 70 percent of rural households depend on agriculture. The extension system in the country is limited in its ability to reach farmers and offer services because of a large population, limited resources, and distances between farmers (Koshy & Kumar 2016). The challenges in delivery of extension services forced the Indian government to seek alternative cost effective strategies of disseminating extension information to farmers. Among the strategies adopted was use of Information and Communication Technologies, especially mobile phones, in delivery of extension services. This led to setting up of Farmers call centers. Kisan Farmers Call Center (KCC) was among the first FCCs that were set up by the Indian government in its endeavor to improve extension services delivery.

The Department of Agriculture and Cooperation (DAC), Ministry of Agriculture, Government of India launched Kisan Call Centers on January 21, 2004, across the country to deliver extension services to the farming community. The purpose of call centers is to respond to issues raised by farmers instantly in their local languages. Kisan Call Centre was designed to handle traffic from any part of the country. Farmers from any part of the State can contact KCC by dialing the toll-free telephone number and presenting their problems or queries related to farming. If the call center representative is unable to respond to the farmer's question, the call is forwarded to a designated agricultural specialist (Koshy & Kumar, 2017).

Kisan Call Centre has achieved considerable success in the delivery of extension services to farmers through phone calls. However, social media platforms like Facebook, Twitter, and WhatsApp are not part of the communication media used by the center. Social Media are equally powerful ICT tools, especially for use by youth in agriculture, they thus should be incorporated in Farmer's Call Centres. This partly explains why this study was conducted, to bring forth the use of social media incorporated with other telephony services in the delivery of agriculture extension services.

### **2.6.2 Nakuru Farmers' Call Centre**

In its endeavor to enhance delivery of extension services, Nakuru County government adopted the FCC strategy by setting up the Nakuru Farmers Call Centre (NFCC) in 2018. Nakuru Farmers call centre is an ICT platform that is supported by the County Government of Nakuru through the Department of Agriculture, Livestock and Fisheries (County Government of Nakuru, 2021). It is an extension delivery mechanism that borrowed heavily from the extension methodology of Kisan Call Centre based in Hyderabad in Telangana State, India. The concept was customized to fit the Kenya's situation and specifically farmers in Nakuru County. NFCC is located at the Nakuru Agricultural Training Centre (ATC) in Soilo farm at the Njoro interchange. It aims to enhance the delivery of agricultural extension services to farmers in the County to counter the high numbers of extension officers retiring from the service and combat challenges resulting from climate change (DOALF, 2018).

Nakuru Farmers Call Centre is operated by four technical officers; a Crops officer, a Livestock production officer, a Fisheries Officer, and a technical officer-in-charge who on daily basis answers farmers' queries. The farmers are also linked to various stakeholders for networking including other farmers, agriculture institutes, private extension providers, agricultural NGOs, research institute scientists, agriculture university scientists, agro-dealers, and agriculture marketing services. There is a Coordinator who ensures the smooth running of the Call Centre (NFCC, 2018).

The NFCC operates five days a week, from Monday to Friday between 8.00 a.m and 5.00 p.m (DOALF, 2020). The NFCC uses mobile telephony in form of calls, SMSs, and social media platforms (WhatsApp, Twitter, and Facebook) as the communication media to reach farmers with extension advisory services. The farmers contact NFCC using the same communication channels. For farmers to get quality extension services from NFCC, the farmers' queries are required to be answered in real time or within twenty-four hours (NFCC, 2020). The NFCC concept is also borrowed from other counties in Kenya like Laikipia, Nyeri, and Nandi. There is a need to understand its effectiveness in the delivery of agriculture extension services to farmers in the County to strengthen the extension methodology. This study was to bring out the effectiveness of the Nakuru farmers Call Centre in the delivery of agriculture extension services to farmers in Nakuru County.

### **2.6.3 Effectiveness of FCC's Communication Media in Delivery of Agricultural Extension Services**

FCC is a strategy that aims at disseminating to farmers quality information on all aspects of farming activities in the agricultural value chain (Mapiye et al., 2021). For effective service delivery, the communication media used by call centers should be reliable, affordable, and easy to use. Effective service delivery refers to successful internalization of information delivered to farmers or skills, so that they have the potential to solve related problems (Khan et al. (2017). Anang et al. (2020) and Kiptot and Franzel (2015) contend that, extension models are deemed effective when they are readily available, accessible and able to improve productivity. Call centers use a variety of communication media to interact with farmers, they include Phone calls, Short Message Services (SMS), and social media platforms such as WhatsApp, Twitter, and Facebook (Kwapong et al., 2020). Similarly, advisory services from call centers are accessed by farmers through their mobile phones.

Studies have shown that the communication media used by adopters of FCC strategy were effective in delivery of extension services (Lajoie-O'Malley et al., 2020). Langat et al. (2018) demonstrated that ICT based communication platforms enabled experts to package information using simple words that most farmers could easily understand. As a result of the repackaging, farmers found the agricultural information communicated relevant, and were able to copy or modify them to suit their farming needs. A study in Kilosa District in Tanzania by Mlozi et al. (2016) observed that mobile phones and SMS were the most popular communication media among farmers. The popularity of mobile phones was attributed to the fact that they were affordable, allowed direct communication with extension workers, and information could be shared using SMS technology. Ogola (2015) noted that farmers rated mobile phones and SMS usage in delivery of extensive services effective because they received prompt information on a wide range of areas such as market prices, financial management and methods of irrigation, use of insecticides and soil management.

However, a study by Khan et al. (2017) in Bangladesh found that the media used by call centers, especially social media platforms were not effective in delivery of extension services. This was attributed to farmers' lack of knowledge, skills and awareness of role of social media in e-extension. A study by McGuire et al. (2015), identified cost of accessing information and lack of basic phone skills as factors which impacted negatively on effectiveness of e-extension. Mamun-ur-Rashid and Goa (2018) also cited unreliable communication networks, lack of co-

ordination among research extension and extension service providers themselves as hindrances to effective delivery of extension services by call centers. Despite these weaknesses, communication media used by call centers are effective channels for providing extensions services which complement those provided by public and private agencies.

#### **2.6.4 Effectiveness of FCC Strategy in Linking Farmers to Stakeholders**

Farmers are linked to stakeholders because they are not able to singly solve the multi-faced problems they encounter in their farming activities (Nalumu et al., 2021). Connecting farmers to stakeholders enhances their access to extension services, technology, inputs and markets. Stakeholders are groups of people, organizations, institutions, or individuals that are influenced by and have abilities to significantly impact directly or indirectly on an area of interest (Mozumder et al., 2018). In the context of this study, stakeholders refers to farmers, research institutions, agriculture university scientists, and private and government entities engaged in the delivery of extension services, provision of inputs, credit, marketing and other services in the agricultural value chain. Krell et al. (2019) argue that call centers are manned by experts who by virtue of their training and experience are best placed to guide and link farmers to stakeholders who are sources of information, inputs and services.

Studies have shown that linking farmers to agricultural extension stakeholders is among services provided through FCC strategy (Sutherland & Labarthe, 2022; van Dijk et al., 2022). Linkage between farmers and stakeholder are formed through a process that involves a farmer sending an agricultural extension related query to a FCC (Koshy & Kumar, 2017). Such queries are often problems that FCCs are not in a position to effectively deal with. The query may be about soil testing, inputs, pest, parasites and diseases control. Some of the common linkage areas and related stakeholders are summarized in Table 1.

Table 1

## Agricultural extension Stakeholders and area of Linkage to Farmers

Stakeholder	Area of linkage with farmer
Another farmer	Agricultural information, technology, and innovation sharing
Government/Public extension service providers	Provision of agricultural extension services, farm visits, training, demonstrations
Private extension providers	Selling technologies and innovations to farmers
An agro-dealer	Supply of inputs (certifies seeds, fertilizers, chemicals) livestock drugs
Agriculture institutes	Sharing knowledge, technology, and innovations, offering training, conducting demonstrations
Research institute scientists	Providing expert knowledge based on research, knowledge banks on crops, livestock, fisheries, bulking materials, soil testing, breeding
Agriculture university scientist	Sharing scientific knowledge, technology, and innovations, providing specialized training, and conducting demonstrations.
Agricultural NGO's	Soil testing, providing funds for agricultural technologies development and activities.
Agriculture marketing services providers	Connecting farmers to markets (contract, online, physical)
Credit providers	Provision of vehicles for financing farming activities and agricultural transactions such as loans, notes, bills of exchange, banker's acceptance

Upon receipt of the query, FCCs searches for stakeholders in its database that are best placed to handle it. Stakeholders that are best placed to handle the query are identified and the farmer's problem and personal details relayed to them (NFCC, 2020). Similarly, FCC also relays details of the stakeholders with the capacity to solve the problem to the farmer. Once the connection is completed, FCC is supposed to encourage the farmer and stakeholder to work together towards

finding a solution to the problem. Ideally, FCC is supposed to make follow-ups as a way of ensuring that the farmer is assisted by the stakeholder.

Studies have shown that adoption of FCC strategy enhances linkages between farmers and stakeholder. Rose et al. (2021) argue that the information required by farmers is diverse as it covers areas such as pests, parasites and diseases control, animal husbandry, post-harvest management, and markets among others. They contend FCCs are the best placed entities to midwife linkages between farmers and stakeholder because of the training and expertise of their staff, and position in the agriculture sector.

A study conducted in West Nile region, Uganda by Waiswa (2021) established that use of FCC strategy was effective in providing extension information and linking farmers to markets and suppliers of inputs. Krell et al. (2019) study conducted in Central Kenya established that Call Centers do not only play a significant role in delivery of extension services but were also effective in recommending to farmers who to go to for what. Winter et al. (2017) contend that given that call centers interact with both farmers and agriculture stakeholders, it is only prudent that two are connected through call centres.

Studies have also indicated that use of FCC strategy is not effective in linking farmers to stakeholders. Ladele and Akinwale's (2017) study conducted in Nigeria study identified distrust, breach of contract, delay in service delivery and conflicts between farmers and stakeholders among the challenges encountered in linkages created through the FCC strategy. Nalumu et al. (2021) also noted that small holder farmers in Ghana were not satisfied with the services provided by stakeholders with regard to quality, timeliness and costs. Even though challenges have been encountered in use of FCC strategy to link farmers to stakeholders, the advantages associated with it outweighs them, thus its popularity.

### **2.6.5 Effectiveness of FCC Strategy in Provision of Quality Extension Services**

Farmers Call Center strategy has also been associated with provision of quality extension services (Khan et al., 2017). Quality refers to the totality of features and characteristics of a product or service that bear on its ability to satisfy specified needs (Agholor et al., 2013). With regard to extension services, indicators of quality include timeliness, relevance and adequacy of information (Thar et al., 2021). Other indicators of information quality is that it should be easy to understand and implementation. Truong (2022) noted that adoption of FCC strategy enhanced quality of agricultural extension services delivered to farmers. The enhanced quality was

attributed to use of a blend of ICT based and face-to-face extension models, which ensured timely and reliable delivery of services. Similarly, Mwombe et al. (2014) observed that the use of ICT-based agricultural innovations helped call centers codify and repackaged extension services to suit the needs of farmers. The repackaging made the information delivered to farmers easy to understand and implement.

Results of a study by Mamun-ur-Rashid and Goa (2018) contradicted those of the foregoing studies. It noted that call centers provided poor quality services due to inadequate personnel and facilities, lack of co-ordination among farmers, research extension and other extension service providers. Khan et al. (2017) study established that a remarkable number of respondents were of the view that quality of services provided by call centers were low due to challenges related to information adequateness, understandability, persuasiveness and applicability. MANAGE (2017) also noted that inadequate number of extension staff in call centers negatively impacted on provision of quality services as it led to delays in response to farmer requests. Review of foregoing literature reveals mixed reactions with regard to provision of quality extension services using FCC strategy. In addition, these studies were not conducted in Nakuru county, hence the need for this one.

## **2.7 Theoretical Framework**

This study was guided by two theories namely; the Technology Acceptance Model (TAM) theory and the diffusion of innovation theory. Fred Davis developed the Technological Acceptance Model (TAM) in 1986. The Technology Acceptance Model theory is specifically tailored to modeling users' acceptance of information systems or technologies (Lai, 2017). The Technology Acceptance Model theory has been applied to explain or predict individual behaviors across a broad range of end-user computing technology and user groups (Fathema & Sutton, 2013; Moon & Kim, 2001). According to Davis (1989), the goal of TAM was to explain the general determinants of computer acceptance that lead to explaining users' behavior across a broad range of end-user computing technologies and user populations. Perceived Usefulness (PU) and Perceived Ease of Use (PEU) were two specific beliefs that were examined in the fundamental TAM model (PEU).

Limitations of TAM theory with regard to weak explanatory power (R2), lead Venkatesh and Davis (2000) to develop the Model Theory Two (TAM2). The original TAM structures were preserved in the TAM2. Additional indicators such as perceived usefulness, usage intention

constructs, and understanding how the effect of these determinants changed with increasing users' experience over time with the target system were included in TAM2 (Venkatesh & Davis, 2000). TAM3 by Venkatesh and Bala (2008) added the determinants of TAM's perceived ease of use and usage intention constructs for robustness. Therefore, TAM3 presented a complete law-like network of the determinants of users' Information Technology System adoption.

Technology Acceptance Model theory provides a quick and inexpensive way to gather general information about individuals' attitudes toward a system and it can be used to measure general levels of satisfaction of users with diverse interests (Mathieson, 1991). TAM is empirically strong, powerful, and theoretically justified (Davis, 1989; Yousafzai et al., 2007). The model is applied to study information technology adoption or utilization (Davis, 1989; Venkatesh Morris, 2000; Venkatesh & Bala, 2008). The Technology Acceptance Model theory is useful in describing the users' technological adoption behavior in different environmental settings. The theory assumes that an individual's technological acceptance behavior is determined by many factors; Perceived Ease of Use and Perceived Usefulness as perceived by the potential adopter. These are important variables in predicting the adoption rate.

The Technology Acceptance Model theories were considered appropriate since this study examined acceptance of information systems or technologies in delivery of extension services. Its principles of Perceived Ease of Use and Perceived Usefulness as perceived by the potential adopter informed this study on the choice of the different communication media used in the NFCC. The theory guided a quick and inexpensive way of gathering information about farmers' attitudes toward a system. This was used to measure the general levels of satisfaction of users with diverse interests. This theory informed the satisfaction of farmers with the quality of agricultural extension services delivered through NFCC.

Diffusion of Innovation (DOI) theory, developed by Rogers in 1962 originated in communication to explain how over time, an idea or product gains momentum and diffuses through a specific population or social system. People as a part of a social system adopt a new idea, behavior, or product as a result of this dissemination. Adoption depends on a person's ability to see an idea, behavior, or product as novel or inventive. This makes it possible for diffusion. The adoption of a new idea, behavior, or product is a process whereby some people are more apt to adopt the innovation than others (Omotayo, 2005). Researchers have found that people who adopt an innovation early have different characteristics than people who adopt an innovation later (Robinson, 2009). When promoting an innovation to a target population, it is important to

understand the traits of the target demographic that will facilitate or impede the adoption of the invention is crucial when promoting it to that group. According to the theory, innovators are categorized as, early adopters, early majorities, late majorities, and laggards are the five established adopter groups.

Those who are innovators are those that wish to try new things first. They are bold and curious about novel concepts. These folks are frequently the first to come up with novel ideas and are very eager to take chances. Early Adopters are those who are thought leaders in their fields. They like taking on leadership responsibilities and embracing change. They are already aware of the need to change and so are very comfortable adopting new ideas. Strategies which appeal to this population include how-to-do manuals and information sheets on implementation. The knowledge is not necessary to persuade people to change. Early Majority hardly ever take the lead, members of this group are often the first to adopt novel concepts. Usually, before they adopt an idea, they need to see proof that it actually works. Success stories and proof of the innovation's efficacy are what s to this demographic group. Late Majority: These folks are resistant to change and won't adopt a new idea until the majority has given it a shot. Information on how many other individuals have tried the innovation and successfully adopted it is one tactic to appeal to this audience. Laggards are exceedingly traditional and tradition-bound people. They are very skeptical of change and are the hardest group to bring on board. Strategies to appeal to this population include statistics, fear appeals, and pressure from people in the other adopter groups.

The DOI theory was deemed appropriate for this study as it was to assist in explaining the adoption of the Nakuru farmers Call Centre as a new extension model for delivering agricultural extension services to farmers in Nakuru County. Nakuru Farmers Call Centre is a new idea or an innovation in Nakuru County, this theory clearly explained the targeted group for this study as those farmers who had contacted the NFCC for extension service as the innovators, early adopters, and early majority.

## **2.8 Conceptual Framework**

A conceptual framework is a product of consolidating a multiplicity of key findings relevant to research in narrative or schematical form, into a single unit that reveals the position of a study with what exists in literature (Shikalepo, 2020). It thus describes a contextual setting under which variables interact. The interactions between the independent, moderator, and dependent variables of the study are depicted in Figure 1.

**Figure 1**

*Conceptual framework showing Interaction between Variables*

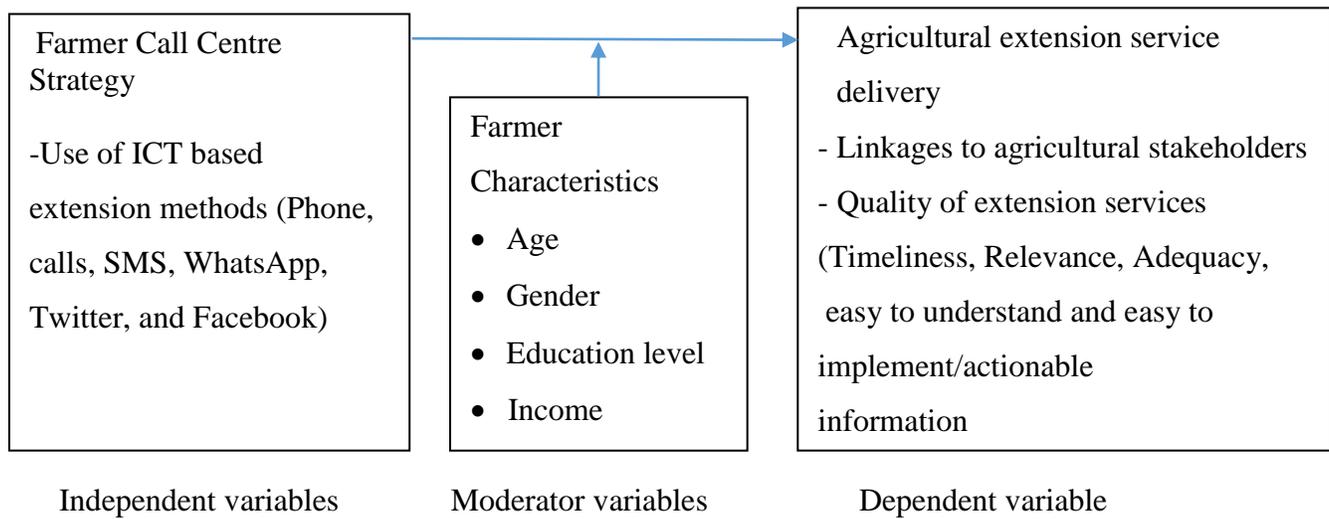


Figure 1 shows that Farmers Call Centre Strategy was the independent variable while the dependent variables were agricultural extension services delivery and its quality and farmers' linkage to stakeholders. This figure shows that under ideal conditions, the effectiveness of delivery of agriculture extension services depends on the communication media of the FCC. Similarly, the quality of extension services and the linkages to agricultural stakeholders also depend on FCC strategy. However, under dynamic conditions, the relationship between the independent variables and the outcome is moderated by factors such as farmers' age, gender, education, and income levels. The effects of the moderator variables on the outcomes were minimized through randomization and sampling as recommended by Best and Khan (2010).

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter presents the research design, the location of the study, the target population, the sampling procedure, and the sample size. It also covers instrumentation, data collection and analysis, and ethical considerations.

#### **3.2 Research Design**

An appropriate research design must be selected during a study as it ensures that the methods match the objectives of an investigation, quality data is collected utilizing credible sources, and the right analysis is conducted (Asenahabi, 2019). It also provides an investigator with a well-structured plan which shows how all the parts of research work in harmony to answer questions of a study. This study adopted the descriptive survey research design. Determining "what is" and the current condition of circumstances is the design's main focus. It involves gathering data from a population or a sample and describing the 'who', 'when', 'where' and 'how' of a situation, problem, phenomenon, service, opinions, habits, or attitudes toward an issue (Mahali et al., 2019; Nardi, 2018). This study examined the effectiveness of FCC strategy in delivery of agricultural extension services to farmers. It involved using a sample to collect data at one point in time without manipulation of variables, hence the appropriateness of the design.

#### **3.3 Location of the Study**

This study was conducted in Nakuru County, Kenya. Nakuru County is located in the South Eastern part of the Rift Valley region. It borders seven counties with Baringo to the North, Laikipia to the North East, Nyandarua to the East, Kajiado to the South, Narok to the South West, and Bomet, and Kericho to the West. Nakuru County covers an area of 7,495.10 square kilometers (Nakuru County First Integrated Development Plan, 2013). The area comprises of 5,039.40 square kilometers of arable land, 852.10 square kilometers of non-arable land, 202 square kilometers of water mass (Naivasha, Elementaita, and Nakuru) and 679.60 square kilometers of gazetted forest (DOALF. (2021). Nakuru County has eleven Sub-Counties namely; Naivasha, Gilgil, Nakuru East, Nakuru West, Bahati, Subukia, Njoro, Molo, Rongai, Kuresoi North, and Kuresoi South.

Nakuru is cosmopolitan as it has both rural and urban settings and a population of 2.2 million people that is made up of many ethnic communities (Kenya Bureau of Statistics Census, 2019). Agriculture is the lifeline of the economy of Nakuru County as 70% of the 7,495.10 square kilometers of the County's land is arable and productive. The communities which reside in the county engage in crop farming, livestock keeping, fish farming, and business. Other economic activities which the inhabitants of the county engage in include mining, manufacturing, and tourism since Nakuru is blessed with various tourist attractions such as game parks, craters, and lakes (Kenya Open Data, 2014). The location was chosen because Nakuru County Government was among adopters of the FCC strategy through NFCC. The adoption aimed at enhancing delivery of extension services, which was expected to lead to improvement in productivity and profitability in the agricultural value chain. These expectations were not achieved even though FCC strategy has been in use for nearly five years. There was need for this investigation since it is possible the unmet expectations could be due to ineffectiveness of NFCC in the delivery of extension services.

### **3.4 Target Population**

The targeted population of this study comprised all the 3,473 farmers who had interacted with the Nakuru Farmers Call Centre to obtain agricultural extension services in Nakuru County (NFCC, 2020). The 4 NFCC agricultural extension experts (key informants) who answer farmers' questions daily were also part of the target population. The accessible population was the 4 NFCC agricultural extension experts and 1993 farmers from Njoro, Subukia, Molo, and Rongai Sub-Counties farmers who had interacted with the Nakuru Farmers Call Centre to obtain agricultural extension services. The experts were selected because of their expertise, they manage the call center and are best placed to provide information on its operations. The 4 sub-counties were selected because they had the highest number of farmers who had interacted with the Nakuru Farmers Call Centre (Etikan et al., 2016). In addition, most of the County's agricultural activities are concentrated in the 4 sub-counties. The distribution of the accessible population of the farmers by sub-county is given in Table 2.

**Table 2***Distribution of Accessible Population by Sub County*

Sub-county	Farmers number
Njoro	557
Subukia	536
Molo	432
Rongai	468
<b>Total</b>	<b>1993</b>

**3.5 Sampling Procedure and Sample Size**

A database of the 1993 farmers from Molo, Njoro, Subukia and Rongai who had interacted with the Nakuru Farmers Call Centre was obtained from the NFCC. The database which was organized by sub-county constituted the sampling frame. The sample size of the farmers was then determined using the recommendations of Kathuri and Pals (1993). They recommend a minimum sample size of 100 subjects for an educational or social science study without major subgroups. This recommendation was adopted, the sample size of the study was thus 100. The sample size of the farmers was increased by 20 percent to 120 during the study to cater for dropouts and non-responsive subjects. This is in line with Chaudhuri and Dutta (2018) assertion that a 20 percent increment in the calculated sample is effective in taking care of natural attrition and non-responses.

After determining the sample size of the farmers, proportional sampling techniques were used to determine the number of farmers that were drawn from the Njoro, Molo, Rongai, and Subukia Sub-Counties. At the Sub-County level, simple random sampling was employed to select farmers who participated in the study. This involved picking randomly farmers in the database obtained from NFCC for each of the participating sub counties. All the 4 experts (census) who manage NFCC were included in the study. Table 3 gives a summary of the distribution of the farmers' sample size by Sub-County.

**Table 3***Distribution of the Farmers' Sample sizes by Sub- County*

Sub- County	Sample
Njoro	32
Subukia	29
Molo	23
Rongai	26
<b>Total</b>	<b>110</b>

### 3.6 Instrumentation

Data was gathered using two instruments, a farmers' questionnaire (Appendix A) and an experts' interview guide (Appendix B). The questionnaire was used because of the benefits associated with it such as efficient collection of data from a large sample that is dispersed over a wide geographical area and is easy to administer, score, and analyze (Sadan, 2017). The selection of the interview guide was based on its strengths such as efficient utilization of time, minimizing bias and subjectivity (Doody & Noonan, 2017). An interview guide also enables a researcher to control the topics and format of a discussion, thus making it easier to code and analyze data.

#### 3.6.1 Farmers' Questionnaire

The farmers' questionnaire was semi-structured and contained both open and close-ended items. The questionnaire was developed in line with the objectives of the study. The questionnaire had four sections: the first section covered the respondents' characteristics such as age gender, and level of education among others. The second section of the questionnaire had a set of 15 close-ended items that were used to determine the effectiveness of the communication media used by the NFCC in delivering agricultural extension services to farmers. Effectiveness was operationalized as the level of success of phone calls, and SMS. WhatsApp, Twitter, and Facebook in delivery of extension services to farmers in crop, livestock, and fishery farming areas. The items were used by the farmers to rate the success of the 5 communication media in the delivery of extension services on a 1 to 5 (1= Not successful 2=Somehow successful, 3=Moderately Successful, 4=Successful, =Very Successful) points scale.

The third section of the questionnaire was used for eliciting data on the effectiveness of NFCC in linking farmers to stakeholders. The section had a set of 10 close-ended items on stakeholders. The stakeholders were public/government and private agricultural extension services providers, agro-dealers, agricultural institutes, agricultural Non-Governmental Organizations (NGOs), marketing services, and credit providers. These stakeholders were selected based on their interaction with farmers with regard to provision of extension services, inputs, credit, processing and marketing of farm produce, and technical expertise. Effectiveness was operationalized as the level of success in connecting farmers to these stakeholders bases on a 5 points scale ((1= Not successful, 2=Somehow successful, 3=Moderately Successful, 4=Successful, 5=Very Successful).

The fourth section of the questionnaire generated data on the quality of agricultural extension services that farmers received through the NFCC. Data on the quality of agricultural extension services in crops, livestock, and fisheries farming areas were elicited using a set of 15 close-ended items. Five indicators of quality, namely; timeliness, relevancy, adequate, easy to understand, and implementation, were used to measure it. The farmers rated each of the indicators on a 1 to 5 points scale (Very Low =1, Low =2, Moderately High = 3, High = 4, Very High =5). The means of the five indicators for each farming area were computed and used as a measure of quality.

### **3.6.2 Experts Interview Guide**

The experts' interview guide (Appendix B) was used to collect in-depth information from the NFCC agricultural extension experts. It was constructed using open-ended items and was structured such that each participant was asked the same questions using the same wording and in the same order. The items generated the respondents' characteristics and effectiveness of communication media used by NFCC in the delivery of agricultural extension services data. The instrument had also items for collecting data on the effectiveness of NFCC in linking farmers with stakeholders and delivery of quality agricultural extension services.

### **3.6.3 Validity**

The face and content validity of the farmers' questionnaire and expert's interview guide were assessed before they were used to collect data. This was deemed necessary since validating a research instrument ensures that the layout and language are appropriate and it contains

indicators of the variable being measured (Bolarinwa, 2015). The validity of the two instruments was assessed by experts from the Department of Agricultural Education and Extension, Egerton University. This is in harmony with Taherdoost's (2016) assertion that validation should be done by a panel of experts since it involves theoretical assessment, rating suitability of items, and evaluating their fitness in defining a construct. The comments and recommendations of the experts were used to improve the instruments before using them to gather data.

#### **3.6.4 Reliability**

The reliability of the farmers' questionnaire was estimated using samples from Naivasha Sub-County before it was used to gather data in the field. The estimation was deemed necessary since reliability tests ensure that the methods used to collect data give the same measures over repeated trials (Mohajan, 2017). This enhances the quality of research findings and conclusions. A sample of 19 farmers was involved in the estimation of reliability. This sample size was within the range of 10 - 25 participants, as recommended by Whitehead et al. (2016). The Cronbach alpha method was used to estimate the reliability. The method is considered ideal in situations where an instrument is constructed using closed-ended polychromous items and administered once (Heale & Twycross, 2015). The instrument yielded a reliability coefficient of 0.879. It was deemed reliable since the coefficient was above the 0.7 threshold recommended for social science and education research (Taherdoost, 2016).

#### **3.7 Data Collection Procedure**

Data collection is the process of measuring and gathering information on a study variable systematically, to answer research questions and or test hypotheses (Nayak & Singh, 2021). The researcher sought clearance from the Board of Postgraduate studies at Egerton University and applied for a permit from the National Commission for Science, Technology, and Innovation (NACOSTI). Upon being granted the permit, the researcher sought clearance from the County Commissioner and the Department of Agriculture, Livestock and Fisheries, Nakuru County. The farmers and experts were formally contacted and the purpose of the study was explained to them. Their consent was also sought by requesting them to fill the consent form (Appendix C). Dates and venues for administering questionnaires and conducting interviews were set in consultation with the participants.

On the material days, the researcher explained to the farmers how to fill the questionnaire before administering them. The researcher assisted those who had challenges filling the questionnaire. The respondents were given ample time to fill the questionnaires, after which the completed ones were collected. The NFCC experts were interviewed in their offices after being taken through the modalities of the exercise. They were informed that the interviews would take about 45 minutes and would be recorded using both audio and video recorders. The information gathered through the interviews supplemented those collected using the farmers' questionnaire.

### **3.8 Data Analysis**

The collected data was cleaned of errors and coded. A data file was prepared using the Statistical Packages for the Social Sciences (SPSS) version 25.0 and the coded data was keyed into it. The Listwise deletion, which is an SPSS feature, was used to exclude the missing items when analyzing the data (Field, 2018). Qualitative data were described and summarized using frequencies and percentages. The effectiveness of NFCC in the delivery of extension services to farmers was determined using closed-ended items. Responses to the items were scored using five points scale. The scale for measuring the effectiveness of NFCC communication media and linking farmers to stakeholders was; Not successful (1) Somehow successful (2), Moderate (3), Successful (4), and Very Successful (5). Similarly, the scale for determining the quality of extension services provided to farmers by NFCC was Very Low (1), Low (2), Moderately High (3), High (4), and Very High (5). The means scores of items for measuring the effectiveness of NFCC communication media in the delivery of extension services were computed and transformed into its overall mean. The same procedure was used to compute the overall means of the effectiveness of NFCC in linking farmers with stakeholders and providing them with quality extension services. The overall mean was used as a measure of both effectiveness and quality. A mean of 3.00 (mid-point) and above was considered effective or of quality. The mean of 3.00 was arrived at by adding 1 to 5 and dividing by 2, given that a 5-point rating scale was used when determining effectiveness, and quality. A summary of data analysis techniques used during the study is given in Table 4.

**Table 4***Summary of Data Analysis Techniques*

Research questions	Independent variable	Dependent variable	Analysis
How effective is the communication media used by Nakuru Farmers Call Centre in delivering agricultural extension services to farmers in Nakuru County?	Communication media used by the Nakuru Farmers Call Centre	Delivery of agricultural extension services to farmers	Frequency, percentages, means, standard deviation
How effective is NFCC in linking farmers to stakeholders in Nakuru County?	Nakuru Farmers Call Centre	Linkage to stakeholders	Frequency, percentages, means, standard deviation
What is the quality of agricultural information that farmers in Nakuru County receive through the Nakuru Farmers Call Centre?	Nakuru Farmers Call Centre	Quality agricultural extension services	Frequency, percentages, means, standard deviation

**3.9 Ethical Considerations**

Ethics is concerned with defining norms of conduct and distinguishing between acceptable and unacceptable behavior (Dooly et al., 2017). Research is concerned with ensuring that the set ethical standards are upheld. They include honesty, objectivity, integrity, carefulness, openness, respect for intellectual property, confidentiality, responsible publication, non-discrimination, legality, and protection of subjects (Yip et al., 2016). Attempts were made during this study to comply with the ethical guidelines. Clearance to conduct the research was sought from the Graduate School and Egerton University Ethics Review Committee (EUREC). A research permit was obtained from NACOSTI as required by the law. Once the permit was obtained, the farmers and experts from NFCC were formally contacted. The purpose of the study was explained to the respondents and their consent to participate in the study was sought. Once consent was granted, the researcher set the dates and venues for administering the questionnaires and conducting

interviews in consultation with the respondents.

During data collection, the respondents were urged to be truthful and honest when responding to items in the data collection tools. The NFCC experts were further urged not to be biased as the exercise was not an evaluation or investigation of their work but an academic activity. The farmers and experts were also treated with respect, and equitably and were not exposed to harm during the data collection process. Access to the collected data was controlled by locking them in a cabinet and use of a password. Privacy and confidentiality were ensured by using numbers instead of names, reporting only aggregated data, and not sharing information with unauthorized persons. This data will be kept for five years after graduation after which it will be destroyed. When writing the thesis, plagiarism was minimized by listing all the sources cited in the reference. Further, the information provided by the respondents was not altered or modified to suit the researcher's opinion.

## **CHAPTER FOUR**

### **RESULTS AND DISCUSSION**

#### **4.1 Introduction**

This chapter presents the results of the study, which are organized by objectives. It contains sections on questionnaire return rates, characteristics of the respondents, delivery of extension services, and effectiveness of communication media used by NFCC in providing services. The last two sections of the chapter present result on the effectiveness of NFCC in linking farmers with stakeholders and the quality of agricultural extension services that farmers received through NFCC.

#### **4.2 Questionnaires Return Rates**

A questionnaire was used to gather data from the farmers while an interview guide was utilized to collect data from NFCC experts. The proposed sample of farmers was 120, subsequently; the same number of questionnaires was administered. Out of this number, 110 filled questionnaires were returned giving a response rate of 91.7%. The proposed sample size of the NFCC experts was 4; all of who were interviewed giving a response rate of 100.0%. These results confirm that the study did not suffer from low return rate which is a common problem with studies that utilize questionnaires to collect data (Lavidas et al., 2022).

#### **4.3 Respondents' Characteristics**

The respondents' characteristics were analyzed before providing answers to the study questions. There was a need for this analysis since one's socio-economic characteristics have been associated with the adoption of emerging technologies such as e-extension (Owiti et al., 2018). The characteristics of the farmers examined were gender, age, marital status, main sources of income, and farming area. Table 5 presents the characteristics.

**Table 5***Characteristics of the Farmers*

Scale	Characteristics	Percentage
Gender ( n = 106)	Male	61.3
	Female	38.7
Age (n = 110)	29 years and below	14.5
	30 to 39	13.6
	40 to 49	24.5
	50 to 59	26.4
	60 years and above	20.9
Marital status (n = 110)	Married	70.9
	Single	18.2
	Widowed	10.9
Highest level of education (n = 108)	None	1.9
	Primary	21.3
	Secondary	40.7
	Tertiary	19.4
	Degree	13.0
	Post graduate certification	3.7
Main sources of income	Farming ( n = 110)	88.2
	Formal employment ( n = 110)	27.3
	Business (n = 110)	13.6
	Informal employment ( n = 110)	13.6
Farming area	Crop ( n = 110)	100.0
	Livestock ( n = 110)	71.3
	Fisheries ( n = 110)	6.4

The results in Table 5 indicate that the majority (61.3%) of the farmers were males while the rest (38.7%) were females. The observed gender bias in favor of the males could be because farming involves use of land and the tenure systems practiced in the region traditionally allowed only men to own and or inherit the land. Similar observations were made by Musangi (2017) who noted

that despite equality as enshrined in the constitution of Kenya 2010, the customs and traditions of most communities allowed women to own land only through their relationship with a male.

The results also indicate that over 70% (71.8%) of the respondents were aged 40 years and above. The low percentage of the young engaging in farming could perhaps be due to their perceptions of agriculture. According to Njeru (2017), majority of youths in Kenya perceive agriculture related activities as difficult and are meant for the aged in rural areas. Similar observations were made by Mwaura (2019) who noted that youths had negative perceptions towards agriculture as it is seen as a less worthy form of employment or a last resort for underachievers.

The results further indicate that the majority (61.1%) of the farmers had attained primary and secondary level of education while about a third (32.4%) of the respondent had tertiary and university levels of education. These results suggest that farming is now attracting those with higher levels of education. Education is important as it raises farmers' ability to perceive, interpret and respond to new ideas and technologies which they are exposed to through extension services (Ninh, 2021). Habtamu (2019) noted that education was related to farmers' awareness and adoption of new technologies and increased productivity.

Majority of the respondents were married (70.9%) while the rest were single (18.2%) or widowed (10.9%). Farming was the main source of income for majority (88.2%) of the respondents; it was followed by formal employment (27.3%), business (13.6%), and informal employment (13.6%). With regard to farming areas, all (100.0%) of the respondents were crop farmers, 70% kept livestock while a few (6.4%) engaged in fish production. These results are in harmony with a report by the County Government of Nakuru (2021) which indicated that the majority of farmers cultivate crops and rear livestock. These results are also in concurrence with the findings of a study by Kenya Public Policy Research and Analysis (KIPPRA) (2018) which showed that the uptake of fish farming in Nakuru County was low compared to other farming areas.

Similarly, the characteristics of the four NFCC experts were analyzed. The attributes of the experts examined were the highest level of education, duration in NFCC, area of specialization, and duties/responsibilities. Table 6 gives a summary of their characteristics.

**Table 6***Profiles of the Experts (n = 4)*

Scale	Characteristics	Percentage
Highest level of education	Diploma	50.0
	Bachelors	25.0
	Masters	25.0
Duration in the station	1.3 years	50.0
	1.5 years	25.0
	4 years	25.0
Areas of specialization	Farm management (crops),	25.0
	Extension and community development,	25.0
	Fisheries and aquaculture	25.0
	Dairy technology	25.0
Duties/responsibilities	Preparation of extension services and documentation	75.0
	Receiving requests and providing extension services	100.0
	Linking farmers with stakeholders	50.0

Table 6 shows that half (50.0%) of the experts had certificates while the rest were holders of bachelors (25.0%) and masters (25.0%) degrees. The experts had been in the station for periods of 1.3 (50.0%), 1.5 (25.0%), and 4 (25.0%) years respectively. Their areas of specialization were farm management (crops) (25.0%), extension and community development (25.0%), fisheries and aquaculture (25.0%), and dairy technology (25.0%). Their duties and responsibilities at the station included preparation of extension services and documentation (75.0%), receiving requests and providing extension services (100.0%), and linking farmers with stakeholders (50.0%).

#### **4.4 Delivery of Agricultural Extension Services to Farmers**

Before providing answers to the study research questions, data on the delivery of extension services to farmers by NFCC was analyzed. Data gathered from the experts and farmers were

analyzed and results were used in identifying types and providers of agricultural extension services. Table 7 presents the service providers from the farmers' perspective.

**Table 7**

*Providers of extension Services to Farmers (n = 110)*

Extension service provider	Frequency	Percentage
Nakuru Farmers Call Centre expert directly	70	63.6
County subject matter specialist	24	21.8
Sub –County subject matter specialist	27	24.5
Ward agriculture extension officer for the farm visit	51	46.1
Agriculture stakeholders (universities, research institutions, credit providers, etc.)	21	19.1
Others specify (fellow farmer, credit provider, private vet officer)	5	4.5

The result in Table 7 shows that NFCC (63.6%) and Ward Agriculture Extension Officer (46.1%) were the main providers of agricultural extension services to farmers. The two categories of service providers were followed by Sub–County (24.5%) and County (21.8%) subject matter specialists. These results are evidence that the NFCC places a central role in the provision of extension services to farmers in Nakuru County. These results confirm that NFCC is not the sole provider of extension services, it complements the work done by public and private services providers. These results also indicate that the main providers of extension services are linked directly or indirectly with the county government. This is because agriculture has been under county governments since the inauguration of devolution in Kenya in 2013. Since then, quite several County Governments have put in place programs such as the provision of extension services, geared towards the improvement of agriculture in their respective regions (Ali & Farah, 2019).

Data on the types of agricultural extension services provided by NFCC in crops, livestock, and fisheries farming areas were gathered from the sampled farmers and analyzed. The responses of the farmers on types of agricultural extension services provided concerning crop farming are summarized in Table 8.

**Table 8***Agricultural Extension Services received from NFCC by farmers (n = 110)*

Service	Frequency	Percentage
Soil testing	40	36.4
Inputs (seed, fertilizers, agro-chemicals)	49	44.5
Crop husbandry (planting, weeding)	38	34.5
Pests and diseases control	59	53.6
Preservation and storage	22	20.0
Crop marketing and value addition	36	32.7

An examination of the results in Table 8 reveals that the extension services were mainly on pests and diseases control (53.6%), inputs (44.5%), and soil testing (36.4%). The results suggest that controlling pests and diseases, access to inputs, and knowing the status of soils are among the challenges that farmers in Nakuru county face. These results support those of a study by Wanyama (2010) which established that soil testing and inputs were among the frequently sought services by farmers. The study noted that the test results assisted farmers in selecting soil management practices that promote sustainable agricultural productivity. Similar observations were made by Danso-Abbeam et al. (2019) who noted that farmers frequently sought technical advice from extension services providers on inputs, land preparation, and planting among others. The technical advice received enables them to keep abreast with the most current technologies and access quality inputs.

Regarding livestock farming, the farmers listed a variety of extension services that were provided by the NFCC. Table 9 gives a summary of services given in this farming area.

**Table 9***Extensions services on Livestock farming that farmers received from NFCC (n = 110)*

Service	Frequency	Percentage
Livestock husbandry	29	26.4
Livestock diseases/pests	32	29.1
Vet- chemicals	19	17.3
Livestock breeds	31	28.2
Livestock marketing and value addition	23	20.9

Table 9 indicates that a relatively high percentage of farmers received extension services on livestock diseases and pest control (29.1%), livestock breeds (28.2%), and livestock husbandry (26.4%). These results suggest that pest and disease control, breed selection, and livestock husbandry, were the main challenges faced by the farmers. Farmers need to be active in these areas since pests and disease control ensure that the animals are healthy which in turn leads to increased productivity (FAO, 2018). Breed selection, on the other hand, ensures that the animals are well taken care of and only animals with the best traits are chosen. It also ensures that the next generation will be genetically improved and possesses the desired traits. Livestock husbandry helps in the proper management of animals through feeding, provision of shelter, and protection against diseases (UNIQUE, 2020).

The farmers were also asked about the types of agricultural extension services on fisheries that they received from NFCC. Only a few of them engage in this farming area as shown by the responses in Table 10.

**Table 10**

*Extensions services on Fish farming that farmers received from NFCC (n = 110)*

Service	Frequency	Percentage
Fish management	8	7.3
Fish breeds	11	10.0
Fish ponds designs	13	11.8
Fish marketing and value addition	9	8.2

The results in Table 10 show that the response rate was low (7.3% to 11.8%), a confirmation that only a few farmers in Nakuru county were involved in the fish farming. Those who engaged in this area had been provided with extension services on fish pond design (11.8%) and breeds (10.0%). These results support those of a study done in Ghana by Mapiye et al. (2016) which indicated that feed preparation, seeds/fingerlings, pond design, and breeds were among the information provided to this category of the farmer. The information given to the farmers assisted them to improve productivity and their levels of income.

Analysis of respondents characteristics data show that farmers in Nakuru were provided with extension services on crop, livestock, and fish farming. These results show that extension services are provided by public and private entities among which is NFCC. The presence of

NFCC is a confirmation that FCC is among the strategies used by Nakuru County Government in the delivery of extension services. Despite adoption of FCC, there are still some challenges with regard to provision of extension services. The NFCC experts indicated that demand for extension services was high, particularly those on crops and livestock; with very few officers servicing this demand. Studies by Sigei (2014) and Cheplogoi (2021) have also noted a shortage of extension officers in Kenya. This inadequacy in personnel needs to be addressed as it is a hindrance to the provision of quality extension services.

#### **4.5 Findings about the Effectiveness of Communication Media used by NFCC in the delivery of Agricultural Extension Services**

The first objective of the study was to establish the effectiveness of communication media used by NFCC in delivering agricultural extension services to farmers. This was achieved by first analyzing the communication media used by both NFCC and farmers to interact and the languages the call center uses. Thereafter, the effectiveness of the communication media was established.

Analysis of data provided by the farmers indicated that NFCC used a variety of communication media to deliver extension services. Table 11 gives a summary of the communication media.

**Table 11**

*Communication Media used by NFCC to deliver extension services to farmers (n = 110)*

Communication media	Frequency	Percentage
Phone call	82	74.5
SMS	60	54.5
WhatsApp	22	20.0
Twitter	2	1.8
Facebook	8	7.3
Others (oral during a visit to a farm)	11	10.0

Table 11 reveals that the majority of the farmers received extension services through phone calls (74.5%) and SMS (54.50%). These three media were thus the most commonly used mode of communication by NFCC. The results also reveal that NFCC rarely used social media platforms

like WhatsApp (20.0%), Facebook (7.3%), and Twitter (1.8%). This was confirmed by information provided by the NFCC experts. The experts reported that their preferred communication media were phone calls, SMS, and WhatsApp. This is consistent with the findings of a study by Aker (2011) who noted that mobile phones were the most used channel of communication in the e-extension sector. This was attributed to the fact that mobile phones have both audio and video features that meet most of the basic needs of the poor and allow two-way communication between farmers and service providers.

The farmers were also asked about their preferred communication media when engaging with NFCC. Their responses are summarized in Table 12.

**Table 12**

*Communication media used by Farmers to engage with NFCC (n = 110)*

Communication media	Frequency	Percentage
Phone call	94	85.5
SMS	55	50.0
WhatsApp	18	16.4
Twitter	3	2.7
Facebook	6	5.5
Others (oral visit office face to face x6, farm visit)	7	6.4

The results show that phone calls (85.5%) and SMS (50.0%) were the most preferred communication media when farmers were engaging with NFCC. Social media-based platforms such as WhatsApp (6.4%), Facebook (5.5%), and Twitter (2.7%) were rarely used. These results imply that the majority of farmers in Nakuru county access NFCC extension services through phones and SMS. A study in Kilosa District in Tanzania by Mlozi et al. (2016) also observed that mobile phones and SMS were the most popular communication media among farmers. The popularity of mobile phones was attributed to the fact that they are affordable and allow direct communication with extension workers, and information can be shared using SMS technology. The results show low uptake of social media-based communication media such as Twitter and Facebook. Similar observations were made by Khan et al. (2017) in a study conducted in Bangladesh. The low uptake of these media was attributed to farmers' lack of knowledge and skills and awareness of the role of social media in e-extension.

The farmers were further requested to indicate the languages NFCC used to deliver Agricultural extension services to farmers. Table 13 contains a summary of their responses.

**Table 13**

*Language NFCC uses to deliver Agricultural Extension services to farmers (n = 110)*

Language	Frequency	Percentage
English	62	58.2
Kiswahili	92	83.6
Local language	14	12.7

The results in Table 13 show that the most frequently used language was Kiswahili (83.6%) while the least used were local languages (12.7%). The frequent use of Kiswahili could be due to the fact that it is the national language and the population of Nakuru County comprises of multi-ethnic groups. It should be noted that it is important to transmit agricultural information to farmers in a language that they understand best. This calls for use of local languages. A study conducted in Nigeria by Abdullahi et al. (2016) revealed that translation of agricultural extension services into local languages ensured it was understood and effective in assisting farmers in solving the problems they encountered in farms.

The effectiveness of the NFCC communication media in delivering agricultural extension services was determined using data gathered using the farmers' questionnaire. Five communication media, Phone calls, SMS, WhatsApp, Twitter and Facebook, which NFCC uses to delivery extension services were examined. Their effectiveness in delivery of extension services in crop, livestock and fish farming areas was assessed using a set of 15 closed-ended items. The items were based on a five points rating scale (1= Not successful [NS], 2=Somehow successful [SS], 3=Moderate [MS], 4=Successful [SU], =Very Successful [VS]) that expressed level of success in delivery of services. The responses to the items were scored, their means calculated then transformed into the overall communication media mean score. Table 14 presents the mean score for each communication media and their standard deviations.

**Table 14***Communication Media items mean scores and their standard deviations*

Communication media	Farming area	n	Mean	SD
Phone calls	Crops	93	4.39	1.03
	Livestock	66	4.14	1.15
	Fish production	23	4.09	1.31
	<b>Mean scores for Phone calls</b>	<b>3</b>	<b>4.21</b>	<b>0.16</b>
SMS	Crops	81	4.14	1.10
	Livestock	55	4.02	1.23
	Fish production	22	4.05	1.25
	<b>Means for SMS</b>	<b>3</b>	<b>4.07</b>	<b>0.06</b>
WhatsApp	Crops	79	3.20	1.44
	Livestock	50	3.18	1.47
	Fish production	18	3.33	1.41
	<b>Means for WhatsApp</b>	<b>3</b>	<b>3.24</b>	<b>0.08</b>
Twitter	Crops	55	2.15	1.30
	Livestock	44	2.25	1.40
	Fish production	12	2.58	1.68
	<b>Twitter means</b>	<b>3</b>	<b>2.33</b>	<b>0.23</b>
Facebook	Crops	67	2.46	1.47
	Livestock	44	2.50	1.41
	Fish production	12	2.08	1.31
	<b>Facebook means</b>	<b>3</b>	<b>2.35</b>	<b>0.23</b>

The results in Table 14 show variations in the mean scores of the five communication media. Phone call mean scores ( $M = 4.21$ ,  $SD = 0.16$ ) and was followed by those of SMS ( $M = 4.07$ ,  $SD = 0.23$ ) and WhatsApp ( $M = 3.24$ ,  $SD = 0.08$ ). However, the means scores of Twitters ( $M = 2.33$ ,  $SD = 0.16$ ) and Facebook ( $M = 2.351$ ,  $SD = 0.23$ ) were relatively low. These high mean scores imply that the farmers were of the view that phone calls, SMS and WhatsApp were effective in delivery of extension services in crop, livestock and fish farming. The low mean scores of the other media is an indicator that they were perceived by the farmers to be ineffective.

The effectiveness of the five (mobile phones, SMS, WhatsApp, twitter and Facebook) types of communication media used by NFCC to delivery extension services combined was determined using the mean scores of each of them. The five media mean scores were used to calculate the overall communication media mean score (the index). This overall mean score was used as the measure of effectiveness. Table 15 presents the overall mean score.

**Table 15**

*Effectiveness of Communication Media Overall mean score and Standard Deviation (n = 3)*

Communication media	Mean	SD
Phone Calls	4.21	0.16
SMS	4.07	0.06
WhatsApp	3.24	0.08
Twitter	2.33	0.23
Facebook	2.35	0.23
<b>Communication media overall mean</b>	<b>3.24</b>	<b>0.90</b>

An examination of the results in Table 15 indicate that the overall communication mean score was 3.24 (SD = 0.90) based on a 5 points rating scale. This mean was above the set 3.00 points mark that was used to decide whether the media was effective or not. It was thus an indication that the farmers' perceived NFCC communication media effective.

Data from the experts on effectiveness of NFCC's communication media was also analysed. According to the experts, the most effective communication media were phone calls, SMS and WhatsApp. Phone calls were most effective because it enabled the service providers to articulate issues and give further explanations. The high rating of WhatsApp was attributed to its ability to relay photographs and Facebook because of its wide audience. However, the experts noted that the effectiveness of some of the media was constrained by limitations in ability of farmers to use some ICT devices and social media platforms, and low quality (not smart) phones.

These findings indicate that the communication media used by NFCC were effective in delivery of agricultural extension services. This implies that FCC strategy is effective in delivery of agricultural extension services to farmers. These results support those of Langat et al. (2018) which showed that ICT based communication platforms enabled experts to package information using simple words that could be understood by most farmers. As a result, farmers found

agricultural information communicated relevant and were able to copy or modify them to suit their farming needs. The results are also in concurrence with those of Ogola (2015) who noted that farmers rated mobile phones and SMS usage in delivery of extensive effective because they received prompt information on a wide range of areas such as market prices, financial management and methods of irrigation, use of insecticides and soil management.

These results, however, are not in harmony with those of a study conducted in Bangladesh by Khan et al. (2017) who established that a high proportion of the farmers considered e-extension as either low or moderately effective in disseminating agricultural information. The low rating was mainly due to farmers' lack of ICT skills, poor networks and low internet speeds. It means that for a communication media to be effective it must be reliable and farmers must be conversant with it and possess the skill to operate it. Providers of e-extension services should therefore be aware of these shortcomings and also take them into consideration for effective provision of services.

Farmers were asked to state the challenges associated with communication media used by NFCC in delivery of agricultural extension services. Even though this was not an objective of the study, establishing the challenges helped in identifying issues related to delivery of extension services using NFCC communication media. These challenges were taken into consideration when making recommendations of the study. The farmers responses to the question on challenges were organized by themes, tallied and expressed as a percentage of the sample. The challenges are presented in Table 16.

**Table 16**

*Challenges associated with communication media used by NFCC in delivery of agricultural extension services (n = 110)*

Challenge	Frequency	Percentage
Cost of utilizing the communication media (smart phone, airtime, data bundles)	42	38.2
Poor phone network	25	22.7
Inadequate ICT devices/skills (smartphones, skills to twitter, WhatsApp, face book)	20	18.2
Delay in getting response from NFCC	13	11.8
NFCC does not make follow ups to ascertain farmers have been assisted	6	5.5
Negative attitudes towards e-extension (not taken seriously, the elderly used to face-to-face interactions)	3	2.7
Not as effective as face to face interactions where discussions/ demonstration can be conducted	3	2.7
Others (not a 24 hours services, cannot be consulted during emergencies after office hours, media like face book lacks anonymity/confidentiality)	4	3.6

The farmers highlighted a number of challenges perceived to impact negatively on effectiveness of communication media used by NFCC in delivery of extension services. The main challenges were; cost of utilizing the communication media (38.2%), poor phone network (22.7%) and inadequate ICT skills (18.7%). Similar observations were made by McGuire et al. (2015), they identified cost of accessing information and lack of basic phone skills as factors which impacted negatively on effectiveness of e-extension. Mamun-ur-Rashid and Goa (2018) also cited unreliable communication networks, lack of co-ordination among research extension and extension service providers themselves as hindrances to effective delivery of extension services by call centres. These challenges are a pointer that adoption of FCC has challenges which if not addressed could hinder realization of benefits associated with it with regard to delivery of agricultural extension services.

The farmers were further requested to suggest ways of enhancing the effectiveness of communication media used by NFCC in delivery of extension services. Table 17 shows that suggestions that were given by the farmers.

**Table 17**

*Farmers' suggestions of ways of enhancing the Effectiveness of Communication Media used by NFCC in the delivery of Agricultural Extension Services (n = 110)*

Suggestions	Frequency	Percentage
Train farmers on e-extension (phones, computers, internet, use of social media)	21	19.1
NFCC should make follow-ups (using their media, farm visits)	15	13.6
Reduce costs (airtime, bundles, smart phones) of using media (toll free, discount rates)	14	12.7
Organize face-to-face forums (open days, field days, workshops, seminars) to supplement NFCC services	11	10.0
Advertise/sensitize farmers about NFCC (mandate, services provided)	10	9.1
Use a combination of media (calls, SMS, Twitter etc.)	9	8.2
Employee more specialist as those at NFCC seems overloaded	7	6.4
Deliver services in time, avoid delays	7	6.4
Form farmer groups (WhatsApp) for a wider up-take of NFCC services	4	3.6
Package information in a form (language, easy to understand, adequate, actionable) for the farmers to use it to solve problems	3	2.7
Others (provide 24 hours services to assist in dealing with emergencies after office hours, improve competence (reduce ignorance, knowledge, skills, dedication) of NFCC staff	4	3.6

Table 17 shows that the suggestions given included; training farmers on e-extension (19.1%), making follow-ups (13.6%), organizing face to face forums (12.7%) and sensitizing farmers about services provided by NFCC (10.0%). The farmers felt there was need for training since some of them had limited ICT skills. Similarly, follow-ups were recommended because this would enable the experts to ascertain whether the farmers had been assisted. It would also provide farmers with opportunities to ask further questions and seek clarification.

The experts also made several recommendations with regard to enhancing effectiveness of NFCC communication media, some of which were similar to those made by the farmers. The suggestions included; organizing awareness campaigns on services provided by NFCC, responding promptly to farmer requests, making follow-ups (calls, field visits) to ensure farmers have been assisted; providing toll free services, packaging information in a manner that is easy to understand and actionable.

Both the farmers and experts made several suggestions related to training, awareness and blending FCC strategy with others which could enhance effectiveness of farmers call centers in delivery of extension services. It means that more needs to be done for farmers to reap full benefits associated with FCC strategy. Farmers need to be made aware of services provided by call centers, trained on ICT, empowered financially to meet cost of accessing extension services. Similar recommendations have been made by Nkomu (2015) as a way of enhancing accessibility, relevance and provision of up-to-date and time extension services.

#### **4.6 Effectiveness of NFCC in Linking Farmers to Stakeholders**

Objective two established the effectiveness of the NFCC in linking farmers to various stakeholders in Nakuru County. The answer to this objective was provided by ascertaining whether the sampled farmers had been linked to extension stakeholders by NFCC, the extension area the linkage was based on and effectiveness of the call centre in facilitating the linkage.

The sampled farmers were asked whether they have been linked to extension stakeholders by NFCC. Majority (80.9%) indicated that they had been linked to stakeholders. Those who had been linked to stakeholders provided additional information on extension areas the linkage was based on. Table 18 presents the crop farming areas the linkage to stakeholders was based on.

**Table 18**

*Crop farming extension areas the Linkage to Stakeholder was based on (n =110)*

Agriculture extension area	Frequency	Percentage
Soil testing	56	50.9
Inputs (seed, fertilizers, agro-chemicals)	46	41.8
Crop husbandry (planting, weeding)	26	23.6
Pests and diseases control	47	42.7
Preservation and storage	14	12.7
Crop marketing and value addition	26	23.6

The results in Table 18 show that soil testing (50.9%), pests and diseases control (42.7%) and inputs (42.8%) were the major extension areas the linkages were based on. This supports the findings of a study by MEAS (2015) that established that information on pest and weed control and fertilization schedules were frequently sought by farmers besides those on weather and market prices. A study done in India by Chachra et al. (2015) also listed information regarding disease/pests outbreaks, crop cultivation technologies, new crop varieties and soil tests as the most sought services from Kisan Call Centre.

The farmers also gave information on livestock farming extension areas the linkages to stakeholders were based on. The areas are contained in Table 19.

**Table 19**

*Livestock farming extension areas the Linkage to Stakeholder was based on (n =110)*

Agriculture extension area	Frequency	Percentage
Livestock husbandry	27	24.5
Livestock diseases/pests	30	27.3
Vet-chemicals	14	12.7
Livestock breeds	25	22.7
Livestock marketing and value addition	12	10.9

Table 19 shows that livestock diseases and pests (27.3%), husbandry (24.5%) and breeds (22.7%) were the areas the linkages to stakeholder were based on. The results confirm that farmers seek

information and inputs related to livestock farming from stakeholders. This ensures farmers have the best animal breeds with desired traits, have knowledge and skills to properly manage their livestock by providing them with food, shelter and protection against diseases (UNIQUE, 2020).

The farmers further provided data on fish farming extension areas the linkages to stakeholders were based on. Analysis of this data revealed that the percentage of farmers that had been linked to stakeholders in this farming area were relatively low compared to the others as shown in Table 20.

**Table 20**

*Fish farming extension areas the linkage to stakeholders was based on (n =110)*

Agriculture extension area	Frequency	Percentage
Fish management	8	7.3
Fish breeds	5	4.5
Fish ponds designs	8	7.3
Fish marketing and value addition	5	4.5

Table 20 reveal that the linkage to stakeholders was based on fish management (7.8%) and pond design (7.8%). The low percentages observed suggest that fish farming is not popular in Nakuru county given that this area attracted very few responses. Even though fish farming attracted only a few farmers, those in it still sought linkages to perhaps improve their knowledge and skills in this farming area. This is in line with Nakuru County Government strategic plan of 2022-2025 which advocates provision of support to farmers in fisheries management and development and other farming areas (County Government of Nakuru, 2021).

The effectiveness of NFCC in linking farmers to stakeholders was determined using a set of 10 close ended items in the farmers' questionnaire. The respondents were asked to indicate the extent of success of NFCC in linking farmers to various stakeholders using a five points (1=Not Successful to 5=Very Successful) scale. The responses to the items were scored, their means calculated and transformed into Linkage to Stakeholders overall mean. The Stakeholders overall mean was then used to decide whether NFCC was effective in linking farmers to stakeholders or not. Linkages to stakeholders overall means and their standard deviations are in Table 21.

**Table 21***Means of Linkages to Stakeholders*

Stakeholder	N	Mean	SD
Another farmer	61	3.38	1.66
Government/Public extension service providers	73	4.15	1.21
Private extension providers	53	3.40	1.43
An agro-dealer	62	4.02	1.25
Agriculture institutes	43	2.98	1.46
Research institute scientists	46	3.04	1.61
Agriculture university scientist	45	2.62	1.67
Agricultural NGO's	41	2.80	1.50
Agriculture marketing services providers	50	3.54	1.50
Credit providers	45	3.47	1.52
<b>Linkage of farmers to stakeholders overall mean score</b>	<b>10</b>	<b>3.40</b>	<b>0.50</b>

An examination of the results in Table 21 reveals that farmers rated NFCC ability to link them to Government/Public extension service providers (M = 4.15, SD = 1.21), agro-dealers (M = 4.02, SD = 1.25) and agriculture marketing services providers (M = 3.54, SD = 1.50) highly. However, linkages to agriculture university scientist (M = 2.62, SD = 1.67), Agricultural NGO's (M = 2.80, SD = 1.50), and institutes (M = 2.98, SD = 1.46), posted relatively low mean scores. The high mean scores is an indication that NFCC were effective in linking farmers to stakeholders. The overall mean score was high as it was above the set 3.00 points mark, which was used to decide whether NFCC was effective or not. On the basis of the overall mean score, NFCC was considered effective in linking farmers to stakeholders.

Data gathered from the experts on effectiveness of NFCC in linking farmers with stakeholders was also analysed. The experts were of the view that NFCC was effective in linking farmers to agro-dealers, research institutions, spray and silage preparation and extension services providers. They attributed this to attempts by NFCC to ensure that all those who make inquiries and request for services were served.

The results reveal that both the farmers and experts were of the view that NFCC was effective in linking farmers to agricultural extension stakeholders. This is an indication that FCC is effective in linking farmers to agricultural extension stakeholders. The results support those of

a study conducted in West Nile region, Uganda by Waiswa (2021) which found out that use of e-extension was effective in providing extension information and linking them to markets and suppliers of inputs. Krell et al. (2019) in a study conducted in Central Kenya established that Call Centers do not only play a significant role in delivery of extension services but were also effective in recommending to farmers who to go to for what. They argue that call centers are manned by experts who by virtue of their training and experience are best placed to guide and link farmers to sources of information, inputs and services.

Winter et al. (2017) contend that farmers should be connected to multiple stakeholders because farming requires information from diverse sources. Linkages connects farmers to those who can provide information needed in diverse areas such as pests, parasites and diseases control, animal husbandry, post harvest management, markets among others. Given that call centers interact with both farmers and other agriculture stakeholders, it is only prudent that two are connected through call centres.

The farmers also provided data on challenges which impeded NFCC from effectively linking farmers to stakeholders. This data was organized in themes, tallied and summarized using frequencies and percentages as presented in Table 22.

**Table 22***Challenges which impeded NFCC from effectively Linking farmers to Stakeholders (n = 110)*

Challenges that impend linkages	Frequency	Percentage
Delay in responding by stakeholders	32	29.1
Competence of stakeholders doubtful (low knowledge, poor customer service, inconsistent, inability to solve farmers' problems)	10	9.1
Costs of airtime/data bundle	8	7.3
Difficulties in using ICT (smartphone, social media, internet) limits interaction with stakeholders	6	5.5
Poor network	5	4.6
NFCC does not follow up to check whether the linkage is useful to farmers	5	4.6
Reluctance of farmers (lack of trust) to engage with stakeholders who are strangers to them, presence of NFCC required to jumpstart the linkage	3	2.7
Difficulties in understanding/utilizing information provided by stakeholders to solve farmers problems	3	2.7

The challenges highlighted by the farmers were delay in responding by stakeholders (29.1%), competence of stakeholders doubtful (9.1%) and costs of airtime/data bundle (7.3%). These results show that farmers encounter some problems when connecting with stakeholders. This is consistent with the findings of a study conducted in Nigeria by Ladele and Akinwale (2017). The study identified distrust, breach of contract, delay in service delivery and conflicts within multi-stakeholder partnerships among the challenges encountered in linkages. A study in Ghana by Nalumu et al. (2021) also noted that small holder farmers were not satisfied with quality of services provided by stakeholders with regard to quality and timeliness. The farmers also complained of added costs of dealing with stakeholders.

Linkages are initiated because farmers are not able to singly solve the multi-faced problems they encounter in their farming activities. Connecting them to stakeholders is supposed to enhance access to extension services, technology and inputs required in their farms. For these to

be realized, call centres should make follow-ups after linking farmers to stakeholders, as a way of ensuring that the expected benefits are realized.

The farmers were further asked to suggest ways of improving effectiveness of NFCC in linking farmers to stakeholders. The suggestions are summarized in Table 23.

**Table 1**

*Suggestions given by Farmers on ways of improving effectiveness of NFCC in linking farmers to Stakeholders (n = 110)*

Suggestion	Frequency	Percentage
Make follow-ups	41	37.3
Create forums/platforms (e.g. WhatsApp) for farmers and stakeholders	10	9.1
Sensitize farmers on role of NFCC for them to enjoy services such as linkages	8	7.3
Train farmers on ICT, especially the aged, for them to interact with stakeholders using smart phones, Facebook, Twitter, WhatsApp	6	5.5
Use other avenues (field days, workshops, open days) to link famers with stakeholders	5	4.6
Timely response from NFCC and stakeholders will enhance linkages	5	4.6
Improve (number, qualification, experience, service quality) on workforce at NFCC for better farmer/stakeholder interactions	5	4.6
NFCC should build trust between farmers and stakeholders by accompanying them during initial interactions	4	3.6
NFCC should assist in reducing costs of linkages (negotiations in cost of products/services provided by stakeholder/bundles/airtime	2	1.8

A number of proposals for enhancing effectiveness of NFCC in linking farmers to stakeholders were advanced by the respondents as indicated in Table 23. They suggested that NFCC should be making follow-ups (37.3%), as this would enable the experts to check whether farmers had been

assisted by the stakeholders. The farmers also proposed that NFCC should create a social media platform (9.1%), such as WhatsApp, for farmers and stakeholders. This would provide them with a forum to interact, know each other better, discuss extension matters in greater detail, thus improving the linkages. The farmers further proposed that NFCC should sensitize farmers on the services they provide and its role in linking them to stakeholders (7.3%). This would boost their confidence in e-extension model adopted by NFCC and services provided by stakeholders.

The suggestions on improving linkages made by both the farmers and experts are important in that they can be used by NFCC and adopters of FCC strategy to strengthen linkages between farmers and stakeholders. Ifejika et al. (2019) argue that call centers must mid-wife the linkage process for it to build trust and confidence between the farmer and stakeholder, for the connection to yield the expected benefits, such as quality information, competitive cost of inputs among others.

#### **4.7 Quality of Agricultural Extension Services Farmers received through NFCC**

The third objective of the study sought to determine the quality of agricultural extension services that farmers receive through the Farmers' Call Centre. Quality of agricultural extension services was analysed with regard to the three farming areas, crops, livestock and fisheries. Data on quality was gathered from both the farmers and NFCC experts.

Data on quality of agricultural extension services in the three farming areas (crops, livestock, fisheries) was collected from the farmers using five indicators namely; timeliness, relevancy, adequate, easy to understand and implement. The farmers rated each of the indicators on a 1 to 5 points scale (Very Low =1, Low =2, Moderately High = 3, High = 4), Very High =5). The means of the five indicators for each farming area were computed and used as a measure of quality. The item and farming area means and their standard deviations are presented in Table 24.

**Table 24***Farmers rating of Quality of extensions services in Crop, Livestock and Fisheries farming areas*

Item	N	Mean	SD
<i>Crops</i>			
Timeliness of the information	92	3.86	1.31
Relevance	88	4.26	1.09
Adequacy of information	89	4.17	1.12
Information easy to understand	87	4.10	1.14
Information received is easy to implement/actionable	86	4.17	1.12
<b>Crop extension services quality mean score</b>	<b>94</b>	<b>3.87</b>	<b>1.22</b>
<i>Livestock</i>			
Timeliness of the information	60	4.17	1.14
Relevance	59	4.29	1.08
Adequacy of information	60	4.30	1.05
Information easy to understand	56	4.20	1.12
Information received is easy to implement/actionable	55	4.22	1.07
<b>Livestock extension services quality mean score</b>	<b>61</b>	<b>4.03</b>	<b>1.10</b>
<i>Fisheries</i>			
Timeliness of the information	18	3.78	1.63
Relevance	18	3.89	1.49
Adequacy of information	18	3.94	1.51
Information easy to understand	18	4.00	1.50
Information received is easy to implement/actionable	18	3.94	1.47
<b>Fish extension services quality mean score</b>	<b>20</b>	<b>3.52</b>	<b>1.60</b>

The results in Table 24 reveal that the mean scores of the items on crops were high as they ranged between  $M = 3.86$  ( $SD = 1.31$ ) and  $M = 4.26$  ( $SD = 1.03$ ). The results also reveal that crop extension services quality mean score was high ( $M = 3.87$ ,  $SD = 1.22$ ). These results are an indication that the farmers perceived that the crops extension services provided by NFCC were of quality, given that the rating was on a 5 points scale.

With regard to livestock farming area, the item mean scores ranged from  $M = 4.17$  ( $SD = 1.14$ ) to  $M = 4.30$  ( $SD = 1.05$ ) while livestock extension services quality mean score was ( $M =$

4.03, SD = 1.10). Both the items and livestock extension services quality mean scores were high. This implies that the farmers were of the view that the extension services on livestock received from NFCC were of quality.

Table 24 further reveals that the mean scores of items on fisheries extension services quality were between  $M = 3.78$  (SD = 1.63) and  $M = 4.00$  (SD = 1.60) while the fisheries extension services quality mean score was  $M = 3.52$  (SD = 1.60). The high mean scores observed is an indication that the farmers' perceived the fisheries extension services provided by NFCC were of quality.

The quality of agricultural extension services received by farmers from NFCC as measured by the overall mean score was determined by averaging the mean scores of the three farming areas (crops, livestock, and fisheries as shown in Table 25).

**Table 25**

*Quality of Extensions Services received by farmers from NFCC Mean Score*

Item	Mean	SD
Crop extension services quality mean score	3.87	1.22
Livestock extension services quality mean score	4.03	1.10
Fish extension services quality mean score	3.52	1.60
<b>Quality of extensions services Mean Score</b>	<b>3.81</b>	<b>0.26</b>

An examination of the results in Table 25 show that the overall quality mean score ( $M = 3.81$ ,  $SD = 0.26$ ) was high given that it was out of 5. The overall mean score was well above the set 3.00 points mark, which was used to decide whether the services were of quality or not. This is an indication that farmers perceived services provided by NFCC to be of quality. It also implies that FCC strategy enhances delivery of quality extension services. This is in concurrence with those of a study conducted in Vietnam by Truong (2022) which indicated that farmers in Quang Binh Province were satisfied with the quality of agricultural extension services delivered to them. This satisfaction was attributed to use of a blend of ICT and face to face extension models, and timely and reliability delivery of services. Similarly, Mwombe et al. (2014) also noted that use of ICT based agricultural innovations help call centers to codify and repackaged extension services to

suit the needs of target groups. The repackaging makes the messages delivered easy to understand and implement.

These results however do not support those of Mamun-ur-Rashid and Goa (2018) which noted that call centers provided poor quality services due to inadequate personnel and facilities, lack of co-ordination among farmers, research extension and other extension service providers. A study by Khan et al. (2017) also noted that a remarkable number of respondents thought the quality of services provided by call centers were low due to challenges related to information adequateness, understandability, persuasiveness and applicability.

The farmers were also asked to highlight what lowered the quality of agricultural extension services provided by NFCC. This information was deemed necessary as it was used to strengthening the recommendations of this study. A summary of the factors that impend quality of services are shown in Table 26.

**Table 26**

*Factors lowering Quality of Agricultural Extension Services provided to Farmers by NFCC (n = 110)*

Factors that lowering quality of services	Frequency	Percentage
Delay in response (not timely)	28	25.5
No follow-ups by NFCC	16	14.6
Difficulties in understanding information provided (language used, too technical, incomplete etc.)	10	9.1
Information given not easy to implement (not actionable) and solve problems	8	7.3
Poor network leading to unreliable access to service	4	3.6
Others (lack of not committed, ignorant, not available, few, Cost of e-extension and negative attitudes towards it)	5	4.5

Table 26 indicates that delay in response (25.5%), lack of follow ups (14.6%) and difficulties in understanding and implementing information provided (9.1%) were what the farmers considered lowered the quality of extension services. The NFCC experts on the other hand identified inadequate facilities/equipment and unreliable internet/poor network as factors that impact negatively on their ability to provide timely and adequate extension services to farmers.

These results show the challenges encountered by farmers and NFCC experts in delivery of quality agricultural extension services. This could explain why farmers had raised complain about quality of services provided by NFCC as highlighted in the problem statement. The challenges highlighted are similar with the findings of a study by Mamun-ur-Rashid and Goa (2018) which found that inadequate ICT facilities, poor logistic support, funding for call centers and farmers negatively affected provision of extension services. MANAGE (2017) noted that inadequate number of extension staff negatively impacted on provision of quality services as it led to delays in response to farmer requests. Ogola (2015) identified costs of acquiring information and lack of feedback among challenges that affect quality of services provided by e-extension platforms. The foregoing is evidence that despite the many advantages of FCC strategy, farmers still encounter challenges accessing quality services. Similarly, NFCC experts also had challenges that hinder delivery of quality services to farmers. These have to be addressed for the FCC strategy to provide farmers with quality services at all times.

The farmers were further asked to suggest ways in which quality of agricultural extension services provided by NFCC can be improved. The suggestions given by the farmers are contained in Table 27.

**Table 27**

*Suggestions by Farmers on how to improve Quality of Agricultural Extension Services provided by NFCC (n = 110)*

Suggestion	Frequency	Percentage
Make follow-ups (Calls, SMS, farm visits)	30	27.3
Timely delivery of extension services	17	15.5
Use a combination of communication media (phone calls, SMS, WhatsApp etc.)	13	11.8
Sensitize farmers about NFCC for them to seek the quality services they offer	10	9.1
Train farmers on e-agriculture to enhance their skills and ability to access adequate extension services quickly using a variety of media channels	9	8.2
The extension information be packaged (adequate, language, channel) such that farmers can use them to solve their problems	8	7.3
Blend NFCC services with face to face interactions (visits to call center and farms, workshops, seminars, field days) as quality of services is enhanced through such experiences.	6	5.45
Run NFCC on a 24 hours basis for timely service delivery	2	1.82

The suggestions made by the farmers included making follow-ups (27.3%), timely delivery of extension services (15.5%) and using a combination of communication media (11.8%). It is important to take note of these suggestions since making follow ups could provide NFCC with opportunities to ascertain that the information provided was understood and used to solve farmers' problems. Similarly, using a combination of communication media enhances quality as it enables delivery of information that is complete, easy to understand and actionable.

The NFCC Experts also suggested ways of improving quality of extension services delivered to farmers. Among the suggestions were responding promptly to farmer requests, making follow-ups through phone calls and field visits, and packaging information in a manner that is easy to understand and actionable. The suggestions made by both the farmers and experts concur with those of a study by Kwapong et al. (2020) that proposed faster reaction time to

farmers' requests and making follow-ups by e-extension services providers. They argued that such improvements had the potential to enhance availability and accessibility of agricultural extension services.

The suggestions made by the farmers focused on enhancing quality of extension services delivery through making follow-ups, reducing delay in services delivery and used of combination of communication channels. Making follow-ups is important in that it provides NFCC with the opportunity to find out whether the information delivered to the farmer was relevant, understood, and used for the intended purpose. Relevance, easy to understood and actionable are aspects of service quality (Truong, 2022). Similarly, reducing delay in services delivery ensures that requested services are delivered to the farmer on time. Mamun-ur-Rashid and Goa (2018) consider this important since timeliness is one of the key pillars of quality Further, use of several communication media enables packaging and presentation of extension services in a way that suits the needs of farmers, is easy to understand and actionable, disseminated to a wide range of clientele quickly, cheaply and with minimal distortion (Langat, 2018). Incorporating these suggestions in NFCC operations would go a long way in assisting it enhance quality through planning and implementing its extension activities on the basis of farmers' needs. Incorporation of the suggestions in FCC strategy could also boost delivery of quality extension services.

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Introduction**

The aim of this study was to investigate the effectiveness of FCC strategy in delivery of agricultural extension services to farmers in Nakuru County, Kenya. A summary of the study's findings, conclusions, and recommendations are given in this chapter. The chapter also suggests areas that need further research.

#### **5.2 Summary of the Findings**

This study had three specific objectives from which three research questions were derived. Objective one sought to establish effectiveness of the communication media used by Nakuru Farmers' Call Centre in delivering agricultural extension services to farmers. It was confirmed by majority of the farmers that NFCC provided them with agricultural extension services in crops, livestock and fish farming areas. Majority of the farmers also indicated that NFCC used phone calls, SMS, WhatsApp, Twitter and Facebook to deliver extension services. Phone calls (M = 4.21, SD = 1.31), SMS (M = 4.07, SD = 0.06), WhatsApp (M = 3.24, SD = 0.08) were rated highly while twitter (M = 2.33, SD = 0.23) and face book ((M = 2.35, SD = 0.23) were not. With regard to the overall effectiveness of the communication media used by NFCC in delivery of extension services, the farmers rated them at M = 3.24 (SD = 0.90) on a 5 points scale. These findings suggested that the communication media used by NFCC in delivery of extension services were moderately effective.

The second objective determined effectiveness of the Call Centre in linking farmers to stakeholders. It was observed that NFCC has been linking farmers to extension stakeholders. The linkages were based on crops, livestock and fish farming areas. The Linkage areas included soil testing, pests and diseases control, inputs, animal husbandry, livestock breeding, parasites and diseases control, pond design and fish management. The farmers rated the effectiveness of the Farmers' Call Centre in linking farmers to stakeholders at M= 3.40 (SD = 0.50). The overall rating was above the set mid-point (M = 3.00) mark that was used to determine whether the linkage was effective or not. This was a pointer that NFCC was moderately effective in connecting farmers to stakeholders.

The third objective of the study sought to find out quality of agricultural extension services that farmers received through the Farmers' Call Centre. Quality was measured using five indicators, namely timeliness, information relevance, easy to understand, adequacy and applicability. The farmers rated the quality of agricultural extension services that they receive through the NFCC at  $M= 3.81$  ( $SD = 0.26$ ) based on a 5 points scale. The high rating suggests that the extension services provided to farmers by NFCC was of quality.

### **5.3 Conclusions**

The following conclusions were made based on the findings, they are organized by objectives:

- i. Phone calls, SMS and WhatsApp were effective means of delivering agricultural extension services to farmers while twitter and Facebook were not. Use of the five types of communication media combined enabled NFCC to effectively deliver extension services to farmers.
- ii. NFCC was able to successfully connect farmers to fellow farmers, government, private extension services providers, agro-dealers, research institutions, credit providers and other agriculture stakeholders in the value chain. As a result, the farmers were able to solve most of problems they encountered in their farms with the assistance of the stakeholders. It was therefore effective in linking farmers to stakeholders.
- iii. Agricultural extension services that farmers received through the Nakuru Farmers' Call Centre were delivered on time, relevant, adequate, easy to understand and actionable. The extension services received by farmers through NFCC were thus of quality.
- iv. On the basis of performance of NFCC, it was concluded that FCC strategy was effective in delivery of extension services.

### **5.4 Recommendations**

The following recommendations are made on the basis of the findings and conclusion:

- i. Quite a number of farmers indicated they had challenges using some of the communication media used by NFCC to delivery extension services such as Twitter and Facebook. There is need for NFCC extension experts to train farmers with limited ICT skills so that they can interact effectively with the FCC using the various communication media at its disposal.

- ii. NFCC should make follow-ups as a way of ensuring that farmers have been assisted by stakeholders. This will go a long way in enhancing linkage of farmers to stakeholders. NFCC should ensure services are delivered on time and should blend e-extension with face to face forums (field days, farm visits and demonstrations) for quality extension. Such forums provide participants with opportunities to internalize information provided through interactions, observation, asking additional questions and demonstrations.

County Governments should be encouraged to adopt FCC strategy in the delivery of agricultural extension services given its effectiveness.

### **5.5 Suggestions for Further Research**

This study has provided valuable findings on effectiveness of FCC strategy in delivery of extension services to farmers. However, there were issues that cropped up during the investigation which require further investigations. The study therefore makes the following suggestions for further research:

- i. This study involved only NFCC. It is believed that future studies involving other call centers such as those in Laikipia, Nyeri and Nandi would improve the generalizability of the results.
- ii. The results indicated the percentages of farmers who used social media (WhatsApp, Facebook and Twitter) and effectiveness rating were relatively low. There is need to investigate factors that caused this low rating, as a way of enhancing farmers' access to extension services using these channels.
- iii. The purpose of providing farmers with extension services is to enhance productivity. Further research needs to be conducted to find out the impact of FCC strategy on productivity in crops, livestock and fish farming areas.

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## APPENDICES

### Appendix A: Farmers Questionnaire

#### Dear Farmer,

My name is Shelmith Mucoki, a post graduate student pursuing a Master of Science degree in Agriculture Extension at Egerton University. As part of my studies, I am conducting research entitled “*Effectiveness of Farmers’ Call Centre Strategy in delivery of agricultural extension services: The case of Nakuru Farmers’ Call Centre, Nakuru County, Kenya*”. You have been selected to participate in this study because you have information that is relevant and can contribute significantly towards the success of this study. I respectfully ask that you take a few moments to complete this questionnaire. Whatever information you provide will be managed with the highest confidentiality and used just for this study; I can assure you. Thank you.

#### Instructions

- *Do not write your name on the questionnaire*
- *Indicate the chosen responses by marking the cell or box with a checkmark (✓), or enter the response in the box.*

#### Section A: Bio-data

1. Gender Male [ ] Female [ ] Multi-gender [ ]
2. Age in years .....
3. Marital status Married [ ] Single [ ] Widowed [ ]
4. Highest level of education None [ ] Primary [ ] Secondary [ ] Tertiary [ ]  
Degree [ ] Post-Graduate Certificate [ ] other (specify) .....
5. Main source(s) of income: (Tick all that apply) Farming [ ] Formal Employment [ ]  
Business [ ] Informal employment [ ] other (specify) .....
6. Farming area/s you engage in (Tick all that apply) Crops [ ] Livestock [ ] Fisheries [ ]  
Others Specify.....

**Section B: Information on the communication media used by Nakuru Farmers Call Centre in the delivery of agricultural extension services to farmers in the County**

7. Indicate by placing a Tick (√) in the selected cell, the agricultural extension services that you have received from Nakuru Farmers Call Centre in the areas listed in the table below.

<b>Farming area</b>	<b>Agricultural extension service</b>	<b>Choice</b>
<b>Crop</b>	Soil testing	
	Inputs (seed, fertilizers, agro-chemicals)	
	Crop husbandry (planting, weeding)	
	Pests and diseases control	
	Preservation and storage	
	Crop marketing and value addition	
<b>Livestock</b>	Livestock husbandry	
	Livestock diseases/pests	
	Vet- -chemicals	
	Livestock breeds	
	Livestock marketing and value addition	
<b>Fish production</b>	Fish management	
	Fish breeds	
	Fish ponds designs	
	Fish marketing and value addition	

8. Who provided the above extension service? (Choose all who were involved)

Nakuru Farmers Call Centre expert directly[  ]County subject matter specialist [  ]

Sub –County subject matter specialist [  ]Ward agriculture extension officer for farm visit[  ]

Agriculture stakeholder e.g. University, research institutions, credit providers etc. [  ]

Others specify.....

9. Communication media that you use to engage with the Nakuru Farmers Call Centre (Tick all the ones that you use) Phone call [  ] SMS [  ] WhatsApp [  ] Twitter [  ] Facebook [  ]  
Others (specify).....

10. Communication media that the Nakuru Farmers Call Centre uses to deliver agricultural extension services to you (Tick the ones that they use) Phone call [  ] SMS [  ]WhatsApp [  ]  
Twitter [  ] Facebook [  ] Others (specify) .....

11. Language(s) that Nakuru Farmers Call Centre uses to deliver agricultural extension services

to you (Tick the ones that they use) English [ ] Kiswahili [ ] Local language [ ] Others (specify) .....

12. Rate the level of success of the communication media used by Nakuru Farmers Call Centre in the delivery of agricultural extension services to you as listed in the table below. Use the given scale. *Scale: Not successful (1,) Somehow successful (2), Moderate (3) Successful (4), Very Successful (5)*

<b>Commu nication media</b>	<b>Farming area</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Phone call	Crops					
	Livestock					
	Fish production					
SMS	Crops					
	Livestock					
	Fish production					
WhatsApp	Crops					
	Livestock					
	Fish production					
Twitter	Crops					
	Livestock					
	Fish production					
Facebook	Crops					
	Livestock					
	Fish production					

13. What is the main challenge of the communication media used by NFCC with regard to the level of success in delivery of agricultural extension services?  
.....

14. What needs to be done to enhance the level of success of the communication media used by NFCC in delivery of agricultural extension services? .....

**SectionC:**

**Information on how Nakuru Farmers' Call Centre links farmers to stakeholders**

15. Have you been linked to agriculture extension stakeholders (e.g., Input suppliers, research institutions, universities, credit providers etc.) by Nakuru Farmers Call Centre?

Yes [ ]                      No [ ]

16. Select the agriculture extension area that the linkage was based on by placing a tick (√) in the chosen cell (you can select more than one area)

<b>Farming type</b>	<b>Agriculture extension area</b>	<b>Choose area of linkage</b>
Crop	Soil testing	
	Inputs (seed, fertilizers, agro-chemicals)	
	Crop husbandry (planting, weeding)	
	Pests and diseases control	
	Preservation and storage	
	Crop marketing and value addition	
Livestock	Livestock husbandry	
	Livestock diseases/pests	
	Vet- -chemicals	
	Livestock breeds	
	Livestock marketing and value addition	
Fish production	Fish management	
	Fish breeds	
	Fish ponds designs	
	Fish marketing and value addition	

17. Using the given scale, indicate the level of success of the Nakuru Farmers’ Call Centre in linking you with the stakeholders listed in the table for networking purposes *Scale; Not successful (1), Somehow successful (2), Moderate (3) Successful (4), Very Successful (5)*

<b>Stake holder</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Another farmer					
Government/Public extension service providers					
Private extension providers					
An agro-dealer					
Agriculture institutes					
Research institute scientists					
Agriculture university scientist					
Agricultural NGO’s					
Agriculture marketing services providers					
Credit providers					
Others specify					

18. State the main challenge(s) of using NFCC to network with stakeholders with regard to agricultural extension services delivery.....  
 .....

19. Give one suggestion that can be used to improve the effectiveness of Nakuru Farmers Call Centre’s in linking farmers to stakeholders  
 .....

**Section D: Quality of agricultural extension services that farmers receive through the Nakuru Farmers Call Centre in the County**

20. Rate the quality of the information received through Nakuru Farmers Call Centre based on the indicators in the table below. Use the given scale

Scale; Very Low (1) Low (2), Moderately High (3) High (4), Very High (5)

Farming area	Indicator	1	2	3	4	5
Crops production	Timeliness of the information					
	Relevance					
	Adequacy of information					
	Information easy to understand					
	Information received is easy to implement/actionable					
Livestock production	Timeliness of the information					
	Relevance					
	Adequacy of information					
	Information easy to understand					
	Information received is easy to implement/actionable					
Fish production	Timeliness of the information					
	Relevance					
	Adequacy of information					
	Information easy to understand					
	Information received is easy to implement/actionable					

21. Was there any follow-up done by NFCC? Yes [ ] No [ ]

22. If yes to item 21 above, who made the follow-ups?

Nakuru Farmers Call Centre expert [ ] County subject matter specialist [ ] A Sub – County subject matter specialist [ ] Ward agriculture extension officer [ ] Agriculture stakeholder [ ] Any others (specify).....

23. What contributed most towards *lowering* quality of agricultural extension services provided by NFCC .....

24. What needs to be done (give one suggestion) to improve the quality of agricultural extension service provided by NFCC? .....

**The End**

**Thank you for your time**

**APPENDIX B: Nakuru Farmers Call Centre (NFCC) Experts' Interview Guide**

**Date:.....**

1. Bio-data of the Expert:

Level of education.....

Area of specialization.....

How long he/she has served at the centre.....

Duties and responsibilities) .....

2. In your opinion, how is the demand for agricultural extension services by the farmers in the different farming areas? (Crops, Livestock and Fisheries) .....

.....

3. Which communication media are normally used by NFCC (SMS, mobile phone WhatsApp, Facebook and Twitter) to provide agricultural extension services to farmers?.....

.....

4. How effective are these communication media (SMS, mobile phone WhatsApp, Facebook and Twitter) in providing farmers with agricultural extension services?

.....

.....

5. What is your opinion about the effectiveness of the NFCC in linking farmers with stakeholders (example: - fellow farmers, Agriculture institutes, Private extension providers) and areas of linkage? .....

Give reasons for your answer

.....

6. What are the major weaknesses of NFCC in Provision of agricultural extension services?

.....

.....

7. Suggest ways in which the effectiveness of NFCC can be improved

.....

*End*

## **Appendix C: Informed Consent Form**

My name is Shelmith Waruguru Mucoki, a Master of Science in Agricultural Extension student at Egerton University. I am carrying out research titled; *“Effectiveness of Farmers’ Call Centre Strategy in delivery of agricultural extension services: The case of Nakuru Farmers’ Call Centre, Nakuru County, Kenya”*. I believe you have information that would contribute significantly to the success of the study. I therefore kindly request you to participate in this study by filling the attached questionnaire. You are free to choose whether to participate in it or not. However, before you make a choice, I will provide you with information that will help you make the decision.

### **Purpose of the study**

The purpose of the research will be to investigate the Effectiveness of Nakuru Farmers’ Call Centre in delivery of Agricultural Extension Services in Nakuru County, Kenya. Conducting research is part of the requirements for the award of the Master’s degree.

### **Study Participants**

The study will involve farmers and experts from Nakuru Farmers’ Call Centre.

### **Procedures**

The participants will be visited at farms, Nakuru Farmers’ Call Centre and/or contacted through the Call Centre. During the meetings, the purpose of the study will be explained to participants and their consent sought. During the administration of questionnaires, the farmers will be taken through the modalities of filling them before they are administered. The participants will be given ample time to fill the questionnaires. The experts will be interviewed in their respective offices.

### **Benefits**

Participants will not be given any rewards but will be acknowledged in the thesis. It is expected that the results will be beneficial to farmers, experts at the Nakuru Farmers Call Center, related County and National government bodies by providing them insight of the effectiveness of the call centre and what is required to improve it. The findings may also assist these stakeholders in developing policies and putting in place mechanisms that could improve the effectiveness of the call centre and provision of agricultural extension services in general.

### **Risks**

There will be situations when you feel uncomfortable responding to some items in the questionnaire/interview guide. Please note that you are free not to respond to such items.

### **Are there any costs for me if I agree to join the study?**

Your participation in this study will not incur any financial charges

### **Data Protection, Privacy and Confidentiality**

Data will only be accessed by the researcher and supervisors whenever necessary. Access to data and related files will be controlled by locking them in a cabinet and use of passwords. This data will be kept for a period of 5 years after graduation after which it will be destroyed. Privacy and confidentiality will be ensured by using codes instead of names, reporting only aggregated data and the researcher not sharing information with anybody.

**Results**

The results of the study will be presented in a thesis form to Egerton University. The results will also be published in refereed journals and presented in Agricultural extension seminars and workshops.

**Contact**

Any time you have questions about this study or findings, contact:  
Shelmith Waruguru Mucoki, Mobile No: 0722983340 E-mail: [smucoki@gmail.com](mailto:smucoki@gmail.com)

**Rights**

It is your right to choose whether to participate in the study or not. You are also free to withdraw from the study any time you feel like by simply informing the researcher. It is also the right of the participants to be treated equitably, with dignity and respect.

**Questions about your rights as a research participant**

If you have any questions concerning your legal rights in relation to taking part in this study or if you believe your rights have been infringed, contact Egerton University Research Ethics Committee (EUREC), P.O. Box 536-20115, EGERTON-Kenya, Egerton University, email: [eurec@egerton.ac.ke](mailto:eurec@egerton.ac.ke), Phone number: (Chairperson): +254722443717. A research ethics committee is a group of people that review studies for safety and to protect the rights of study participants.

**Consenter Statement**

I have read the Consent Form, and all the questions that I raised about it were answered to my satisfaction. I therefore voluntarily consent to participate in the study.

Name (Optional)..... Signature or Thumb print .....  
Date .....

[In case it the adult is unable to consent and a Legally Authorized Representative (LAR) is consenting on behalf of the participant]

As the legally appointed representative, I have read the information that has been given to me or read to me. I was given the chance to ask questions, and the queries received satisfactory answers. I freely provide my permission for the person I am representing to take part in the project, knowing that I have the right to revoke my permission at any time and prevent the person I am representing from taking part in the research in the future.

LAR's Name (Optional): .....

Signature-----or Thumb print-----

Date: .....

I the undersigned affirm that the consent have been sought with full disclosure of project details to the participant to consent. (I have explained the study to the extent compatible with the participant's capability, and the participant has agreed to be in the study)

Name of the presenter (who presented/explained the consent document)  
.....

Signature: .....

Date: .....

Principal Investigator: .....

Signature: .....

Date: .....

## Appendix D: Ethics Approval

# EGERTON

TEL: (051) 2217808

FAX: 051-2217942



# UNIVERSITY

P. O. BOX 536

EGERTON

## EGERTON UNIVERSITY INSTITUTIONAL SCIENTIFIC AND ETHICS REVIEW COMMITTEE

**EU/RE/DVC/009**

**Approval No. EUREC/APP/181/2022**

**21<sup>st</sup> June, 2022**

Shelmith Waruguru Mucoki

P.O BOX 530-20100

NAKURU

Telephone: 0722983340

E-mail: [smucoki@gmail.com](mailto:smucoki@gmail.com)

Dear Shelmith,

**RE: ETHICAL APPROVAL: EFFECTIVENESS OF THE NAKURU  
FARMERS' CALL CENTRE IN DELIVERY OF AGRICULTURAL  
EXTENSION SERVICES TO FARMERS IN NAKURU COUNTY, KENYA**

This is to inform you that *Egerton University Institutional Scientific and Ethics Review Committee* has reviewed and approved your above research proposal. Your application approval number is *EUREC/APP/181/2022*. The approval period is *21<sup>st</sup> June, 2022 – 22<sup>nd</sup> June, 2023*.

This approval is subject to compliance with the following requirements;

- i. Only approved documents including (informed consents, study instruments, MTA) will be used.
- ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by *Egerton University Institutional Scientific and Ethics Review Committee*.
- iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to *Egerton University Institutional Scientific and Ethics Review Committee* within 72 hours of notification
- iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to *Egerton University Institutional Scientific and Ethics Review Committee* within 72 hours.

- v. Clearance for Material Transfer of biological specimens must be obtained from relevant institutions.
- vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- vii. Submission of an executive summary report within 90 days upon completion of the study to *Egerton University Institutional Scientific and Ethics Review Committee*.

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

Yours sincerely.



Prof. R. Nguire

**CHAIRMAN, EGERTON UNIVERSITY INSTITUTIONAL SCIENTIFIC AND ETHICS  
REVIEW CTTEE**

*RMN/B*



## Appendix E: NACOSTI Research License

 REPUBLIC OF KENYA	 NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
Ref No: 663008	Date of Issue: 18/July/2022
<b>RESEARCH LICENSE</b>	
	
<p>This is to Certify that Ms.. Shelmith Waruguru Mucoki of Egerton University, has been licensed to conduct research in Nakuru on the topic: <b>EFFECTIVENESS OF THE NAKURU FARMERS' CALL CENTRE IN DELIVERY OF AGRICULTURAL EXTENSION SERVICES TO FARMERS IN NAKURU COUNTY, KENYA</b> for the period ending : 18/July/2023.</p>	
License No: NACOSTI/P/22/18851	
663008 Applicant Identification Number	 Director General NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION
	Verification QR Code 
<p>NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.</p>	

**Appendix F: Research Authorization by Nakuru County Commissioner**



**OFFICE OF THE PRESIDENT  
Ministry of Interior and Coordination of  
National Government**

Email: ccnakurucounty@yahoo.com  
ccnakurucounty@gmail.com

COUNTY COMMISSIONER  
NAKURU COUNTY  
P.O. BOX 81  
NAKURU

When replying please quote:

Ref No. CC. SR.EDU 12/1/2/VOL.VII/6

1<sup>st</sup> August, 2022

Deputy County Commissioners

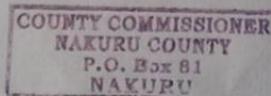
- Njoro
- Rongai
- Subukia
- Molo

**RE: - RESEARCH AUTHORIZATION – MS SHELMITH WARUGURU MUCOKI**

This is to confirm that the above named from Egerton University has been authorized to carry out research on **Effectiveness of the Nakuru Farmers' Call Centre in Delivery of Agricultural Extension Services to Farmers** in Njoro, Rongai, Subukia and Molo Sub Counties in Nakuru County, for a period ending 18<sup>th</sup> July, 2023.

Please accord her all the necessary support to facilitate the success of her research.

**MWANGI NYAGA  
FOR: COUNTY COMMISSIONER  
NAKURU COUNTY**



## Appendix G: Research Authorization by Nakuru County Governor



REPUBLIC OF KENYA  
OFFICE OF THE GOVERNOR  
NAKURU COUNTY



Telephone: Nakuru 2214142  
When replying please quote  
E-Mail:nakurucounty.governor@gmail.com

OFFICE OF THE GOVERNOR  
NAKURU COUNTY  
P.O. BOX 2870 - 20100  
NAKURU

When replying please quote:

**REF: NCG/S/GEN/VOL.V/47**

**2<sup>nd</sup> August, 2022**

SUB COUNTY ADMINISTRATORS  
**NAKURU COUNTY**

**RE: RESEARCH AUTHORIZATION – SHELMITH WARUGURU MUCOKI**

The above named from Egerton University have been authorized to carry out research in Njoro, Rongai, Molo and Subukia on ***“Nakuru Farmers call Centre in Delivery of Agricultural Extension Services to Farmers in Nakuru County, Kenya”*** for the period ending **18/07/2023**.

**BENJAMIN NJOROGE**  
COUNTY SECRETARY AND HEAD OF PUBLIC SERVICE  
**NAKURU COUNTY**

**Appendix H: Research Authorization by County Director of Education**

**MINISTRY OF EDUCATION**  
**STATE DEPARTMENT OF EARLY LEARNING AND BASIC EDUCATION**

Telegrams: "EDUCATION",  
Telephone: 051-2216917  
Fax: 051-2217308  
Email: cdenakurucounty@gmail.com  
When replying please quote



COUNTY DIRECTOR OF EDUCATION  
NAKURU COUNTY  
P. O. BOX 259,  
NAKURU.

Ref. NO. CDE/NKU/GEN/4/1/21/VOL.VII

1<sup>st</sup> August, 2022

**TO WHOM IT MAY CONCERN**

**RE: RESEARCH AUTHORIZATION – SHELMITH WARUGURU MUCOKI**  
**NACOSTI /P/22/18851**

Reference is made to the above-mentioned permit dated 18<sup>th</sup> July, 2022.

Authority is hereby granted to the above-named individual to carry out research on;  
“**Effectiveness of the Nakuru Farmers’ Call Centre in Delivery of Agricultural Extension Services to Farmers in Nakuru County, Kenya**” for the period ending 18<sup>th</sup> July, 2023.

Kindly accord her necessary assistance.

  
**LILIAN ANODE**  
**FOR COUNTY DIRECTOR OF EDUCATION**  
**NAKURU**

**COUNTY DIRECTOR  
OF EDUCATION  
NAKURU COUNTY  
P. O. Box 259 NAKURU**

Copy to:

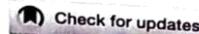
- Egerton University

# Appendix I: Abstract of Journal Article (1) - Publication in the IJAE



Int. J. Agr. Ext. 10 (03) 2022. XXX-XXX

DOI: 10.33687/ijae.010.03.4415



Available Online at EScience Press

## International Journal of Agricultural Extension

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https://esciencepress.net/journals/IJAE

### EFFECTIVENESS OF THE NAKURU FARMERS' CALL CENTRE IN LINKING FARMERS TO AGRICULTURAL EXTENSION STAKEHOLDERS IN NAKURU COUNTY, KENYA

Shelmith W. Mucoki\*, Agnes O. Nkurumwa, Stephen W. Maina  
Department of Agricultural Education and Extension, Egerton University, Kenya.

#### ARTICLE INFO

##### Article History

Received: 11 September 2022

Revised: 05 November 2022

Accepted: 13 December 2022

##### Keywords

Call center  
Effectiveness  
Linking  
Stakeholders

#### ABSTRACT

This paper examined the effectiveness of Nakuru Farmers Call Centre (NFCC) in linking farmers to agricultural extension stakeholders in Nakuru County following reports of delays in responding to farmers' queries and requests by NFCC, provision of low-quality services, and lack of follow-ups. The descriptive survey research design was adopted during the study. The target population was all the 3,473 farmers in Nakuru County who were registered with NFCC and the 4 center experts. A sample of 4 center experts and 110 farmers selected using census, stratified, proportionate and simple random sampling techniques were involved in the survey. Data were collected using the farmers' questionnaire and experts' interview guide. Data were summarized and described using frequencies, percentages, means and standard deviations. The findings showed NFCC had linked majority (80.9%) of the farmers to extension stakeholders. The farmers rated linkages with Government/Public extension service providers ( $M = 4.15$ ,  $SD = 1.21$ ), agro-dealers ( $M = 4.02$ ,  $SD = 1.25$ ) and agriculture marketing services providers ( $M = 3.54$ ,  $SD = 1.50$ ) highly while those to agriculture university scientist ( $M = 2.62$ ,  $SD = 1.67$ ), agricultural NGO's ( $M = 2.80$ ,  $SD = 1.50$ ), and research institutes ( $M = 2.98$ ,  $SD = 1.46$ ), were low. The overall success of NFCC in linking farmers to stakeholders was rated at  $M = 3.40$  ( $SD = 0.50$ ). NFCC was successful in linking farmers with government/public extension services providers agro-dealers and agriculture marketing services providers. However, it was not successful in linking farmers to agriculture university scientist. Number of farmers call centres (FCC) should be increased and the centres be given adequate facilities and staff. These resources will enable FCCs to provide quality services to a wider section of farmers, link them to stakeholder promptly and make follow-ups as a way of ensuring that farmers have been assisted, thus enhancing their effectiveness.

Corresponding Author: Shelmith W. Mucoki

Email: smucoki@gmail.com

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#### INTRODUCTION

Agricultural extension is a system designed to build and strengthen the capacity of rural farmers and other stakeholders through provision of information and new technologies. It enhances farmers' agricultural skills and practices and their capacity to innovate and address

varied rural development challenges (Barber *et al.*, 2018). Agricultural extension also plays a crucial role in improving farmers access to finances and markets (Kwapong *et al.*, 2020). Agricultural extension further plays a key role in linking farmers to other stakeholders in the agriculture sector (Anang *et al.*, 2020).

## Appendix J- Reviewers comments on the publication (1) -IJAE

Saleem Ashraf IJAE@esciencepress.net via escijournals.net Dec 31, 2022,  
1:52 PM

Dear Shelmith,

Your article needs major revisions. You are requested to take the below-mentioned comments into an account and submit revised version before January 10, 2023. Please highlight in yellow all the changes made in the revised version.

Best

Saleem

-----  
Reviewer A:

The topic selected is conceptual and relevant for use of Information Technology for Agricultural Extension. As the Call Centre concept is time and cost effective, most suitable to Agricultural Extension. Hence, the topic selected is most conceptual to the development of Agricultural Extension.

The research has been carried out in African Country, Kenya. The Farmer Call Centre was set up in Nakuru County, Kenya, which is further remote from the National Capital. Hence, the research of this location is more applicable to Agricultural Extension in remote areas. Hence, the location selection is appropriate.

The Research topic deals with innovation, which hitherto used extensively in Information Technology sector, but used in Agricultural Extension in this case. Hence the paper has the extension component using technology, which is innovative.

The research paper has lengthy introduction, which can be apprehended by judicious editing. Otherwise, the content is relevant.

Methodology: Sample size is adequate. However, increase in the sample size would have added to the value of results. Still, sample is sufficient to indicate the impact of the intervention made.

Results and Discussions are appropriate, covering Agriculture, Animal Husbandry and Fisheries Sector. However, the outcome of the data analysis is found to be under-utilized, deducing better results.

Recommendations may be appropriate if made in the direction of increasing number of Farmers Call Centres, which ultimately strengthens linkages between Extension and Farmers.

-----  
-----  
Reviewer B:

In the abstract the sentence "Limited success in linking farmers to stakeholders has been realized as evidenced by delays in responding to farmers' requests by the stakeholders and low-quality services. The unsatisfactory performance of NFCC could perhaps be due to its ineffectiveness in linking farmers to stakeholders." contradicts the conclusion drawn.

2. The recommendation made "The paper advocates for stronger linkage between farmers and agricultural extension stakeholders for enhanced agricultural information delivery" deviates from the core objective of the paper which was an assessment of the effectiveness of the NFCC in linking farmers to stakeholders. Link the conclusion (s) to the measures used to determine effectiveness.

3. While listing the stakeholders, you might want to synthesize or distil out the "research and academia aspect" as a specialized stakeholder with different outcomes.

4. The sentence describing the shortcomings with operations of the NFCC, as currently constructed, sounds like a conclusion statement. It renders the research question redundant. It should be revised to make it a problem statement.

5. Sampling procedures should be better defined. Total population across the 11 sub counties is given as 3473; however, actual sampling was from four sub counties from a sampling frame of 1993. This should be articulated in the abstract and better outlined in the methodology.

6. Outline the 10 stakeholder categories and their relationship with the topic of effectiveness. This can possibly be presented as a table to show the uniqueness of each stakeholder category in linking with farmers. This

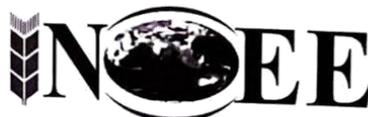
will enable the reader better to understand how the various stakeholders related to the overall topic.

7. The reference does not necessarily relate to the text above. Consider revising and providing a better reference.

8. The conclusion could be strengthened by also focusing on the problem identified earlier – that of a poor effectiveness, while the results indicate that the NFCC is effective. This could be a challenge of poor feedback. A related conclusion could be drawn for the highly ranked stakeholder categories in Table 4 – Government; agro dealers; marketing agencies.

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YEAR 2022

## Appendix L- Abstract of Journal Article (2) - Publication in the INJEE

*Effectiveness of Nakuru Farmers' Call Centre Communication Media in Delivery of Agricultural Extension Services to Farmers in Nakuru County, Kenya*

### **Effectiveness of Nakuru Farmers' Call Centre Communication Media in Delivery of Agricultural Extension Services to Farmers in Nakuru County, Kenya**

**Shelmith Waruguru Mucoki<sup>1</sup>, Agnes Oywaya Nkurumwa<sup>2</sup> and Stephen Wambugu Maina<sup>3</sup>**

1. Principal Agricultural Officer, Department of Agriculture, Livestock and Fisheries Nakuru County, Kenya

2. Senior Lecturer, Department of Agriculture Education and Extension, Egerton University, Kenya

3. Lecturer, Department of Agriculture Education and Extension, Egerton University, Kenya

Corresponding author's e-mail: smucoki@gmail.com

#### **ABSTRACT**

Access to timely, accurate and relevant agricultural information, skills and technologies among the limiting factors contributing towards low productivity and profitability in agricultural value chains in Nakuru County. Nakuru County Government introduced Nakuru Farmers Call Centre (NFCC), which is an alternative and innovative extension model for delivering quality agricultural extension services to farmers. The success of this initiative in promoting delivery of agricultural extension services and productivity has not been determined, especially on the ineffectiveness of NFCC's communication media. The purpose of this paper was to determine the effectiveness of communication media used by NFCC in delivery of agricultural extension services to farmers in Nakuru County. The study employed the descriptive survey research design. A target population of 3,473 farmers who are registered and have obtained agricultural extension services from NFCC and four 4 experts who answer farmer's questions on a daily basis were used. Purposive, stratified, proportionate and simple random sampling procedures were used to select four sub-counties, 110 farmers and 4 experts who took part in the survey. A semi-structured farmers' questionnaire and experts' interview guide were used to collect data. The results indicated that phones calls, Short Message Service (SMS) and WhatsApp were the preferred communication media. Utilization of twitter and Facebook were low due limited farmers' skills in using social platforms, lack of smart phones and cost of data bundles. The farmers rated the success of NFCC communication media in delivery of extension services at  $M = 3.24$  ( $SD = 0.90$ ) on a 5 points scale. It was concluded that the communication media used by NFCC in delivery of extension services was effective. The paper recommends that NFCC should train farmers on e-extension, assist in reducing costs of using communication media by making farmers' aware of discounts rates offered by mobile phone services providers and offering toll free services.

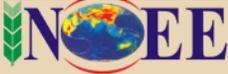
**Key words:** Nakuru Farmers Call Centre, communication media, effectiveness, agricultural extension services

#### **INTRODUCTION**

The agriculture sector plays a critical role in Kenya's economy as it accounts for 20 per cent of Gross Domestic Product (GDP) and employs over 40 percent of the total population and more than 70 percent of the rural populace (Central Bank of Kenya, 2022). It is important to ensure that the agriculture sector is vibrant given the critical role it plays in the Kenya's economy. This can be achieved through effective agricultural extension services since it has a significant impact on performance of agriculture (Cormarck, 2018). Danso-Abbeam *et al.* (2018) argues that the efficiency of a country's agriculture extension services determines the success of its agriculture sector, because through it, farmers are provided with information, technology and innovation which if well utilized leads to increased agricultural productivity.

Agricultural extension are systems designed to build and strengthen the capacity of rural farmers and other stakeholders through provision of access to information and technology as well as enhancing agricultural skills and practices, capacity to innovate and address varied rural development challenges (Barber *et al.*, 2018). Agricultural extension plays a key role in sharing knowledge, technologies, agricultural information and linking farmers to other actors in the agriculture sector (Anang *et al.*, 2020). Provision of quality extension services to farmers is important since it enhances agricultural productivity and their socio-economic well being (Cheplogoi, 2021). Despite its importance, provision of agricultural extension services to farmers has been facing various challenges in most African countries. These challenges include inadequate funding, poorly trained personnel, ineffective agriculture research

## Appendix M- Reviewers comments on the publication (2) -INJEE

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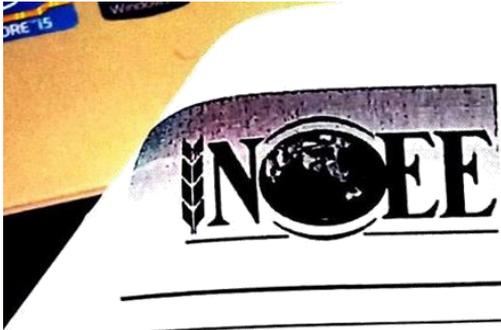
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## Effectiveness of the Nakuru farmers' call center in linking farmers to agricultural extension stakeholders in Nakuru county, Kenya

*Shelmith W. Mucoki, Agnes O. Nkurumwa, Stephen W. Maina*

## Abstract

This paper examined the effectiveness of Nakuru Farmers Call Centre (NFCC) in linking farmers to agricultural extension stakeholders in Nakuru County following reports of delays in responding to farmers' queries and requests by NFCC, provision of low-quality services, and lack of follow-ups. The descriptive survey research design was adopted during the study. The target population was all the 3,473 farmers in Nakuru County who were registered with NFCC and the 4 center experts. A sample of 4 center experts and 110 farmers selected using census, stratified, proportionate, and simple random sampling techniques were involved in the survey. Data were collected using the farmers' questionnaire and experts' interview guide. Data were summarized and described using frequencies, percentages, means, and standard deviations. The findings showed NFCC had linked the majority (80.9%) of the farmers to extension stakeholders. The farmers rated linkages with Government/Public extension service providers (M = 4.15, SD = 1.21), agro-dealers (M = 4.02, SD = 1.25), and agriculture marketing services providers (M = 3.54, SD = 1.50) highly while those to agriculture university scientist (M = 2.62, SD = 1.67), agricultural NGO's (M = 2.80, SD = 1.50), and research institutes (M = 2.98, SD = 1.46), were low. The overall success of NFCC in linking farmers to stakeholders was rated at M= 3.40 (SD = 0.50). NFCC was successful in linking farmers with government/public extension services providers agro-dealers and agriculture marketing services providers. However, it was not successful in linking farmers to agriculture university scientists. The number of farmers' call centers (FCC) should be increased and the centers are given adequate facilities and staff. These resources will enable FCCs to provide quality services to a wider section of farmers, link them to stakeholders promptly and make follow-ups as a way of ensuring that farmers have been assisted, thus enhancing their effectiveness.



**INTERNATIONAL SOCIETY OF EXTENSION EDUCATION**  
Extension Education Section  
College of Agriculture, Nagpur – 440 001 Maharashtra (India)  
editor [injee@gmail.com](mailto:injee@gmail.com), [lbkalantri01@gmail.com](mailto:lbkalantri01@gmail.com)  
[www.inseeworld.com](http://www.inseeworld.com)

**Dr. M. K. Rathod, Editor**  
Cell : +91 8275039522, e-mail : [edoitor.injee@gmail.com](mailto:edoitor.injee@gmail.com)  
Extension Education Section, College of Agriculture, Nagpur, M.S. India

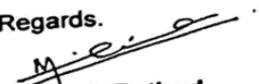
Dear Shelmith Waruguru Mucoki,

Please find below the reviewer's report on your paper entitled, "**Effectiveness of Nakuru Farmers' Call Centre Communication Media in Delivery of Agricultural Extension Services to Farmers in Nakuru County, Kenya**" submitted to publish in the International Journal of Extension Education is reviewed and the reviewers comments given as below.

- 1. Introduction** : It is relevant with the title & subject
- 2. Methodology** : Appropriate methodology used
- 3. Results & Discussion** : Tabulation are in proper format. And interpretations of findings are properly mentioned.
- 4. Conclusion & Recommendation** : Conclusion & recommendation made in the paper are based on the findings.
- 5. References** : One citation Anang *et al.* 2020b (page. 4) is not found in references with b, please clarify and resubmit.
- 6. General comment on the paper** : The paper is suitable to publish in the International Journal of Extension Education with some corrections as mentioned in the manuscript.

Requested to resubmit revised manuscript in two days.

Regards.

  
**Dr. M. K. Rathod**  
Editor, INJEE

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